LYNN M. MORGAN

ICONS OF LIFE

A CULTURAL HISTORY OF HUMAN EMBRYOS

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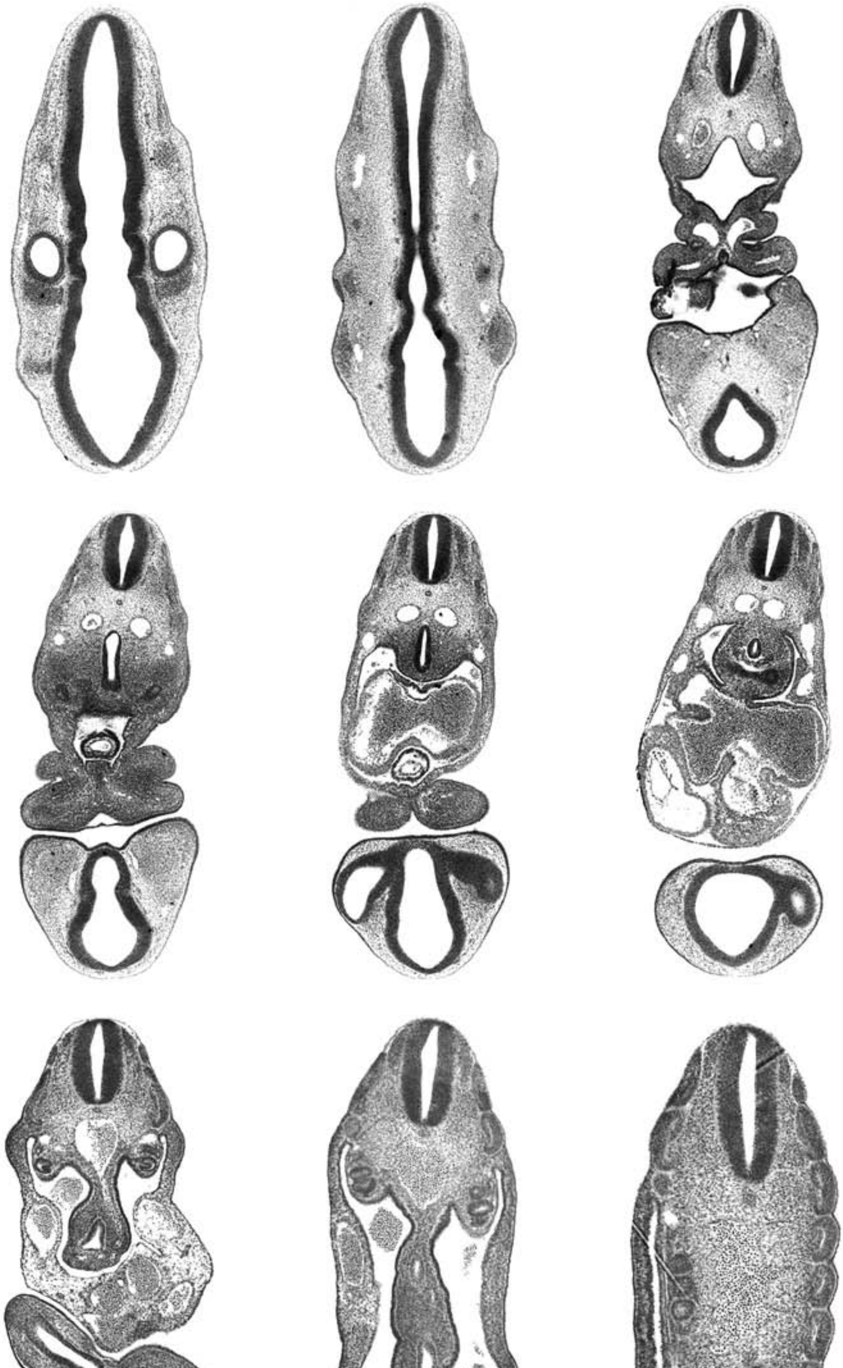

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A CULTURAL HISTORY OF HUMAN EMBRYOS

Lynn M. Morgan

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TO JIM

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PREFACE

It seemed like a win-win situation. A team of stem cell researchers announced in November 2007 that it had managed to coax pluripotent stem cells to grow from human somatic cells. The implications were monumental. Pluripotent stem cells have the potential to develop into many different kinds of cells in the body, and they have been the focus of a great deal of hope on the part of medical researchers ever since James Thomson and his team at the University of Wisconsin isolated the first embryonic stem cell line in 1998. The research has been mired in controversy, however, because it requires the destruction of viable human embryos. The new technique seems to offer a way around the issue, because it does not require that embryos be destroyed. Researchers hope the new method will hasten the development of treatments for diseases such as Alzheimer's and Parkinson's. In the words of bioethicist R. Alta Charo, "This is a method for creating a stem cell line without ever having to work through, at any stage, an entity that is a viable embryo" (Paddock 2007).

Why, then, were pro-choice watchdogs complaining? The problem was that the stem cell line used in the discovery, known as IMR-90, *was* once a viable embryo. In fact, it was once the developing lung of a sixteen-week human fetus, before it was aborted in 1977 and established as a cell line. Someone did indeed have to "work through" it—later we'll get an idea of what that means in material terms—to make it into a cell line. Pro-life critics objected that working with the IMR-90 cell line made the researchers into “accessories after the fact,” complicit in the act of abortion by benefiting from it, even though the abortion had taken place thirty years earlier. Pro-life proponents, on the other hand, did not see a problem because, they said, contemporary research on cell lines does not contribute in any way to an abortion that happened in the remote past (Ertrelt 2004).

This book takes up the relationship between specimens collected in the remote past and the contemporary cultural politics of abortion. One of my key questions is how embryo and fetal specimens came to exist as scientific work objects a century ago, and what implications those specimens, and the knowledge produced about them, have for the present. Science was a major player in solidifying one of today’s predominant cultural origin stories, namely, the story of embryological development. Many of today’s ideas about embryos—what they mean, how they should and should not be used, and who decides this use—can be traced to the cultural assumptions and material practices of human embryo collecting in the early twentieth century.

Icons of Life deals with the place of embryo and fetal specimens in American history. It draws on the history of a large embryo collecting project based at the Carnegie Institution of Washington’s Department of Embryology, but is not a history of that department. It features the anatomist and embryo collector par excellence, Franklin P. Mall, but is not a biography. It touches on the political and philosophical implications of anatomical embryo collecting, but is neither a political manifesto nor a philosophical treatise. Instead, I argue that the history of human embryo collecting had an enormous unacknowledged influence on how we think, in cultural terms, about what embryos are and what they mean. Collecting practices, in other words, had social, political, and cultural implications.

I am an anthropologist and ethnographer by trade, not a historian or philosopher or developmental biologist. Although this project was inspired by ethnographic research, most of the research for it was conducted in archives and libraries. Nevertheless I was informed by cross-cultural questions that arose while I was doing anthropological fieldwork in Ecuador in the early 1990s. Over two oxygen-starved months at ten thousand feet, in a town near the Colombian border, I interviewed thirty rural mothers about the status of fetuses and the morality of abortion. Abortion is and was then illegal in Ecuador, although prosecutions were rare. The women I interviewed all identified themselves as Catholic, and virtually all of them told me that abortion was wrong, a crime and a sin. Their reasons for opposing it, however, had nothing to do with the arguments that were made in my home country, the United States. They had nothing to do with the status of fetuses or fetal personhood. Quite the contrary. Again and again, women said that they did not know whether the fetus was a person. "God never told us," one woman explained. In fact, many people weren't even sure that a newborn was a person until it was baptized. Before baptism, a baby was more like a puppy, a little animal, than a person. Initially, this was confusing for me. By my logic, if a fetus was not a full person, then abortion would be permissible. "What sin does one commit," I asked, "if the fetus isn't a person?" Abortion, I was told, is the sin of self-mutilation. A woman must not take God's will into her own hands.

I wondered what this meant about the status of the fetus in Ecuador. Attitudes of the women I interviewed varied with the circumstances of the pregnancy. There were small unformed embryos, early miscarriages, "just blood." There were later miscarriages, sad but sometimes inevitable. A baby born at eight months' gestation, I was told, would always die. And there were the deaths of infants, the little angels who were sent off to heaven with an all-night party of drinking and dancing. In a nutshell, there was no such thing as "the status of the fetus," because fetuses were not singular entities. The meanings attached to fetuses were thoroughly, relentlessly variable and often vague. Furthermore, no one seemed to be bothered by this haziness; it seemed to be almost intentional. My first clue came early in the interviews, when I asked a woman to tell me how many children she had. I thought it was a straightforward question, until she asked me to specify whether I meant living or dead. Some of the women I interviewed included their miscarriages in tallies of how many children they had (for example, "eight children, including three miscarriages"). Others gave me only the numbers of children born alive, while others counted only those still living at the time of the interview. Clearly, there was no consensus about whether "one's children" would include miscarried, stillborn, only live-born, or deceased children. Who counts?

In highland northern Ecuador, the nebulous status of the fetus extended to burial practices as well. Sitting on the bed in a windowless room with a dirt floor, one woman told me that abortion is a major sin. She was familiar with papal edicts, and she said, "Life begins at conception." I asked whether this belief had implications for how she had handled the remains of her multiple early miscarriages. But there were no special rites for miscarried fetuses, she said, no wakes or cemetery burials. "The priest said that the miscarriages, when they were very early [*tiernitos*], when they were very small, didn't count [*no es cuenta*]." She considered these early fetuses alive and even sacred, but in death she did not treat their bodies or souls as she would have for an older fetus or infant. No unbaptized fetus and infant could be buried in sacred ground, nor could their souls ever get into heaven.

This wretched limbo was so painful that fetuses sometimes responded by turning into spirits the women called *aucas.* The *auca* spirits wandered around the highlands at night, wailing across the steep Andean ravines, mourning their fate. *Auca* was also the name of the national soccer team, and used pejoratively to refer to the heathen Indians who live in the lowlands. Anyone who wasn't baptized was semiwild and not to be trusted; Jews fell into the same category. The fetal *aucas,* as I came to understand them, constituted a category unknown in American abortion debates. They were a class of quasi and almost persons that happened to include those not-yet, unborn beings who die in the process of becoming. Dead fetuses were full of meaning in highland Ecuador. Curiously for me, though, no one jumped to the conclusion that their status automatically had anything to do with abortion. The link between the status of the fetus and the morality of abortion, I realized, belonged to my culture, not theirs.

In Ecuador I began to appreciate the extent to which ideas about embryos and fetal subjects are culturally infused—there is nothing like fieldwork to make that clear. Bringing those lessons home was not easy, though, until I realized that applying a historical perspective could have a similarly defamiliarizing effect, serving to make the familiar seem strange. This book aims to take a story that is very familiar to many people, namely the embryological view of development, and show how it intersects with the social and material history of human embryo collecting.

Funding for this project was provided by the National Endowment for the Humanities Fellowship for College Teachers, and by grants and fellowships from Mount Holyoke College. I am grateful to these institutions for their faith in me, and especially to Donal O'Shea.

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ONE

A Skeleton in the Closet and Fetuses in the Basement

AS I WALKED INTO THE BIOLOGY BUILDING on a glorious June day, the temperature in the basement was cool enough to cause a little shiver, and the piercing smell of formaldehyde in the storeroom gave the eerie impression of entering a morgue. One light bulb was burned out, yet in the gloom I could make out dozens of grimy jars of human fetuses packed three or four deep on industrial metal shelves. Judging by the dust, the collection had been untouched for decades. The formaldehyde had completely evaporated from some of the jars, leaving the contents to rot into sodden gray sludge. No one had taken much care with the collection even in its prime. Fetal specimens were casually stowed in mayonnaise jars and old-fashioned mason jars with glass lids and wire bails; just a few were in museum-quality exhibition vessels. An antique pill bottle with glass stopper held a tiny, one-inch fetus still enshrouded in its cloudlike chorionic membrane. One jar—inadequately sealed with masking tape—held a larger specimen that had turned an uncanny bright turquoise, discolored by the copper wire that held it against a glass plate. Another jar that had once contained eight pounds of Kraft fresh-chilled grapefruit sections now was packed with eight topsy-turvy fetuses in various states of deterioration. In total, I counted nearly one hundred fetuses in the jars.

It wasn't easy to look. I had the impulse to dash upstairs and forget I'd ever requested the visit. This was not the sanitized, schematic view of prenatal development depicted in pregnancy books and Web sites. Nor was it a clean, brightly lit display of well-maintained specimens. It was dark, dirty, moldering. I tried to gather my wits. "You asked to come here," I scolded myself. "You are escorted by a professional scientist in a clean white coat. Don't be such a wimp!" So I drew a careful breath and looked more closely, tried to think of something to say, moved a few jars around. I wished I had brought gloves, although I knew that the impulse was motivated more by a fear of pollution than a fear of dirt. I had the urge to wash my hands. Even as I grew accustomed to the surroundings, the muscles behind my cheekbones remained taut.

The laboratory supervisor picked up one conspicuously large, heavy jar and moved it into the light. We marveled over a full-term, apparently stillborn fetus, with perfect little ears and curly red hair. In that one specimen was embodied the emotional impact of the collection. Each of these "specimens," I realized, had started its journey conceived and carried by some woman, some singular human being who had her own story to tell. Yet her identity was unknown and probably unknowable, as no effort had ever been made to credit her contribution to this scientific enterprise. There were no records that would connect the fetal specimens to the women who had carried them. I would never be able to ask a woman what had happened, or whether it bothered her that the remains of her pregnancy had ended up as an anonymous specimen relegated to the farthest corner of the biology basement storeroom. I felt a complicated sadness, not so much for the lives lost before they began (because I had no way of knowing whether those fetal deaths brought suffering or relief), but for the scientific practice that reduced so many women's reproductive experiences to a forgotten assemblage of zoological specimens pickled in formaldehyde. As an anthropologist, I felt this to be a strange custom indeed.

It had obviously happened a long time ago, but someone once had gathered those misbegotten embryos and fetuses and stored them on the shelves of a science department storeroom at Mount Holyoke College. There were other items on the shelves, including pickled snakes, fetal pigs, and various stuffed animals. Later I learned that most of the skeleton of a woman, minus a few bones, had been donated to the college in the early twentieth century and was still stored in a closet upstairs, along with miscellaneous collections of rocks, wax models of embryo brains, and antiquated instruments. Such is the detritus a college acquires over time. Of all these items, however, the fetal collection seemed the most strange. I knew that abnormal fetuses were practically a required fixture of medical schools. In *The Bell Jar,* Sylvia Plath described her tour of "some really interesting hospital sights," including "the baby in the . . . bottle [that] had a large white head bent over a tiny curled-up body the size of a frog" (Plath 1971:51). I knew that anatomical museums sometimes displayed unusual pathological specimens—fetuses lacking brains and the skeletons of conjoined twins—but I could not imagine why dozens of apparently normal human fetuses were stored in formaldehyde at a venerable women's college in rural Massachusetts. There was no medical school nearby, and human embryology had not been taught at Mount Holyoke in decades. By what logic would anyone have amassed a collection of human embryos and fetuses, and why were they stored in a dark corner of the basement?

At a picnic that evening, a small crowd gathered as I explained what I had found. "Come here," people waved to their friends, "listen to this." After they had heard the details, they pelted me with questions I could not answer. "Where did they come from?" "Why were they there?" The picnickers—including those who had tracked the development of their own gestating fetuses in the pages of *What to Expect When You're Expecting,* and all of whom were perfectly accustomed to seeing fetuses on the covers of news magazines—thought the idea of a specimen collection downright bizarre. As the sun set beyond Groff Park, they spun lurid theories about what might account for the unusual collection. Someone wondered whether Mount Holyoke was once the site of a radical underground network of abortion providers, implying that only some criminal activity could explain the fetal cache, so amateurishly stored. This struck me as far-fetched, but it did make me wonder why, when confronted with the existence of fetal specimens, someone would leap to the conclusion that it must have something to do with abortion.

Eventually I learned that Mount Holyoke's collection was a small outpost of an important large-scale embryo collecting project based at Johns Hopkins during the first half of the twentieth century. The heyday of embryo collecting took place between 1913 and 1944, although the earliest efforts began around 1890 and the project lasted into the 1960s and beyond. During this time, anatomists interested in human embryology collected thousands of human embryos and fetuses as evidence for their scientific study of human origins and development. Results of that research formed the basis for much of what was known about human embryology in the late twentieth century. In contrast to the massive collecting initiative that took place in Baltimore, Mount Holyoke's specimens constituted a scientifically insignificant assortment of about three hundred specimens, used only for teaching. Without them, though, I would not have learned about the collecting effort that treated embryos and fetuses as objects of scientific inquiry and provided the empirical evidence for our embryo-centric worldview.

Embryos are the central actors in the origin stories that many modern, educated people tell themselves—ourselves—about who we are and how we came to be. Some of our most heated debates hinge on the status of embryos, and we seem never to tire of the exchange because we constantly create new spaces to argue over the same issues: abortion, contraception, in-vitro fertilization, cloning, and stem cell research. People who disagree vehemently about these issues nevertheless manage to agree on one score: embryos are important biological organisms, the precursors to our natural selves, without which none of us would exist. Whether we believe that humans originated in the Garden of Eden or evolved from hominid ancestors, the embryo has come to represent the beginnings of each individual life (S. F. Gilbert 2006). Embryos have become the quintessential symbols of humanness, the minutest essence of our selves. Embryos represent our collective human past and the prospects for our future. Who would we be without them?

In the mid-twentieth century, anthropologists analyzed nonwestern origin stories to gain insights into deeply held worldviews. When the British-born anthropologist Ashley Montagu studied procreation beliefs among the aborigines of Central Australia in the 1930s, he realized that not all peoples consider what grows in a woman's womb to be a human embryo. He wrote that the aborigines could not be convinced that "a child born at a very premature stage" was an unformed human being. By their logic, what we would call a miscarried embryo was "nothing like a *Kuruna* [spirit] or a *ratappa* [newborn]; 'they are perfectly convinced that it is the young of some other animal, such as a kangaroo, which has by mistake got inside the woman'" (Montagu 1974:31). Anthropologist Jane Richardson Hanks reported a similar story from her fieldwork in Bang Chan, Thailand, in the 1960s. Women told her they had given birth to all kinds of nonhuman entities, including gold and jewels, monkeys and a fish's stomach, or a "Golden Child" spirit (Hanks 1963:34–35; see also L. M. Morgan 1989). Not schooled in an embryological view of human life, the women of Bang Chan evaluated on its own terms every thing that came from their wombs. Like true empiricists, they reported what they saw, rather than what they expected to see. Turning these insights back on ourselves, we might ask how we came to see in tiny unformed embryos a reflection of our own origins?

Embryos as we know them today are a relatively recent invention. A hundred years ago, most Americans probably would not have been able to conjure up a mental image of a human embryo. When they thought at all about the beginnings of life, they would have been likely to describe development as a mixture of spiritual, emotional, and biological processes. Many would have cited quickening, when a pregnant woman first feels fetal movements, as evidence that a soul had entered the child. Quickening usually occurs four to five months into a pregnancy, yet many people thought it was the first demonstrable sign that a new life was imminent. As Hopwood points out, even women who knew themselves to be pregnant "often did not interpret the contents of their wombs in embryological terms" (Hopwood 2000:39; see also Duden 1993). Nor did many of their doctors. Obstetricians were more likely to encourage pregnant women to think pleasant thoughts and avoid strenuous exercise than to offer them detailed descriptions of embryonic development. The earliest embryos were overlooked by pathologists, because they were literally too small to see. The embryo collectors were part of an immense social transformation that changed all that, turning embryos from entities that were socially and scientifically insignificant into tangible, material objects of enormous cultural importance.

By the year 2006, it was possible to make the following statement: "For most of recorded history, people have fundamentally disagreed about the moral status of the human embryo. In early times this was because people knew very little about what actually went on in the womb—and so had very little idea what an embryo was" (BBC 2006). This statement is remarkable in its confident assertion that the moral status of embryos will be resolved once the scientific facts are known. Morality, in other words, will be wholly consistent with and determined by the biological facts. According to this view, moral disagreements will vanish as technologies (such as microscopes and laparoscopes) allow us to view and to "know" embryos. This book takes up the question of how it became possible to believe that knowledge about "an embryo" would be so transcendent, that meanings would be encapsulated in embryo tissue. How did it become possible to believe that profound moral questions could be resolved by scientific description?

Throughout the late nineteenth and early twentieth centuries, scientists argued over how to understand and explain human embryological development. Some, such as Louis Agassiz (1807–73), believed in recapitulation, the now largely discredited idea that embryos pass through the successive stages of "lower" animals as they develop. On the other side of this argument were an increasing number of scientists who favored material explanations of development. Embryo evidence was critical to this debate, and the importance of embryos was elevated by those who sought to create a holistic, biologically based appreciation of embryological development. Resolution of the dispute would put embryology on a sound materialist footing, and would make religious and spiritual interpretations of human development seem outmoded, premodern, and nonsensical. The effort required empirical evidence, and thousands of nonhuman embryological specimens were gathered around the world. But human embryo specimens, especially those from the first few weeks of development, were in short supply. The embryo collectors dreamed about creating a storehouse of thousands of human embryo specimens, on an unprecedented and previously unimaginable scale. Most of them were bench scientists, though, who lacked access to the women whose bodies harbored the coveted specimens. They had to depend on the kindness of their clinical colleagues for access to specimens. Embryo collecting was born, then, as a collaborative effort between research scientists, clinicians, and pregnant (or formerly pregnant) women.

The embryo collectors spent a great deal of time, initially, teaching doctors how to look carefully through the clots of blood and tissue that passed from women's wombs. Whenever a uterus was scraped, removed through surgery, or examined at autopsy, surgeons and pathologists would look for the chorionic sac that might contain a coveted fresh embryo. Whenever a woman came to the clinic with vaginal bleeding, doctors were alert to the possible presence of a small embryo. Baltimore was full of recently arrived migrants at the turn of the twentieth century, and the women who produced embryos came from different backgrounds: Negro, European, American Indian, Protestant, Catholic, immigrant, native born, factory workers, domestic servants, farmers. But the embryologists were less interested in documenting the medical and sociodemographic diversity of the women than they were in producing a new class of embryo objects (see Landecker 2007:68). Because these embryo objects would be classified as a type, attributes of diversity were arguably less important than their collective identity as homogeneous "specimens." Candidates for the embryo collection were first screened into two fitness categories: those specimens judged "abnormal" or "pathological" were set aside, while those judged "normal" were sent along for further processing. They both marked and challenged "the boundaries of normal and abnormal, nature and culture, self and other" (Lock 2007:284). The putatively "normal" specimens entered the laboratory with their own unique characteristics. There were young specimens and old. Some were fresh, others were shriveled or tattered. After the embryos were processed—after being metaphorically stripped, numbered, and lined up in formation—they emerged with remarkably similar identities, each an adequate representative of relative uniformity, the generic human embryo. It took many embryos to produce the narrative of singular embryological development. If the idea that all human embryos should be included under the same heading seems obvious, it is only because we live inside the embryological view of development.

Creating specimens required that the embryologists give special attention to their social context, but only at first. Each embryo entered the laboratory with medical histories and stories, of women's symptoms and menstrual histories, of how the embryo had "come away," even of the women's husbands and lovers (Medley 2002). Embryologists evaluated the women's histories for details that might help them assess a specimen's age, but once the age was determined, the specimen would be translated into a data point in the larger story of "ourselves unborn" (Corner 1944). Specimens were treated as anonymous things, without parents. If they were granted any genealogical ties, those ties were to the human species rather than to individual families. Specimens were stored carefully in glass jars, but without formal ceremony. The larger fetal specimens were sometimes stored together, en masse, in vats full of other anonymous specimens. They were not personified, named, or clothed, and no memorial services commemorated their service to science. The processing of human fetal specimens was somewhat reminiscent of corporate meat packing, in which carcasses were lined up for treatment according to the exacting standards of industrial production. Producing uniform specimens was important, because it resulted in evidence that condensed and connected the history of the species with the history of individual bodies and selves. The embryologists crafted embryos that corresponded to their empirical, material view of embryological development, and in so doing they "displaced the source of . . . authority downward from the social toward the realm of the biotic" (Palmié 2007:213).

The social production of anonymity might have wrested embryos from the families that produced them, but it was also a crucial step in creating an embryological origin story and an entity called "embryo." As Donna Haraway might say, specimens were a pedagogy "for learning to see who exists in the world" (Haraway 1997:177). It would never have been possible to imagine embryos having "bodies," or functioning as potential or actual members of the human community or miniature versions of our grownup selves, were it not for those specimens. The embryo collectors provided models of the human embryonic form and the very concept of "development," conceived as a cumulative process of unfolding. Historian Nick Hopwood put it nicely when he argued that development should not be "taken for granted" as the subject that embryologists study. Instead, he argues, development should be regarded as an "effect" or "achievement" that the embryologists "labored to produce" (2000:31, 76; see also Haraway 1997:182). By looking at this period of embryo genesis, we can see the social genesis of a supposedly natural form. Embryos and fetuses are thoroughly infused with culture, even (or especially) when tightly swaddled in the cloak of science.

It can take considerable effort to perceive the embryological view of life as one account among many, as *an* origin story rather than *the* origin story. Yet the embryological view shares several features with origin stories from other cultural contexts. All are patterned, predictable accounts of how "we" (the people) came to be. All origin stories get repeated frequently, to socialize children and reinforce a collective identity and history. The details of origin stories remain essentially the same no matter who tells it; the embryological origin story always begins with conception and ends with birth. The embryological view is told as one of the greatest, oldest human truths. Its legitimacy is enhanced by being linked with other powerful forms of knowledge in our society, especially science and religion.

NATURALIZING THE EMBRYO

By the late nineteenth century, the idea of embryological development began gaining ground, along with the Progressive Era social and scientific assumption that human culture is epistemologically rooted in nature. Increasingly, social significance was attributed to biological explanations. Like their peers, the embryologists were convinced that the key to understanding human origins would be found in embryological development. One by one, doctors gathered embryos and fetuses from miscarriages, abortions, and autopsies. They sent them along to embryologists, who preserved and sectioned the specimens, cutting them into thin slices to be mounted on glass slides. By projecting the slides they could draw pictures, create models, tell stories about the development of organ systems, publicize their results, recruit doctors to their cause, and gradually work to produce an "embryological view of life" (Hopwood 2000:32). Hopwood traces the first hints of the human embryological view to the late 1700s, when German anatomist and physician Samuel Thomas von Sömmering made pictures of the sequence of human development (Hopwood 2000:33; Duden 1993:40–41). Yet Sömmering's ideas were slow to catch on. The modern embryological view of life did not take hold until nearly a hundred years later, Hopwood says, after Swiss-born German anatomist and embryologist Wilhelm His (1831–1904), working in Germany, began to promote the idea that human development could be understood as a sequence of demonstrable, predictable steps (Hopwood 2000:34). His began to standardize techniques for collecting and studying human embryos in 1878 (Hopwood 2000:37). He developed standardized developmental tables, called "normal plates," that allowed him to categorize embryos based on their size and morphological features (Hopwood 2005). These were instrumental in allowing embryological development to be envisioned as a sequential series of stages, usually depicted as ranging along a continuum from smallest to largest. The twenty-three developmental stages now known simply as the Carnegie stages summarize "major developmental events . . . correlated with embryonic length, approximate age, and stage" (O'Rahilly and Müller 1999). The Carnegie stages were a major achievement of the scientists who created the Carnegie Human Embryo Collection.

In 1887, one of His's students, a young American doctor named Franklin Paine Mall (1862–1917), brought His's methods for studying human embryology back to the United States. Inspired by what he had learned in Germany, Mall was determined to advance on what he saw as the largely uncharted frontier of human embryology. Operating slowly but steadily, with few resources, Mall began to collect the precious embryo specimens and to educate doctors about the need to save embryos for scientific study. With support from His, Mall worked to establish methods for acquiring, cataloguing, and studying embryos and for disseminating the research results through scientific journals. His persistence paid off, and in time he became an embryo collector and producer par excellence. Mall was certainly not the only embryo collector, nor was he a superstar in the field of embryology. Nevertheless I will use him as a central figure in this book because of his dedication to collecting, and because his motivations and insights say a great deal about the logic and practice of collecting. By the time Mall died, he and his colleagues had cultivated an extensive and far-flung network of physicians committed to helping them gather embryos and fetal specimens from miscarriages, surgery, and autopsies. They established an embryo collecting tradition in the United States that lasted well into the 1960s. By the 1920s, gynecologists, obstetrical surgeons, pathologists, and family doctors had gotten into the habit of saving virtually all embryos and fetal remains that came into their possession. Embryo collecting became thoroughly normalized and unremarkable. During this time, many universities, hospitals, and even small undergraduate colleges would have acquired their own collections to use for reference, teaching, and research. The collection of embryos and fetal specimens became commonplace. Specimens were donated to the Mount Holyoke collection, for example, by the brother-in-law of a zoology professor, a physician who took them from the Pennsylvania hospital where he worked as chief of staff. By 1944, nearly ten thousand human embryos and fetuses had been collected and catalogued by the embryological institute that Mall founded, the Baltimore-based Carnegie Institution of Washington Department of Embryology (CIWDE).

THE EMBRYOLOGICAL VIEW OF DEVELOPMENT

Gradually, the "new scientific objects" called human embryos made their way into popular culture, and embryo and fetal specimens were recruited to fulfill an ever-wider variety of social functions. As Hannah Landecker says in her history of tissue culture, "Scientific, literary, philosophical, and popular responses . . . are more than representations of this new object; they are specific responses to its material form" (2007:93). Embryos were taken up at various points as essential scientific work objects (Casper 1998:118), pawns in debates over the teaching of evolution (L. M. Morgan 2003), educational artifacts for museum display (C. Cole 1993), flashpoints in the conflict between science and religion (Grobstein 1990; George and Tollefsen 2008), and symbols of women's reproductive integrity, autonomy, and morality (Petchesky 1987). By the end of the twentieth century, embryos had escaped the jurisdictional confines of medicine entirely, and had found roles in entertainment, art, advertising, legislation, education, commerce, and of course as political propaganda. Old specimens from the early twentieth century have recently been reanimated and put to new uses. New digital technologies, for example, have allowed sectioned specimens to be scanned for the purpose of creating educational software to train future embryologists (O'Connor 2003; B. R. Smith 1999; Yamada et al. 2006).

It can be difficult to recognize the cultural assumptions behind the embryological view of development. We like to tell ourselves that embryological facts represent *the* truth rather than *a* truth. Only since the 1980s have scholars started to question the cultural roots of our assumptions about embryos, how these are related to notions of reproduction, procreation, and how the latter are related to notions of kinship and relatedness. As Sarah Franklin points out, "The givenness of 'natural facts', and in particular the 'facts of life', has allowed them to operate as fixed, unquestionable anchors for much of the history of anthropology" (1997:2). Those days are behind us now, as anthropologists and historians dig deep into culture-bound assumptions about kinship, genetics, gender, race, and other supposedly stable biological categories (Delaney 1991; Franklin 1997, 2006; Ginsburg and Rapp 1995; Lindee, Goodman, and Heath 2003; Rapp 1995; Strathern 1992; Yanagisako and Delaney 1995). The embryological view of development can be particularly hard to apprehend reflexively, because it tends to obscure the social aspects of reproduction at the same time that it *becomes the basis for their cultural production,* as Franklin so eloquently argues (1991:197). Much is lost when the complicated context of human reproduction is reduced, as it often is in the embryo- and feto-centric climate of the early twenty-first century, to a focus on the viability and sanctity of embryos and fetuses. "This double move, of displacing and replacing the social with the biological, . . . enables a woman's pregnancy, the work of nurturing a child, the meaning of motherhood, the social meaning of personhood (in terms of kinship, identity, naming, reciprocity, interdependence, etc.) all to be reduced to one dimension, which is that of biological life" (Franklin 1991:200). Because the embryological view of development is so taken –for granted in the contemporary world, it is worth spelling out some of its primary assumptions.

1. The embryological view of development holds that each human life begins—at least in organismic terms—at conception, passing progressively through embryological and fetal stages before being born. It holds that the embryo-fetus-baby pathway is the *only route* to becoming a full-fledged human being, and it encourages us to see in every embryo a tiny, telescoped image of our present selves. "The adult being that is now you or me is the same human being who, at an earlier stage of his or her life, was an adolescent, and before that a child, an infant, a fetus, and an embryo" (George and Gómez-Lobo 2005:201). This explanation carries a vestige of the old idea of preformationism, which held that the adult individual was bundled, fully formed but in miniature, inside the germ cells. It does not *necessarily* say when or how we should begin to value embryos (or fetuses, infants, children, adolescents, or any other life phase), just that their biological existence can be traced back to conception. All human beings begin as embryos, and all of us were fetuses at one time (although see Olson 1997).

2. All human pregnancies produce human embryos. According to the embryological view of development, a human pregnancy cannot produce an inanimate object or hybrid embryo of another species, no matter what Thai women or Australian aborigines say (although see Matthews and Wexler 2000:212–18). Cases in which a pregnancy does not produce a human embryo are considered very dire. Obstetricians watch out for a rare but sometimes deadly condition called gestational trophoblastic disease or molar pregnancy.[1] Meanwhile science fiction

writers and filmmakers have long exploited the dystopian possibilities of nonhuman pregnancy (think of Roman Polanski's 1968 horror film, *Rosemary's Baby*). The normal—and normative—course of events is for human pregnancies to produce human embryos.

3. Embryos are assumed to be amoral biological entities, defined and classified solely by their genetic and anatomical features. As one zoologist put it in 1912, "The fact is—and it is one which is not sufficiently recognized—that the formation of an individual from an embryo, the making of a man, is a biological problem fundamentally" (Leighton 1912:37). This kind of biological reductionism leads embryologists to grade and classify embryos according to the morphological features they possess. They do not attend to the spiritual, moral, or social circumstances that generate embryos; they do not differentiate between embryos conceived deliberately, for example, and those conceived inadvertently. The biology is all that matters.

4. Embryological knowledge is held to be true. The embryological worldview holds itself to be the one true story of how life begins, superior to all other explanations and inherently apolitical. Embryologists do not acknowledge their own role in producing embryos or embryo ideologies. They concentrate on their role in producing "knowledge" rather than "beliefs" or worldviews. This naturalized view of embryology was so widely adopted by the mid-twentieth century that most modern citizens called it "the facts of life." Even religiously motivated embryo advocates often cite scientific "facts" to justify their opposition to abortion and human cloning.

If it is hard for us to recognize the embryological view as a cultural rather than a natural artifact, it is no wonder. We are steeped in stories that promote the marvelous truth that is embryological development. One early example can be seen in a 1937, sixteen-minute film called *In the Beginning,* which was billed as "the story of the adventures of the mammalian egg."[2] What makes that film remarkable by today's standards is that it shows reproductive scientists at work operating on a pregnant rabbit, and it emphasizes the microscopic tools and technical work necessary to make reproduction visible to the human eye. By the time the award-winning *Nova* video *Life's Greatest Miracle* was released in 2001, scientists were no longer featured, and the stars of the show were the egg and the sperm that unite to form an embryo that grows into a fetus and then a baby. *Life's Greatest Miracle* is a sequel to the

1986 Emmy-award winning film *The Miracle of Life* (Stormer 1997), which became the most popular *Nova* video ever. Because it was designed to be educational, it was shown on the most public of all media—television (it is also easily accessible online). The story takes just under an hour to tell, and it unfolds chronologically—like most embryological origin stories. Gestation is presented as a unified whole. It would be unthinkable to focus just on implantation, for example, without also considering the sperm's imperiled journey or the amazing rapidity of fetal growth. Most of the film's imagery is set (presumably) inside the body, and explanations are couched in the authoritative language of biology. The script is sprinkled with witty anthropomorphisms about courtship, dating, and chaperones.

Even the most secular of these embryological origin stories are notable for their quasi-religious language and overreliance on the word "miraculous." In Haraway's terms, "A secular terrain has never been more explicitly sacred, embedded in the narratives of God's first Creation, which is repeated in miniature with each new life" (1997:178). The tale of embryological development is portrayed as a secular miracle. "Viewer discretion" is advised, but the program is carefully designed to be inoffensive. The story is fit for prime time; there are no depictions of sexual intercourse, no close-ups of childbirth, no mention of abortion. The star of the show is the plucky embryo-fetus on its arduous, wondrous journey from conception to birth. Viewers are told that human bodies are programmed to make babies. Because the story is told as an empirical account based in scientific rationality, it must begin with a biological event: fertilization. One can almost hear those immortal words from Genesis, "In the beginning, God created the heaven and the earth," as the omniscient narrator intones, "YOU looked like this," while onscreen viewers see a dramatically magnified image of a single cell against a blue background. Using the rationale that conception determines the genetic uniqueness of a new human being, the embryological origin story uses conception as a defining moment. Conception, though, is only the beginning. The next few minutes of *Life's Greatest Miracle* skip from fertilization directly to alluring pictures of a well-developed fetus. The camera zooms in on the fetus's most humanlike features; its pristine unopened eyes, golden fingertips, perfect lips and toes. This quick reprise of the entire gestational period, right at the beginning of the film, reinforces the idea that conception leads directly to babies, and outlines the contours of what AmericanBaby.com (and scores of other web sites and popular sources) refer to as the "amazing journey from conception to birth."

Perceptions of fetuses can be tricky, as Ashley Montagu learned so long ago in Australia. In *Life's Greatest Miracle,* pictures of fetuses are presented as straight-up biological facts. Feminist scholars have analyzed fetal photographs to show how such visual images shape our interpretations of human development.[3] They have noticed, for example, that the story of "life's greatest miracle" is more often illustrated with pictures of large (magnified) embryos and fetuses than with pictures of pregnant women. Such pictures encourage viewers to notice the continuity between tiny embryos and full-term newborns. Yet, curiously, the storytellers rarely say how the pictures were chosen or made. When a fetus appeared on the cover of *Newsweek* magazine in 2003, I tried—in vain—to learn who took it and how. Like the Wizard of Oz thundering, "Pay no attention to that man behind the curtain," editors and designers prefer to give the impression that the story they are telling—like the embryo itself—is a natural fact rather than a production assembled by a team of hardworking photographers, editors, producers, and technicians. *Life's Greatest Miracle* does not mention the scientists who devote their lives to producing embryos or the women whose lost pregnancies contribute to the advancement of embryological science. It ignores the social climate that accepted without question the embryologists' right to collect and section thousands of embryos. Rather than addressing disagreements about the beginnings of life, the *Nova* program, like most secular versions of the modern origin story, emphasizes that life begins during the journey from conception to birth.

The embryological view of development pretends to exist outside of time, yet it has changed a great deal over the past century. It became popular as Darwinian evolution was becoming popular, and during a time when the identification of microscopic pathogens made it possible to prevent and treat infectious diseases (including some of those that caused miscarriage). Energized by the triumphs of biomedical science, Americans were eager to understand the hidden interiors of the human body and to assist in the scientific effort to "make invisible life visible" (Stormer 1997:175). Even Horatio Robinson Storer (1830–1922), the Boston-based physician who led the 1860s movement to criminalize abortion in the United States, had not seen many early human embryos. When Storer argued that human life began prior to quickening, his evidence consisted, by his own admission, of "common sense, analogy, and all natural instinct" rather than empirical fact (1860:10). In the 1860s no scientists had yet observed human fertilization or anything close to it, and the systematic collection and study of early human embryos was still a quarter of a century off.

Storer's argument was uncannily similar to one made today by advocates of mandatory ultrasound screening for pregnant women seeking abortion: if women understood the nature of embryological development, they would be horrified by the prospect of abortion. The argument rests on the assumption that embryological evidence is both more real and more compelling than other considerations. Storer's idea of common sense, however, overlooked the point that knowing the "facts" of embryological development does not tell us what to make of the biological evidence. When we look at a bit of human tissue, how do we know what it means? "Biological science provides not only a set of facts about conception," as Franklin writes, "but also a key source of symbolic material through which these various beliefs are given cultural meaning" (1991:197). Contrary to Storer's assertion, embryos do not carry their meanings intact.

EMBRYO GENESIS

Embryology is one of the origin stories that modern, cosmopolitan peoples (not limited by nationality or language) like to tell themselves. Embryos, in turn, are the social and scientific artifacts that sit at the center of contemporary biological origin stories. They are you, me, and us; each of us is "everyembryo" and "everyembryo" is each of us. This book takes up the question of how embryos—as ideas, images, symbols, and tiny bits of human tissue—are generated, circulated, and enlivened by social and political discourse. I draw attention to the historical and social processes that produced them and attached certain symbolic meanings (but not others) to these small but culturally significant bits of flesh.

How do human embryos come to stand alone and apart from the events that create them? Embryologists ponder a version of this question when they talk about epigenesis. The word *epigenesis* has a very specific meaning in the history of biology, emerging in the nineteenth century as a theory to explain how individual organisms are formed and to address the question of whether an individual's form is predetermined. Do we exist prior to being formed? Developmental biologist Scott Gilbert defines epigenesis as "an embryological concept that celebrates interaction, change, emergence, and the reciprocal relationship between the whole and its component parts. Epigenesis states that the identity of any particular cell is not preordained, but that this particular fate arises through the interactions between the cell and its neighbors" (S. F. Gilbert 2004:xi). When embryologists refer to epigenesis, then, they are referring to the growth and differentiation of a material embryo.

But the theory of epigenesis also addresses questions that have occupied natural philosophers and scientists for millennia, namely, is the form of an organism predetermined or contained within, or does it unfold and emerge over time (Maienschein, Glitz, and Allen 2005; Pinto-Correia 1997; Van Speybroeck, De Waele, and Van de Vijver 2002)? I would pose a similar question, not about the embryonic organism itself, but about our ideas about it. How did embryos come to be assembled and represented as the central figure in our cultural origin stories? Gilbert's definition of epigenesis helps me, as an anthropologist, to reflect on where our ideas about embryos come from and how we decide what embryos mean. Do we regard embryos as predetermined wholes that exist prior to our interpretations of them? Or do we consider embryos as the consequence and result of those very interpretations? The contemporary significance of human embryos can be better understood, I argue, by looking at the occult history of embryo collecting, because it was in the process of collecting that embryos came to be regarded as precious, autonomous objects. As Gilbert's definition of epigenesis demonstrates, it is important to put embryos into a context that includes their "reciprocal relationships." This requires that we consider embryos, not on their own merits, but as part of a constellation that includes those who brought them into social being. Embryos cannot be separated from the women who experienced pregnancy loss; or from the anatomists who bottled the tissue; or from the scientists who argued about evolution and racial differentiation; or even from the late nineteenth-century fin de siécle rise of urbanization, industrialization, immigration, and social upheaval in Baltimore. The place of embryos in our origin stories is not preordained or fixed or timeless; it arises and changes through interactions between embryos and the social contexts in which they are produced (S. F. Gilbert 2004:xi).

There is a reciprocal relationship between embryos as socially constituted entities and the societies that produce them that affects and changes both sides. An essay by the French sociologist of science Bruno Latour, entitled, "The historicity of things: Where were microbes before Pasteur?" dovetails nicely with Gilbert's depiction of epigenesis (Latour 1999:145–73). Latour argues that entities such as microbes (or embryos) cannot exist before the components (he calls them "associations") that bring them into social awareness. If we apply this insight to embryos, we would say that embryos were immaterial, both literally and figuratively, before the embryologists conjured them into existence. Bringing them into social existence was not a one-way street, though. Societies, too, Latour argues, are changed by the entities that they constitute. This reciprocal relationship persists through time. Embryos and societies constitute one another; just as embryos act to compel social action, so do societies act to reshape and reconstitute embryos. We can see this in the way we are willing to organize our lives, politics, and social relationships around them. We imbue them with the power to effect social action. This relationship can include many animate and inanimate actors: artists, scientists, specimens, activists, patients, ultrasound machines, litigants, legislation, and politicians. Latour demonstrates an important point: the embryos that surround us today are decidedly not the same as those the embryologists collected and materialized. Embryos have much greater ontological and political power today because we are constituted by them as much as they are constituted by us. To appreciate why this matters, this book takes us back to a time when people were beginning to understand embryos as asocial biological entities, and when embryos were moving from the embryologists' laboratories into social awareness. It looks at the reciprocal interactions that allowed embryos, scientists, and a host of other embryo-fascinated subjects to co-construct one another.

CONTRADICTIONS ABOUND

When I found the fetal specimens in the basement at Mount Holyoke, I was initially confused about how to react. Were these dead babies or biological specimens? Was I supposed to feel respectful or aloof? Unemotional or disturbed? Although I was confused, I couldn't imagine why. I had been thinking about the relationship between abortion rights and fetal personhood for a number of years already. I had recently spent eight months doing anthropological fieldwork in highland Ecuador, asking women about the status of the unborn and the criteria for ascribing personhood. I was well versed in and had even *written* some of the burgeoning literature on fetal subjects and fetal politics. I was familiar with the cross-cultural research on abortion, fetal subjectivity, and the category of the person, and I knew that my country had an unnatural obsession with fetuses. But none of that helped me in the moment. For ten years I had walked into that building every week, yet I had never expected to find eighty-seven jars of fetal specimens in the basement. Then, to confront the smelly, dead, decaying materiality of those specimens . . . well, made me feel confused.

The confusion resulted, I suspect, from trying to fit the specimens into the uniquely American debate over abortion. Where did they fit?

What did they mean? Looking at them in jars on the shelves, a jumble of competing, contradictory interpretations filled my head. This confusion, though, was one of the first clues for me that embryos and fetuses symbolize many different things. Any attempt to fix a single set of meanings to them seems either impossible or arbitrary. How, then, can there be any ontological stability or moral consistency with respect to embryos or fetuses? After an hour-long conversation about the many ways that fetuses are interpreted in nonwestern cultures, a bioethicist once asked me in frustration, "But what *is* the fetus?" It does seem frustrating that embryos and fetuses are so epistemologically slippery that they seem to resist the considerable effort that goes into defining and circumscribing them. The Catholic Church has a reputation for opposing abortion, for example, yet an influential pro-life group is called Catholics for a Free Choice. Feminists generally support abortion rights, yet a powerful anti-choice organization is called Feminists for Life. Abortion is discussed as both sin and salvation. The death of an embryo can be portrayed as a moral infraction *and* as evolution's ingenious solution to chromosomal abnormalities. Fetal tissue might be ritually mourned *and* coveted as valuable research material. Conflicting emotions can coexist in the same individual, who might cherish one pregnancy and regret another. Fetal surgeons may work feverishly to repair a neural tube defect in a fetus that could still legally be aborted, as sociologist Monica J. Casper points out in her prize-winning study of fetal surgery. "Contradictions abound," she says (Casper 1998:14–15).

The contradictions result from trying to fix a set of meanings to a process—the beginnings of life and personhood—that is inherently ambiguous and open to social negotiation. Anthropologist Katherine Verdery makes a similar point about the meanings associated with corpses in her book *The Political Lives of Dead Bodies:*

> Because they have a single name and a single body, they present the illusion of having *only one* significance. Fortifying that illusion is their materiality, which implies their having a single meaning that is solidly "grounded," even though in fact they have no such single meaning. Different people can invoke corpses as symbols, thinking those corpses mean the same thing to all present, whereas in fact they may mean different things to each. All that is shared is everyone's *recognition* of this dead person as somehow important. In other words, what gives a dead body symbolic effectiveness in politics is precisely its ambiguity, its capacity to evoke a variety of understandings. (Verdery 1999:29)

Verdery's insight shows the error I made in trying to have the specimens in the basement correspond to any of the static, unified images I carried in my head. This expectation, though, was based on the assumption that there is such a thing as "the" embryo or "the" fetus. As Franklin and Roberts note in their study of preimplantation genetic diagnosis, "it does not really make sense to speak of *the* embryo as a singular entity." Of the twenty or so embryos that might be used in a given cycle of IVF treatment, they explain, "some will be used for treatment, some may be discarded as pathological or morbid, some may be stored for future treatment, some may be donated to other couples, and some may be donated for research purposes" (Franklin and Roberts 2001:4; emphasis in original). That we can think of "the" embryo at all is one of the legacies left by the early embryologists, who helped to naturalize embryos. To be fair, the embryologists produced several kinds of embryos, too: some they sectioned, some they modeled, some they discarded, some they stored for dissection by the medical students, some they donated to other embryologists. Some they designated "abnormal." But their embryos were confined to a narrower range of meanings than today's embryos. Today, embryos may be invoked in debates over the availability of emergency contraception, but in the early twentieth century the embryologists did not link their work (or their work objects) to Margaret Sanger's (1879–1966) ongoing campaign to disseminate contraceptives. Their embryos were biological entities first and foremost, discursively separated from women's stories and cultural politics. Standing in the basement of the biology building, I was in the same boat as scientists, ethicists, and judges who have trouble determining "*the* status of *the* fetus"—there are so many embryos, so many fetuses, and so many ways to feel about them.

There can be no doubt that the embryological view of development has paved the way for significant scientific and medical advances in the past century. Without it there would be no pregnancy test, no birth control pill, no prenatal screening for birth defects, no assisted reproductive technologies, no test tube babies, and no effective treatments for infertility. Yet the embryological view of development has also fostered the creation of an embryo- and feto-centric political climate, which in turn has hampered scientific progress. Federal funding has been unavailable for most kinds of embryo and fetal tissue research since the 1970s, partly as a result of intense lobbying by abortion opponents (see Rini 1988). This move has effectively blocked federal funding for medical research that has the potential to save lives—including, paradoxically, the lives of those yet to be born (Coutts 1993).

One case in point is embryonic stem cell research. In 1998, scientists at the University of Wisconsin figured out how to isolate and grow pluripotent human embryonic stem cells using the inner masses of surplus embryos left over from in-vitro procedures. Pluripotent stem cells are capable of differentiating into any of the body's organs and tissues, and are of interest for their potential in developing new ways to treat diseases such as Parkinson's and Alzheimer's. Because embryonic stem cell research requires the destruction of embryos, however, it is controversial. In 2001, President George W. Bush prohibited the expenditure of federal funds on anything other than a small number of already existing embryonic stem cell lines. Some researchers moved their research outside the United States, while others tried to devise cumbersome alternatives. Some have tried, for example, to coax somatic stem cells (which are not derived from embryos) to function like embryonic stem cells. Stem cell scientists are forced to use more complex methods than they would otherwise, to navigate around the political obstacles. The embryological view of development, in short, made possible the politics that drives the science, and the science that drives the politics.

Embryo-centric attitudes on the part of lawmakers and ethicists have impeded other kinds of research as well. Religious ethicist Ronald M. Green, who served on the National Institute of Health's Human Embryo Research Panel in 1994, cites the prevention of birth defects as one casualty of the federal ban on embryo research. If the ban had not been in effect, he argues, scientists would have realized much sooner that folic acid supplementation can prevent neural tube defects including the incomplete closure of the spine known as *spina bifida* (2001:x). Few over-the-counter or prescription medications are tested on pregnant women or fetuses before they are approved. As a result, pregnant women who become ill—even with a simple headache or hay fever—are forced to choose between suffering without medication and risking harm to the fetus they are carrying. This situation is particularly dire for women with chronic or life-threatening conditions who must choose between cancer treatment, say, or controlling their seizure disorders, and the health of their fetuses. Likewise there has been relatively little scientific research on the causes of miscarriage, stillbirth, and infertility. On the other hand, the embryological view of development has resulted in increased surveillance of pregnant women's behaviors such as smoking and the consumption of drugs and alcohol (Hartouni 1997; Oaks 2001; Roth 2003), and an increase of interventions such as fetal surgery that elevate the risk to a healthy woman's life (Casper 1998). A less skewed, less embryo-centric view would consider pregnancy and women's health more broadly, under the assumption that fetuses will do better under social policies that look out for the health of women, mothers, men, children, families, and communities.

From the 1980s forward, ideological controversies about the beginnings of life came to center increasingly on the physical "stuff," the corporeal substance, of embryos and fetuses. The feminist political theorist Rosalind Petchesky made this point in the 1980s, writing about the history of abortion politics: "Increasingly, in response to accusations of religious bias and violations of church-state separation, the evidence marshaled by antiabortionists to affirm the personhood of the fetus is not its alleged possession of a soul but its possession of a human body and genotype" (1984:334). Petchesky's insight was important because she identified a shift in moral and political discourse that meant that the embryological view of development was destined to become *more* politicized in the years ahead. It was a prescient observation. No longer do opponents argue abstractly about morality; no longer is the debate framed as a battle between scientific knowledge and religious doctrine. Rather, the focus has shifted to science, putting pressure on how scientific evidence is interpreted and deployed. People on all sides now look inside the "bodies" (or tissue, or cell masses) of embryos and fetuses for answers to metaphysical, moral, legal, and ethical questions. Pro-life priests and Catholic in-vitro fertilization specialists cite embryological evidence to support their views (see DeMarco 2000; Roberts 2007). Meanwhile, some scientists seek to distance themselves from the moral or philosophical interpretations of their work, while staying faithful to the tenets of embryology. As cultural studies critic Nathan Stormer says, "Pro-choice and pro-life advocates . . . stand on the same biological ground" (1997:173). Once a relatively uncomplicated scientific proposition, the microscopic body has come to dominate reproductive politics.

As the embryological view of development rose to prominence, it was easy to overlook the fact that even scientists were not all of one mind as to when life begins. There is a great deal of disagreement among embryologists about the so-called facts and significance of fertilization and other biological markers. Developmental biologist Scott Gilbert and anthropologist Rebecca Howes-Mischel cite four different schools of thought among biologists on the question of when life begins: "(1) fertilization—the acquisition of a novel genome (2) gastrulation—the acquisition of an individual identity, (3) EEG activation—the acquisition of the human-specific electroencephalogram, and (4) the period of or surrounding birth" (2004:381). Back in the 1960s, Carnegie embryologist Bent Boving insisted that the egg and sperm are also alive and that there is nothing special (biologically speaking) about a fertilized ovum. Of course embryologists would not need to be so precise were it not for the fact that embryos are so heavily politicized. The moral significance of biological markers is raised only in relation to humans; it does not come up when discussing the embryological development of sheep, pigs, or cattle (Gilbert and Howes-Mischel 2004:378). There is no consensus among scientists; there are no apolitical embryos.

AN ANTHROPOLOGIST APPROACHES EMBRYO COLLECTING

I was initially interested in embryo politics as a medical anthropologist researching procreation beliefs, trying to understand how people negotiate the status of new and incipient persons at life's earliest margins. Although I took a cross-cultural approach to examining how people welcome the youngest members of their communities, I was always motivated by a desire to understand what was happening in the United States, where I grew up. *Roe v. Wade,* the Supreme Court decision legalizing abortion, was handed down in 1973, when I was sixteen years old, and I grew up surrounded by an increasingly uncivil, vituperative, and deadly debate over abortion, women's right to choose, and the status of fetuses. Anthropology provided an ideal set of tools for investigating the passions incited by this issue and the cultural meanings of the bio-logical.

Anthropologists have long inquired about the procreation beliefs of non-western cultures. How do people produce understandings of the beginnings of life? How do people come to define bodies as persons, and under what circumstances are they accepted (or not) into social worlds? What kind of entities are embryos thought to be, and what kind of cultural work do they perform? Anthropologists emphasize that personhood is based not in biology, but in the social significance granted to biological phenomena and the meanings attributed to bodies, relationships, and potentialities. Scientific knowledge will never answer the question of when life begins, therefore, because people are made by people. All peoples must decide how, when, and under what circumstances to value (or not) its youngest members. And in every culture, there are bound to be disagreements as people continually renegotiate who will be admitted to personhood and under what circumstances.

The anthropologist's comparative perspective gives ample evidence of how the meanings ascribed to fetuses are both variable and linked across time and geography. For example, anthropologist Tine Gammeltoft shows that Vietnamese fetuses may be perceived as potential threats to the body politic.

High rates of therapeutic abortion can be traced to the lingering effects of Agent Orange, a toxic defoliant sprayed by American pilots during the Vietnam War. Three generations later, Agent Orange still causes fetal malformations and birth defects. In this context, pregnant Vietnamese women receive multiple ultrasound screenings and may abort fetuses identified as "defective," as a way to improve population quality. "In this atmosphere of demographic anxiety," writes Gammeltoft, "the malformed fetus takes a central position, as living evidence that past traumas continue to haunt the nation of Vietnam, hindering it from developing into the internationally competitive society that policymakers envision" (2008:583). It seems painfully ironic that the status of Vietnamese fetuses today may hinge on actions taken by American soldiers more than three decades ago.

In these days of assisted reproductive technologies, there are many ways to manipulate the developmental process through genetic screening and embryo selection. Once a baby is born, however, we intervene little on the development of the bones and skeleton. This is not the case in the highlands of Ecuador, where a woman once showed me how to massage a newborn infant firmly to make its body grow straight (*recto*). She showed me how to pull gently but insistently on the bowed little legs that still collapsed so easily into the fetal position. She showed me how to pinch its flattened nose and smooth the top of its lumpy head. She stressed the importance of swaddling the baby tightly, like a mummy, before putting it to sleep. She treated her newborn very much like a clump of clay, molding and shaping its body before it hardened. Her maneuvers reminded me of how differently children's bodies are disciplined now than when I was a child. I grew up reading stories about the Choctaw, Native Americans who used to artificially flatten their babies' heads. Several children in my elementary school wore special braces and shoes to correct their bowlegs and pigeon-toes. Today's parents are more often assured that bowlegs and lumpy heads are normal and will correct themselves. Babies' bodies don't need to be molded, we tell ourselves; their bodies will assume their own genetically determined dimensions. That the Ecuadorian women deliberately stretched and kneaded their babies' limbs seemed to me a clue to an important cultural difference: they consider babies' bodies to be eminently malleable, formed not just "naturally" but by human intention. To what extent do we "form" (as well as "reform") children, I wondered, and by what means?

After finding the fetal specimens in the basement, I used anthropological questions to study the history of embryo collecting. Typically, an anthropologist would collect data through interviews and participant observation, but most of the original embryo collectors had long since died by the time I began this research. I adapted my methodology accordingly, borrowing from the historian's toolkit. "When a subject is given its history," says historian Rickie Solinger, "it becomes unsettlingly impossible to think about the subject in a fixed, static way or to claim universalized, decontextualized meanings for [it]" (Solinger, ed., 1998:1–2). I visited archives in Baltimore, Washington, D.C., Philadelphia, Princeton, Boston, Ann Arbor, Woods Hole, rural western Virginia, and South Hadley, Massachusetts. I pored over the embryologists' often hand-written correspondence, struggling to decipher Mall's execrable handwriting and hiring a translator to read letters written in old German. I examined institutional reports and records, read scientific publications, and donned white cotton gloves to handle yellowing photographs in an effort to piece together the social lives of the specimens.

Anthropology, like history, is about context, and the historian's methods suited my goal. Yet the questions I asked in the archives were more anthropological than strictly historical. In this book I draw from the work of historians who have analyzed the intellectual, institutional, material, and social environments in which the embryologists worked, but my questions have to do with how specimens are produced, how specimens figure in the embryological view of development, and how that story came to underwrite the story we tell ourselves about "ourselves unborn." At every step, I aim to show that the biological entity we call "embryo," as well as the embryo collecting project, stand *inside* of culture (Good 1994:66). Only by understanding the cultural dimensions is it possible to question the assumption, commonly made, that disagreements about the moral status of embryos are rooted in ignorance of the biological "facts." According to this logic, if we only knew "what actually went on in the womb," then it would be "natural to think of the embryo as a being that was able to do things" (BBC 2006). But the so-called facts are only as convincing as the cultural consensus that surrounds them, and only by adding culture to the equation can we appreciate why some highly educated individuals would devote their lives to collecting and studying minuscule bits of human flesh (or, for that matter, to writing books about them). Only in a specific cultural context could human embryos be transformed into such potent symbols and instigators.

RECOGNIZING FETAL SUBJECTS

Luckily for me, a cohort of feminist scholars began to write about "fetal subjects" in the 1980s (Morgan and Michaels 1999). There were plenty of reasons for them to be concerned. There was a backlash against women during the Reagan era in the 1980s, brought on in part by the rise of the New Right and its intense opposition to the *Roe v. Wade* decision legalizing abortion. The hostility took various forms. Access to reproductive health services was challenged by legal restrictions such as parental notification laws, abortion clinics were firebombed, and abortion providers feared for their lives. In this context, the rapid proliferation of fetal imagery in popular culture carried a dangerous political undercurrent (Faludi 1991; C. Mason 2002; Stabile 1999). One infamous example was the 1984 anti-abortion propaganda film *The Silent Scream,* which purported to show what was happening to the fetus during an abortion. Rosalind Petchesky wrote a now-classic critique of the film and in the process showed the importance of visual culture to anti-abortion politics (Petchesky 1987).[4] These authors were picking up on a disturbing confluence of events that seemed poised to elevate the status of fetuses, to the detriment and exclusion of women.

Around the same time, sociologist Barbara Katz Rothman published a small but influential book called *The Tentative Pregnancy* (1986). In it, she showed that the new technology of amniocentesis was changing the way women related to their pregnancies. Women who planned to undergo amniocentesis, either because of their age or their family history, were waiting to become emotionally attached to their pregnancies until they learned the results of the test. Rothman showed that they were reluctant to become attached, knowing that they might opt to terminate even a wanted pregnancy if the test showed a serious problem. Without a doubt, the emerging fetal subjects were affecting attitudes toward pregnant women and abortion. Petchesky reminded readers that to focus on fetuses was to divert attention from other important moral questions, such as whether women should be forced to bear children they did not want (Petchesky 1984:327). Janet Gallagher asked—in a theme that would be reiterated many times in subsequent decades—how government could best protect and provide for poor women and families rather than fetuses (Gallagher 1987). Feminists who wrote about fetuses risked compounding the problem of feto-centrism by drawing attention to it. In countering this trend, anthropologist Faye Ginsburg interviewed activists on both sides of the debate about building an abortion clinic in Fargo, North Dakota. Her results showed that attitudes toward abortion were determined, not by anything to do with fetuses per se, but by differing approaches to women's shared commitments to motherhood and nurturing (Ginsburg 1989).

Throughout the 1990s, feminist social scientists covered an ever-wider range of social phenomena that fit under the heading of fetal politics. In her ethnographic study of fetal surgery and the construction of fetal patients, Monica Casper explained how fetal politics was expanding in late twentieth-century America:[5] "Fetal politics [include] the crafting of a new science called fetology, controversies over fetal tissue research, the emergence of fetal rights in law and ethics, debates about and proscriptions on pregnant women's behavior, a cultural obsession with fetal images, and the relentless pursuit of new reproductive technologies. Many of these practices themselves are sites at which fetal personhood and maternal identity are constructed and contested" (Casper 1998:4).

The feminist position was consistent: the personhood of pregnant women needs to be paramount, because "fetuses are part of their mothers' bodies" (Rothman 1989:59). They argued for looking at how and why fetal personhood has been asserted and practiced, rather than trying to convince others on moral matters. Lynn Paltrow, a respected reproductive rights attorney, takes a pragmatic approach. She argues that abortion and fetal personhood are ideological devices that divert us from recognizing and opposing policies that jeopardize the health and well-being of women, fetuses, and families. At the same time that President George W. Bush was signing the Unborn Victims of Violence Act into law, his administration was deregulating coal-burning power plants, thus releasing harmful mercury into the environment and creating a direct threat to fetal and child health (Paltrow 2006). It is an important point, especially in an era when governments increasingly treat fetuses as though they were independent entities. For example, the U.S. government awarded health insurance coverage to fetuses, while denying it to the pregnant women who carry them. It also required that ethical review boards consider fetuses as "human subjects" in federally funded research projects (Casper and Morgan 2004).

Despite Paltrow's admonitions, the popularity of embryos and fetuses continued to grow throughout the 1990s. Anthropologist Janelle Taylor drew attention to the rise of the public fetus in her analysis of the contradictory cultural politics of a fetal image that appeared in a magazine ad for Volvo. A full-page ultrasound image of a fetus was poised over the caption, "Is something inside telling you to buy a Volvo?" Other advertisements followed, portraying fetuses in ways that both drew upon and distorted anti-abortion messages and imagery (Taylor 1992:67). This trend continues. A recent example came across my desk from Pampers.com. Five postcard-sized cards showed big close-ups of the now-familiar fetus, one of which seems to be sucking its thumb. Rather than addressing the reader, the cards addressed the fetus directly: "You're not even born yet and you're already discovering your world."

They invited “Mom” (not Dad?) to register on the Web site (“enter membership code ‘Rattle’”) to gain access to a pregnancy calendar timed to provide information (including “weekly sonograms”) for “Mom” to experience “the world from [her] baby’s point of view.” It was impossible not to see behind this campaign the manufacturer’s desperate wish to figure out how to put fetuses in diapers.

Fetuses sell. Taylor captured the marketing power of fetuses by beginning her article with these words: “Not long ago, a fetus tried to sell me a car—or should I say, a car tried to sell me a fetus?” (1992:67). Fetuses were used to sell a range of products in the 1990s: long-distance telephone service, cars, books, music, and of course baby products. By the beginning of the new century, advertisers had taken the consumers’ fetal fascination to a whole new level. In their latest guise, fetuses would represent our collective desire for a cleaner planet. Who could object? Ford Motor Company’s “green” advertising campaign used computer-generated images and silicon models of fetal dolphins, elephants, and polar bears to sell flexifuel vehicles, “for the next generation.” The irony was too much for some critics, who charged that the Ford Motor Company was at the same time suing to stop California from reducing gas emissions and had reneged on its promise to increase fuel efficiency on its gas-guzzling SUVs (Robison and Viscusi 2006). These inconvenient truths, however, could not undermine the appeal of a cute, animated polar bear fetus. It was a short step from the sublime to the ridiculous, and fetal kitsch can now be found all over the Internet. During the second Iraq war, the MissPoppy.com Web site sold an “Unborn Baby [Christmas] Ornament, US Troop Model.” A three-inch-long gun-toting plastic fetal replica, carrying a military rucksack, was encased in a clear plastic bubble topped by a yellow ribbon. The page read, “Protect our troops—from the womb to the war. What if the fetus you were going to abort would grow up to be a soldier bringing democracy to a godless dictatorship?” The designers felt obliged to include a “NOTE TO THE CONFUSED: This is a real product, from a real site. The product is a satire, but it is also a real product—FOR SALE.”[6] It is one thing to analyze how embryos are constituted, but these examples serve to show how we are likewise constituted by our understandings of them.

It has always been easier for anthropologists to recognize when people in nonindustrialized societies project their social assumptions and prejudices onto their interpretations of embryos and fetuses; it is not so easy to recognize the culture-bound features of the anthropologist’s own reproductive origin stories. This began to change in the 1980s, when Emily Martin showed that medical textbooks often utilize metaphors of assembly lines and other features of industrial capitalism when they discuss the biological "facts" of reproduction (Martin 1987). Biological reductionism is another feature of modern industrialized societies that permits an obsessive focus on embryos and fetuses. Petchesky showed biological reductionism to be the product of Darwinian thinking, eugenics, and scientific rationalism that accompanied the rise of modernity (Petchesky 1984:334). Yet even many feminist writers tended to accept uncritically the view that embryos and fetuses are naturally developing creatures, the biological consequence of sexual intercourse and nature's way of perpetuating the species. Petchesky herself asked what an "accurate representation of a real fetus" would be, seeming to assume that the fetus was—underneath the political distortions—a natural object (Petchesky 1987:268). She cited biological reductionism as responsible for claims of fetal personhood that "showed photographs of fetuses at different stages of development, revealing recognizable physiological features" (Petchesky 1984:334). By framing her discussion as a critique of fetal personhood, Petchesky laid the groundwork for social scientists and philosophers to criticize the attribution of personhood to fetuses and to see it as a historical and political process, but she overlooked the extent to which the idea of fetal autonomy was constructed by the embryo collectors. Only after they collected and described "the" embryo, determined its stages, identified its features, and convinced the lay public to set aside alternative explanations of prenatal development did it become possible to personify embryos and fetuses. None of Petchesky's "different stages of development" or "recognizable physiological features," in other words, would have been recognizable before the embryologists did their work, because the Carnegie embryologists produced the very embryos that they purported to discover.[7]

There were two contradictory trends occurring simultaneously throughout the late twentieth century. On one hand, the proliferation of fetal imagery made it much easier to see and appreciate human embryos and fetuses. On the other hand, it became much harder to accept embryos, fetuses, and other biological "facts" as given, because new work in the social studies of science challenged many supposedly stable biological "facts." Stories about sexual reproduction, hormones, kinship, stem cells, and primates were all shown to be shaped by unexamined social assumptions, economic arrangements, and power relations.[8] Embryos and fetuses were already heavily laden with cultural assumptions by the time they emerged into public discourse in the mid- to late twentieth century. "A theory about human development is never culturally neutral" (Gilbert and Howes-Mischel 2004:377), and indeed American embryologists put considerable effort into shaping and molding the features that many of us have come to accept as "natural." When the embryologists isolated specimens from women's bodies and brought them into their laboratories, they created embryos that would correspond to their anatomical concerns and preoccupations. Today, nonscientists do the same thing when they create representations of embryos that will conform to their specific agendas (emotional, political, and social). Obstetrical ultrasound and prenatal testing, for example, have much in common with earlier embryo-production technologies, because in each "the [embryo or] fetus emerges as the product of expert intervention" (Mitchell 2001:121).

THE SILENCING OF FETAL DEATH

While feminist social scientists identified the practices that produced fetal persons (Hartouni 1999), most of them were concerned with active, living fetal subjects. Yet we must also direct our attention to dead embryos and fetuses—research and anatomical specimens—which were produced within specific social contexts (Clarke 1987, 2004; Sappol 2002). Let us pause for a moment to consider just how many dead embryos and fetuses are produced each year in the United States, in addition to the approximately four million registered births that occur annually. In contrast to births, the deaths of embryos and fetuses are almost invisible, in social terms, and any numbers are at best estimates. Dead embryos and fetuses are counted under the headings of miscarriage (also called "spontaneous abortion"), induced abortion, and stillbirth. Miscarriage rates are notoriously difficult to ascertain because many miscarriages occur before women realize they are pregnant. Researchers estimate are that between 15 and 50 percent of fertilized ova die or abort spontaneously. Among known pregnancies, an average of one in ten women will miscarry (MedlinePlus 2006). There were 1.29 million induced abortions in the United States in 2002. That year, 24 percent of pregnancies (not including miscarriages) ended in abortion. At those rates, one-third of American women would have an induced abortion by the time she was forty-five years of age (Guttmacher Institute 2006). In 2001, twenty-six thousand stillbirths, defined as the death in pregnancy of a fetus of more than twenty weeks' gestation, were reported in the United States (Stillbirth Collaborative Research Network 2004). It seems surprising, given the large number of pregnancy losses and terminations, that we do not talk about them publicly and that few social rituals acknowledge fetal death or tell us how to handle the remains.

The silence surrounding embryo and fetal deaths sends the message that these deaths do not count. Anthropologist Nancy Scheper-Hughes's ethnographic study of infant death in the northeast of Brazil showed that much can be learned by looking at who counts and who gets counted (1992). She found that many babies' deaths in Brazil were not recorded in vital statistics registries. The question of who counts was brought home to me when I asked my aunt, from the Mexican side of my family, to list her children in birth order. She listed Valerina, Ronald, Patricia, Roger, Rick. Then she paused, "Do I include the boy who died at seven months, before he was born?" My brother, standing behind her where she couldn't see him, was vehemently shaking his head. "No," he was trying to tell me, "don't write that down." Should this child, dead before it was born, be included among her children in the permanent family genealogy? Of course the fact that she was telling me about it fifty years later proved that the loss was significant to her, but my brother obviously thought it inappropriate to list never-born children in the family history. Who counts?

The same point was made by one of my students on a genealogy assignment. She had asked her Mexican grandmother for background about the family, and dutifully recorded as "deceased" the two miscarriages that the grandmother included among her offspring. Never before had one of my students included a never-born "person" in a genealogical diagram. Not even a pro-life student. The exceptions prove the rule; we do not count babies that die before they are born. A poignant story appeared in *The New Yorker* magazine in 2006. I had to read the title twice before I could make sense of it: "Irene Raeburn: Born December 28, 2004, Died December 24, 2004." When Raeburn and his wife went to a support group meeting for parents of stillborn infants, Raeburn asked the others, "What do you say when people ask you if you have kids? If I say yes, they're going to ask about them. If I say no, I'm lying." No one, he said ruefully, knew how to answer his question (Raeburn 2006:52). We live in a society that celebrates and places great importance on childbirth and on the biological essence of humanity. We ascribe great social significance to biological initiations, such as genomic maps, fertilization, ultrasound pictures of unborn babies, and birthdays. But death at the beginning of life weighs heavily, as if ignoring it could make it disappear.

The experience of pregnancy loss is silenced in the United States, as anthropologist Linda Layne clearly shows in *Motherhood Lost: A Feminist Account of Pregnancy Loss in America* (2003), and the disposition of embryo and fetal remains is hidden from public view. A great deal of embryonic and fetal tissue is incinerated by hospitals and clinics under the heading of "medical waste."

For stillborn fetuses greater than twenty weeks' gestation, parents are given the option of burying or cremating the remains. Yet we hear little about the disposition of fetal tissue in the media, even as prime-time television shows like *CSI* zoom in on cadavers and morgues. The disappearance of fetal remains and fetal collections is correlated with the broader disappearance of dead fetuses from American society, which Layne would argue is a purposeful act of erasure. A wall of invisibility, silence, and taboo has been systematically built around the experience of pregnancy loss and the disposal of embryonic and fetal remains (Layne 2003:68–74). This silence is damaging to women who experience miscarriage and stillbirth, Layne argues, when society denies the emotional pain and legitimacy of their losses. This silence also cedes territory to anti-abortion activists, when the only images of fetal remains to appear in public are intentionally horrifying, bloodied, and dismembered (Davis 2003; Stabile 1999). It can be difficult, in this context, to remember that not all dead embryos and fetuses are the product of abortion, and that abortion should not be reduced to dead embryos and fetuses. Yet as long as fetal remains appear only to symbolize abortion, this link will remain unchallenged. This is a vicious cycle: the less that fetal remains are visible in public, and the more limited the contexts in which they appear, the more shocking and sordid their appearance comes to seem.

For the past forty years collections of embryo and fetal specimens have been gradually disappearing from museums, universities, and hospitals. This is lamentable because the display of old embryo collections can be an important way to break the symbolic association that makes "dead fetus" symbolize "abortion." There are other reasons why it makes sense to display and discuss these old collections. The collections make it obvious that there are many reasons for pregnancy loss and termination, including, for example, infectious disease, environmental contamination, occupational injury, the stigma of pregnancy out-of-wedlock, and lack of access to contraception. Putting old collections on display would provide an opportunity to discuss the many uses to which embryo specimens have been put since the early twentieth century, including educational displays, descriptive scientific research, and development of vaccines and other therapies. A variety of specimen preparations could be displayed, including those that are embalmed, cleared, sectioned, plastinated, and/or dye-injected (see Schultz 1924). Alongside the specimens, an exhibit could show how they have been used in artistic, photographic, and propagandistic renderings (Worden 2002; Purcell and Gould 1986). The display of old collections would be a rare opportunity to see embryos in their unmediated state, thus providing a counterweight to the sanitized, beautified, digitized, colorized, magnified, lifelike images that currently dominate the visual imagery associated with embryos and fetuses (Duden 1993; L. M. Morgan 2006a). And finally, of course, a display could put the embryo-collecting endeavor into its historical context, showing what it meant to anatomists, embryologists, and clinical doctors and illustrating how it shaped the embryological view of development.

The embryological view of development is by now deeply entrenched. It is fundamental to the stories that many educated, modern citizens—despite vastly different religions, politics, and cultural beliefs—tell themselves and each other about how we came to be. The embryological view is indispensable to scientists who use embryos for therapeutic and research purposes. It is also increasingly central to the production of emergent life forms, forms of population surveillance and control, and to the politics of life itself (N. Rose 2007). The result of this proliferation of meanings attached to embryos is both contradictory and confusing, but it also explains why embryos have become such potent symbols. On the one hand, we trust developmental biologists to provide factual scientific information that will prevent unwanted pregnancy, treat infertility, and identify genetic anomalies. On the other hand, embryos have escaped from the confines of science and the ability of scientists to control what they mean. Competing constituencies claim the right to define what embryos and fetuses are, what they should mean, and what should be done with them. These claims will be familiar to readers who follow the polarized politics of the abortion debate: should embryo research be permitted if it destroys embryos? If it saves lives? Paradoxically, it is the embryological view of development that keeps even those fetuses that have already been designated by their parents-to-be as "persons" locked into their status as "fetuses," because the embryological view of development determines the operative "rules of recognition by which societies selectively allocate their members to specific subject positions" (Palmié 2007:210). The contestation is met with attempts to legislate solutions, as seen in the recent U.S. Supreme Court decision upholding the ban on so-called partial-birth abortion, but legislative efforts end up fanning the flames of controversy. The embryological view of development renders it impossible to conceive that not all embryo-fetal trajectories are the same. They are classic boundary crossers—the dead unborn.

Today's lively fetal subjects are historical and cultural achievements, built atop the remains of thousands of dead embryos, fetuses, and infants. Without these specimens, embryologists would not have been able to construct the empirical foundation for describing embryological anatomy and physiology, which in turn provided the "recognizable physiological features" so familiar to us today. Specimens provided the data with which to write atlases and textbooks of embryological development to instruct students of medicine and developmental biology. Specimens were behind the ubiquitous online pregnancy calendars that describe the week-by-week development (with pictures, videos, and lots of advertising) of "your baby." Because specimens were separated from pregnant women, it became possible to imagine that fetuses had "their own" interests, which led to the idea that fetuses could be "in conflict" with their mothers. Specimens provided the information people use when they glorify and enshrine the sanctity of microscopic embryos. Specimens were the "fetal subjects" of embryology long before parents named their unborn children and incorporated them into their social worlds (Rothman 1986).

OUTLINE OF THIS BOOK

The ten thousand specimens that make up the Carnegie Human Embryo Collection are still in existence, housed at the Human Developmental Anatomy Center in the Museum of Health and Medicine, in Washington, D.C. (Noe 2004). It can be strange, from today's vantage point, to imagine that anyone would ever have wanted to collect thousands of human embryo and fetal remains. It is stranger still to realize that those forgotten specimens provided the foundation for so many competing interpretations of what embryos and fetuses are and what they mean. This book peels back those layers of strangeness to expose the cultural logic and social practices that made embryo collecting seem both normal and reasonable. Embryo collecting helped to underwrite a scientific narrative of progress, but the exalted status of the embryo in contemporary society cannot be reduced to scientific advances. The special status accorded to embryos reveals less about what embryos are than it does about our cultural willingness to give ontological priority to anatomical evidence. Embryos mean only as much as the faith that is placed on embryological evidence.

In giving attention to the cultural history of embryo collecting and the social lives of specimens, this book gives short shrift to other frameworks used to analyze embryo controversies, including the ethical, political, institutional, scientific, and intellectual histories of embryology told elsewhere.[9] Likewise I skip over the headlines concerning stem cell research, abortion, and the fate of surplus embryos, except insofar as they related to embryo specimen collecting. The collection was an important step in turning embryos from worthless scraps of tissue into material entities that would eventually become highly visible and contentious symbols of life, and embryo specimens continue to act as protagonists in a powerful modern origin story.

The next chapter is an introduction to the world of Franklin Mall, the anatomist and avid human embryo collector without whom the embryo collection might not have existed. Mall's career spanned a transitional period in the history of anatomy, from an old style concerned with descriptive morphology to a new style focused on experimentation and heredity, and Mall was both a traditionalist and an innovator. He used the old comparative and descriptive methods to study a new, relatively uncharted object: the human embryo. He considered human embryology the last uncharted frontier of human gross anatomy, and in 1913 he convinced the Carnegie Institution of Washington to set up a department of embryology. As its first director, he created a far-flung culture of embryo collecting, cultivating a network of doctors who eagerly saved specimens for science.

The embryologists regarded embryos in biological terms and urged others to do the same. Although they looked in and at embryos for clues about human origins, much of their daily collecting work was by necessity social. Chapter 3 describes how they built the professional relationships that gave them exclusive access to the precious specimens located within women's bodily realms, and how they devised mechanisms for acquiring, exchanging, labeling, and handling specimens. The embryologists worked hard to convince women that doctor-experts held the most accurate knowledge about pregnancy, and that "superstitions" about fetal development had no place in a modern woman's thoughts. During the mid-twentieth century, the exchange of embryo specimens was widespread among health professionals who solidified their social networks through the exchange of embryo specimens, as was evident in the hundreds of specimens donated by alumnae and friends of Mount Holyoke College from 1917 through the 1950s.

Chapter 4 moves inside the embryological laboratories. It traces the stories of two embryo specimens produced there: the first was a model of a so-called "embryo" brain (although it was probably that of a fetus or infant) made by Gertrude Stein in 1901 when she was a young medical student at Johns Hopkins. The second specimen was a young human embryo, collected in 1914, that later became famous (or as famous as an embryo specimen can be) as Carnegie no. 836.

Chapter 5 looks at the social and medical circumstances that generated a reliable supply of embryo specimens. It considers the health and welfare of pregnant women in early twentieth-century Baltimore, and the circumstances that caused pregnancy loss. The availability of specimens was contingent on myriad factors that made women susceptible to pregnancy, pregnancy loss, and obstetrical surgery, including a moralistic social context that stigmatized out-of-wedlock birth and led to the deaths of one-third of illegitimate infants. In Boston in the 1930s, an obstetrical surgeon teamed up with an embryological pathologist to ferret out the very earliest human embryos, which still remained to be found even after two decades of searching. The charismatic duo known as the "the Ham and the Egg" found what they were looking for by examining the wombs of 210 women subjected to hysterectomy. Such specimens, when they were later featured in embryological textbooks and museum exhibits, were described as "naturally occurring."

All embryos are produced within a social framework, even when the dominant origin story directs people's attention to the riveting drama of the sperm penetrating the ovum. With the expansion of the embryological view of development, a de facto consensus emerged: biological scientists would be the legitimate anatomical and embryological experts, collecting specimens and producing knowledge inside the laboratory, while others would avert their collective gaze. Our story straddles both sides of this divide, entering into the hallowed halls of the embryological laboratory in 1914 to watch while scientists painstakingly work to produce a single, exemplary, quarter-inch embryo specimen. On the other side of the divide, we accompany a writer who stood before the closed doors of an anatomical collection with a question on her lips. Poised to knock, she turned away because she felt ashamed that her curiosity was "morbid."

What do embryos tell us? While feminist scholars traced the emergence of the public fetus to ultrasound and other imaging technologies, chapter 6 examines how embryos were recruited much earlier to "speak" about the social issues of the day. When the Scopes trial was underway in 1925, embryologists weighed in on the side of Darwinian evolution by invoking the human embryonic tail to argue that humans were descended from monkeys. Embryologists trained at Johns Hopkins University went to China in the second decade of the twentieth century, where they collected Chinese embryos and fetuses to study what they called "racial embryology." Throughout the latter twentieth century, embryo specimens were recruited to "speak" about a changing and ever-expanding array of social issues, from birth defects to women's rights to the spiciness of jalapeño hamburgers to global warming. When embryos "speak," of course, their utterances reflect the concerns of the grownups who put words in their mouths. But there is a reciprocal effect as well, when the emergence and increasing volubility of embryos fuels debate and sparks social anxiety.

Chapters 7 and 8 examine what happened to embryo specimens after the end of the collecting project. In the 1960s, embryo and fetal imagery moved outside the laboratory into popular magazines, prenatal guidebooks, and photographs. Specimens were pivotal in this transformation. People started to spruce them up and feature them in feel-good stories about the wonders of life and our common humanity. In the process, embryos were granted ever more authority and social agency. They began to assert their influence in law, medicine, politics, and the identities people were willing to ascribe to their children-to-be. Just as we (in our varied identities and guises) created embryos (in their varied identities and guises), so embryos created us. Embryo specimens from the Carnegie collection continue to surface in popular culture, in creative and sometimes surprising ways. But attention to the ubiquity of these fetal icons masks the fact that specimen collections were quickly disappearing. Embryo collecting fell out of fashion in the 1960s, and collections began to be de-accessioned, destroyed, and erased from public consciousness. The Carnegie collecting project has been largely forgotten or obscured, although some of the specimens are very much alive—including a single, exemplary Carnegie specimen produced in 1914 (and mentioned earlier), which was recently reanimated as a digitized, beautified icon of life.

At the end of the book we return to Mount Holyoke to learn the fate of the specimens I found in the basement. The news media increasingly represent fetuses as of two types: "good" fetuses are associated with life, innocence, and our collective humanity; "bad" fetuses are represented as dead, polluting signs of our collective depravity. The Carnegie embryo collecting project once provided dead embryos and fetuses with scientific legitimacy and a place on the shelf. Now, the collection, along with memories about its origins, has been largely dismantled. One unfortunate consequence of these vanishing acts is that the disappearance of specimens reflects and reinforces the political agenda known as the "culture of life," in which dead embryos come to stand for abortion. Although some of the embryologists' collecting practices would be prohibited by today's standards, the embryologists were reasonable, dedicated scientists with noble intentions. They could not have taken today's approach to embryo subjects, because there were no such subjects before they did their work. To resuscitate memories of the collection, as I do in this book, is to show that social contexts produce multiple interpretations of embryos and fetuses.

The embryo collectors helped to produce a modernist interpretation of embryos that would be consistent with their view of the factors relevant to development. As the designated scientific experts in growth and development from conception through birth, their primary goal was to document what they understood to be a biological process. For at least the first half of the twentieth century, they valued embryos as scientific specimens. They did not regard embryos as incipient persons; nor could they have imagined the political role that embryos would come to play. Looking back on the embryologists' legacy today, the paradox becomes clear. Their view of embryos as autonomous, free-floating, biological specimens justified their efforts to collect and section ten thousand embryos for the greater good of science. On the other hand, they created the corpus of scientific data that allowed nonscientists to imagine embryos as natural, asocial creatures, and to appropriate that ideology (and the corresponding embryo imagery) in support of a variety of competing causes. We still draw on culturally authorized scientific data, but we use it underwrite contradictory claims. In a society that prizes scientific knowledge and that ascribes social significance to biological material, we are trapped in a view of embryos that is at once scientific (because science is the source of authoritative knowledge about bodies) and symbolic (because fetal imagery has broken free of the laboratory). Both the view of embryos as the product of scientific knowledge and the view that "embryos-are-us" leave out the social contexts in which pregnancy is conceived. In dealing with embryos and fetuses in their capacity *as anatomical specimens,* this book steps outside the familiar, conventional embryological narratives to show how scientists produced embryos and wrote women out of the picture, and how embryos shape who we are.

TWO

Embryo Visions

IN 1874, CORNELIA CLAPP WANTED TO PURCHASE an incubator to use in the zoology course she was teaching at Mount Holyoke Female Seminary, but the administration did not grant her the funds. Determined to teach the embryological development of the chick to her students, Clapp rented a broody hen from a local farmer. (People who buy their eggs in supermarkets may not know that a hen is called "broody" when she has laid a clutch of eggs and cannot be dissuaded from sitting on them until they hatch.) Every day for twenty-one days, Clapp placed a freshly laid egg underneath the hen. At the end of the third week, she opened each egg and set it in a saucer. This embryology exhibit showed each stage of chick embryo, from "a day's growth to one that walked and peeped." It was so popular that the embryos "were arranged on a table and an admission was charged for seeing them, thereby paying for the hire of the hen" (A. H. Morgan 1935:1). Clapp's peep show was a time-honored crowd pleaser; Aristotle described a similar demonstration more than two thousand years earlier (Van Speybroeck, De Waele, and Van de Vijver 2002:9). It was not long before the administration capitulated and bought Clapp an incubator (Clapp 1916:361).

Fast-forward more than a century. The year is 1997; my seven-year-old daughter has come home from first grade reciting a textbook definition of *embryo.* Like many American schoolchildren, her elementary school introduction to the topic of reproduction has taken the form of a lesson in chick hatching. She is already an expert in the matter, having incubated her first eggs in preschool. This time, though, she is expected to use greater scientific precision, including structured observations, measurements, and a logbook. She will eventually learn valuable lessons about the scientific method, the circulatory system, and—when a chick is pecked to death by its peers—the fine line between beauty and brutality. In addition, she has learned another important lesson about American culture—namely, that reproduction properly belongs to the realm of science.

Many of us are so well socialized that we might scarcely notice the cultural lessons buried in an elementary school unit on chick hatching. But schooling is clearly a kind of socialization, and chick-hatching lessons became common in the American elementary school curriculum after 1950 for several reasons. As more children were raised in cities and suburbs, chick hatching reflected a nostalgia for rural knowledge and farm traditions. In addition, scientists had generated a wealth of accessible information about chick hatching. They even figured out how to remove a bit of shell to photograph the developing embryo. *Window into an Egg* was the title of a popular illustrated book describing the results of this technique for young readers (Flanagan 1969). Chick hatching continues to be popular in classrooms because it is inexpensive, easy, and because chicks develop conveniently "outside of mom" (as a biologist friend phrased it)—the stages of development are readily visible even to first graders.

At a more subtle level, chick-hatching lessons teach children how to organize and categorize their knowledge about reproduction. Chick hatching teaches them to place knowledge about reproduction under the heading of biology. They learn that biologists are the authorized cultural experts on the subject; so that, to become a cultural expert on reproduction, a person might want to study biology. By directing children's attention to the morphological details of development, hatching projects teach them to frame their observations about reproduction in the language of biology rather than that of religion, by stressing that embryological development is a *secular* rather than a divine miracle. That the same children might learn something entirely different in Sunday school is an implicit lesson in separating science (which will be taught in public school) from religion (which will not). Children are taught to appreciate that the biologist's way of knowing about chick hatching is respected enough to be taught in school, while the religious view is "considered invalid [at least in the school setting] and unworthy of public esteem" (Giroux 1994:329).

Chick hatching conveys another important cultural message, which is that life unfolds in the interval between conception and birth. Birth marks the end of the gestational period and the culturally approved beginning of independent life. By focusing on the relatively abbreviated period between conception and hatching, chick-hatching projects perhaps inevitably pick up and echo other discussions of reproduction that take place in American society. While there is nothing inherently political about chick hatching, one has to wonder whether the language used on a prize-winning 4-H Club Web site was intentional or coincidental: "4-H Embryology teaches students about science and respect for life. Students hatch chicks in the classroom and witness the exciting miracle of life."[1] This is the kind of language used by opponents of abortion. The phrase "respect for life" appeared, for example, in a 2007 opinion written by five members of the U.S. Supreme Court, who upheld the federal ban on so-called partial birth abortions, writing that Congress was within its rights to "promote respect for life, including the life of the unborn." The phrase "miracle of life" was the title of a 2001 award-winning *NOVA* episode about human gestational development. When I asked my daughter recently what she remembered about her first-grade chick-hatching project, her first response was, "One egg didn't hatch." When tragedy lives in the failure to be born, the lessons of chick hatching sound disturbingly politicized.

The classroom peep show is orchestrated to look more "natural"—less the product of human intervention—than it actually is. First-graders are usually not taught about the larger context of mass-produced chickens or eggs. They might hatch chicks several times without being told that the poultry industry puts most male chicks to death shortly after they hatch, or that factory egg farmers have bred out the hens' instinct to brood because broody hens do not lay daily eggs. Children did not practice their addition toting up the profits earned when Tyson Foods replaced unionized laborers with undocumented workers (Barboza 2002). Nor do they accompany the teacher who borrows the incubator and purchases the eggs, or calculate the incubation dates to make sure the chicks will hatch on a weekday rather than on a Saturday morning when the classroom is empty. They are not taught about the background enterprises that make schoolroom chick hatching—or industrial chicken and eggs—possible.

Not even a simple egg is free of culture. Chickens are the product of hundreds of years of selective breeding and scientific research that resulted in today's breeds: broiler chickens with breasts so meaty they can barely walk (Pollan 2006:171), and hens bred to be high-yield egg machines (Cooke 1997). From feeding certain food and hormones to the egg-laying hens, to choosing which roosters to cull from the flock, to carefully controlling temperatures and humidity levels that determine the thickness of an eggshell, breeders are influenced by culture in the production of every egg and embryo. Little about chick hatching is free of culture, yet first-grade hatching lessons tend to overemphasize the biological aspects of embryology and reproduction. Through chick hatching, American schoolchildren learn to think about embryos as "natural" creatures.

THE GENESIS OF AN EMBRYO COLLECTOR

Human embryology was—and still is—a subfield of human anatomy, yet this chapter explores the ways in which human embryo collecting was similar, in certain metaphoric ways, to chick hatching and the mass production of eggs. Women were conceived as human incubators, as mechanical devices that were designed to nurture embryos as they grew but that had little other function, while human embryos were cast as inert biological specimens, little different from those of other species, except that they were harder for scientists to procure. As in the process of chick hatching, human embryo specimens were collected and centralized in a single location, and eventually they were also put on display to educate and edify children. Most importantly, though, both chick hatching and human embryo collecting were brought within the rational, highly controlled realm of scientific intervention.[2]

Human embryo collecting was born in the waning years of the nineteenth century, when some anatomists grew bored with gross anatomy. Dissection had become routine, and although anatomy was indispensable to medical education, it ranked low in prestige compared to newer biomedical specialties such as surgery. Anatomists still had a few technical challenges to tackle, such as how best to preserve bodies for dissection, but in general many of them felt the field promised few new intellectual challenges. Enter human embryology. Embryology remained the unconquered frontier of human anatomy, and it made bodies matter in whole new ways. It promised new technical, intellectual, and professional challenges, as well as ways to use the anatomist's skills. Tempted by the possibilities and inspired by what they learned in German research laboratories, a number of American anatomists began to turn their gaze toward the rarest and most prized bits of human flesh—embryos and fetuses. If truths could be read from the body, they reasoned, new worlds would be revealed once embryos and fetuses could be scrutinized by expert eyes. The anatomists who moved into this unknown territory did not just *discover* embryos, they *produced* them in ways that were consistent with their rational, empirical, laboratory-based vision of the material world (Hopwood 2000). In the United States, foremost among these anatomists was Franklin Paine Mall, who dedicated himself to collecting tens, hundreds, and eventually thousands of human embryo specimens. This chapter is an effort to put embryo collecting into context.

Mall was in many ways an unlikely embryo collector. He was born to German immigrant parents in the newly settled prairie town of Belle Plaines, Iowa, in 1862. Franz, as he was known, was said to be a sad child, especially after his mother died when he was ten years old (Sabin 1934b:7). Although he had never shown any affinity for anatomy or embryology, he left the family farm at the age of eighteen and set off for Ann Arbor to study medicine.[3] Medical education was in flux in 1880. The University of Michigan had a decent enough reputation at the time but Mall despised the place. He found the caliber of education substandard, and he disliked the flamboyant anatomy professor, Corydon L. Ford. Mall worked for two years as under-demonstrator—a student assistant in dissection—in Ford's large anatomy classes, alongside his friend, William Mayo, of Mayo Clinic fame, who remembers Mall as a "frail lad from Iowa" (Clapesattle 1941:187). Posterity has not looked kindly on the Michigan style of medical education in 1880, which relied heavily on passive learning. One of Mall's associates later wrote, "Dr. Mall up to the time he received his M.D. degree was deprived of an intellectual environment. His schooling was primitive" (Streeter 1939). Mall himself recalled that medical education consisted of sitting and listening: "Students paid a single fee, for which they heard much, saw little and did nothing" (quoted in Sabin 1934b:26). At Michigan, Mall developed a lifelong loathing for rote learning and an abhorrence for mediocre professors.

After graduating from medical school in 1883, Mall went to study in Germany, as was then the custom for American doctors and scientists. The trip must have been daunting. Mall had not learned much German at home in spite of his ancestry, yet he crossed the ocean with a list of relatives to visit in Söllingen. After gathering eggs, planting potatoes, and pushing a plow with them for a few weeks, he must have been relieved to get back to the lofty atmosphere of Heidelberg, where he frequented the opera house and became friendly with William Welch, the pathologist who went on to become one of the founders of the Johns Hopkins School of Medicine. In Leipzig, Mall studied under Wilhelm His, the eminent embryologist, and Carl Ludwig, the physiologist (Rosen 1936). It was later said that Mall got his real scientific education in Germany rather than in Michigan (Sabin 1934b:30).

In Leipzig, working under His's direction, Mall became fascinated with new techniques for conducting human embryological research, which offered the mix of technical and intellectual challenges that he found so stimulating. At His's elbow, Mall became a convert to scientific research and to embryology. His had devised a revolutionary new method to "fix" embryos, that is, to put them in a chemical solution to render them solid, to preserve them indefinitely for scientific study. Mall learned how to use the microtome, a cutting apparatus that His had developed, similar to a delicatessen meat slicer. With the microtome, embryologists could take fixed embryos, which were embedded in blocks of paraffin blocks, and cut them into very thin slices. These serial sections, as they were called, were arranged on slides to be stained. Another of His's great breakthroughs was to develop a method for constructing large-scale models of the sliced embryos, so that scientists could envision and study the smallest morphological details of their tiny specimens (Hopwood 1999). Mall became so absorbed with the embryos that His bestowed upon him a precious gift: two tiny human embryo specimens. Storing the two little stowaways in his trunk, Mall returned to the United States in 1886, determined to try His's methods on his own embryos. "The mantle of His fell upon Mall," wrote Sabin, "and he in turn became the leading embryologist of his time" (Sabin 1934b:214).

Mall returned from Germany to a coveted position in pathology at Johns Hopkins, where research-oriented doctors could expect to devote their lives to biomedical research unencumbered by clinical duties or the need to make house calls. These research scientists were more interested in "pure" rather than applied research. As historian Philip Pauly notes, "The most notable characteristics of the generation of university biologists who matured between 1870 and 1900 were obsession with research and insulation from the culture around them" (Pauly 2000:195). As a pathological assistant for three years, Mall did pretty much what he was asked to do. He conducted physiological research and performed dog surgery with his new friend William Stewart Halsted (1852–1922), who went on to become the preeminent Johns Hopkins surgeon credited with introducing surgical gloves to the operating room. Mall also spent time cultivating anaerobic bacteria (sometimes employing methods that threatened to blow up the laboratory) (Sabin 1934b: 80). His position was temporary, though, and he worried about the future.

In 1889, Mall was recruited to teach anatomy at Clark University, in Worcester, Massachusetts. Clark was one of the most intellectually stimulating places in the country, and Mall was fortunate to be there from 1889 to

1892. It was his first real faculty appointment, and because it was in anatomy rather than physiology, Ludwig wrote to tease him: “My God, now he is an anatomist, he doesn’t want to have anything to do anymore with us poor physiologists” (quoted in Sabin 1934b:92).[4] At Clark, Mall worked with several other embryologists, although he was the only one working on vertebrates. While the others unraveled the embryological secrets of lobsters, sea anemones and sea urchins, mollusks, arthropods, and amphibians, Mall labored to make a model of a single human embryo specimen that he estimated might be twenty-six days old. He settled into the relative freedom of an unfettered research environment, ordering microscopes and modeling equipment, hiring an assistant, and using His’s techniques to build a painstaking model of his prized specimen. Sabin writes that Mall made one of his most important discoveries at Clark, “the discovery of the vasomotor nerves of the portal vein” (Sabin 1934b:90).

Not everyone at Clark thought that embryo modeling was a good use of Mall’s time. The Clark University president felt obliged to explain to the trustees Mall’s decision to expend so much time working on a single model: “Some three months were occupied in modeling a human embryo less than a month old. The extreme difficulty to obtain perfect specimens of this age justifies him in devoting so much time to a single, apparently insignificant, specimen” (Hall 1890:48). Given the exciting experiments being done with nonvertebrate embryos, the president regarded human embryology as inferior to the study of “the lower animals.” But this can be considered a lack of foresight on his part, because no one had yet studied human embryology systematically in the United States. A hundred years later, a Clark University historian could boast that while Mall was at Clark he “successfully constructed the first model of an early human embryo to be made in America by the Born wax-plate method” (Koelsch 1987:31).

Mall left Clark in a legendary exodus of distinguished—and disgruntled—faculty who defected in 1892 (D. Cole 1999). Along with several other Clark exiles, he moved to the then-new University of Chicago, where he spent just a year before being lured away to Johns Hopkins, where he would remain for the rest of his life. Mall had a heavy workload in Baltimore, including teaching gross anatomy. After his Michigan experience, Mall had given up on lecturing and examinations; he preferred to let students work independently and make their own way. In addition to teaching, he had plenty of administrative duties. He was charged with forming the department of anatomy, designing a new building, and developing the profession of embryology. In the years leading up to the 1910 publication of the Flexner Report, which set standards for medical education, Mall participated actively in discussions about how best to prepare future doctors (Sabin 1934b).

There was only so much that such a busy man could accomplish, but Mall always managed to find time for his embryos. He built his own collection by urging doctors to send him any specimens they might find. For twenty years he steadily collected embryo specimens, while he dreamed of starting an embryological institute in America (F. P. Mall 1911a; 1913a). An institute, he thought, would allow him to put into practice the ideas and techniques he had brought from Germany. An institute would give him the technical staff to collect, section, measure, photograph, and draw scores of human embryos. It would allow him to amass a database to document—for the first time—the very earliest stages of human development and to investigate the genesis of tissues and organ systems. Such an institute would use anatomical methods to address physiological questions. Among other things, Mall wanted to figure out how to assess the gestational age of embryos using precise measurements. This was a pressing problem, because patient histories were notoriously unreliable. In addition, many embryos died in the womb and began to deteriorate before being expelled, making it impossible to tell how long they had gestated. An institute might provide enough data to figure out rates of miscarriage and why some fetuses developed abnormally into what were commonly called "monsters." He wanted to determine whether miscarriage was caused by "germ" (what we could call "genetic") abnormalities or, as he believed, by environmental deficiencies in the womb. In short, Mall wanted to establish human embryology on an empirical foundation. In order to realize this vision, he would require many, many embryo specimens.

In 1913, at the age of fifty-one, and with approximately one thousand human embryo specimens in his personal possession, Mall finally succeeded in convincing the Carnegie Institution of Washington to fund an independent department of embryology on the campus of Johns Hopkins Medical School (Maienschein 2004:7; Sabin 1934b). The funding allowed Mall to realize his lifelong dream: a free-standing research institute wholly devoted to the study of embryology. Endowed with a sizeable research budget, staff, equipment, and the prestige of Carnegie funding in addition to his own reputation, Mall redoubled his efforts to expand the collection. Embryo collecting took off at this point, as we will see in greater detail in the next chapter. Mall sent announcements to over half the doctors in the United States and many American doctors overseas, appealing for specimens. He published announcements also in anatomical journals and newsletters. Doctors responded enthusiastically, collecting and sending in the specimens they used to throw away. Sometimes doctors donated small collections which they themselves had amassed over the years. This period marked the beginning of an international embryo-collecting project that led the Carnegie Institution of Washington Department of Embryology (CIWDE), under Mall's leadership, to build the most extensive collection of serially sectioned human embryos in the world. By the start of World War II, the CIWDE had nearly ten thousand human embryo and fetal specimens in its possession.

Embryo collecting was in many ways a perfectly logical thing for Mall to do. It was consistent with the triumphalism of American biomedical sciences, the rise of bureaucratic rationalism, and the intersection of civil with medical forms of authority. Between 1890 and 1920, writes Louis Menand, "American social and economic life was tipping over into modern forms of organization, forms whose characteristics reflect the effects of size: impersonal authority, bureaucratic procedure, mass markets" (Menand 2001:236). Anatomical collections fit these characteristics perfectly. Modernity would bring progress, including medical progress, through the standardization of evidence-based treatments. Many elite, educated, Progressive Era anatomists believed that scientific and medical progress would eventually alleviate ignorance, poverty, disease, and associated social ills. Their approach, they were sure, "would bring opportunity, progress, order, and community" (Wiebe 1967:170). Massive anatomical collections would provide the empirical basis to answer important questions about race, evolution, and the nature of the species, and collections would also provide data for the medical research and progress they envisioned.

Embryo collections should be seen as a manifestation of these modernist values. The specimens were anonymized, detached from patient histories, rendered impersonal, and incorporated into the authoritative regime of science. Hopwood points out that the collections "did not just homogenize the meaning of the objects," that is, the embryo specimens, but also "made them physically equivalent by treating them all in the same way" (Hopwood 2000:40). They created homogeneity out of a diverse class of objects. The effort was not unique to embryo specimens. Mall's plan to collect normal human embryos mimicked other anatomical collecting enterprises, including of course the one of his mentor, Wilhelm His, but also the project of Burt Green Wilder at Cornell University, who collected hundreds of human brains (Burrell 2005). Only by collecting and comparing large numbers of specimens could scientists be confident that their results were scientifically valid and therefore unimpeachable.

EMBRYO COLLECTING IN CONTEXT

It may be difficult now to recognize just how little was known about human embryology in 1900. Scientists at that time had only recently established that "man is not only a vertebrate, but a mammal and a descendant of the primates" (Human embryology 1893:263). Until Karl Ernst von Baer identified the mammalian ovum in 1827, scientists did not know that humans, like other mammals, develop from eggs. That human ovulation occurs monthly was not known until 1840, and by 1900 scientists had still not determined the timing of ovulation in relation to menstruation or fertilization. Fertilization had been described for the scientific community in 1875, just eighteen years before Mall began teaching at Johns Hopkins, and embryologists were still trying to piece together an accurate account of fertilization in humans. The discovery of DNA was half a century in the future, and in 1910 embryologists were debating whether the sex of the offspring could be influenced by factors occurring in utero. Some were convinced that ova came in two varieties, male and female, and that sex was established before fertilization occurred; others were not so sure (Keibel and Mall 1910–12:15). Embryological discoveries were invariably applied last to humans, because of the difficulty of getting access to human evidence.

The period between 1890 and 1920 was a time of great conceptual advances in embryology, and Baltimore was arguably the American intellectual epicenter of this movement (Allen 1978; Benson 1981; Clarke 1998; S. F. Gilbert 1991; Haraway 2004 [1976]; Hopwood 1999; Oppenheimer 1967; Pauly 1987, 2000). Curiously, though, Mall himself figures hardly at all in historians' accounts of this period; certainly most of them would disagree with Sabin's statement, quoted earlier, that Mall was the leading embryologist of his time. Historian and philosopher of science Jane Maienschein says, "Americans central to the emergence of 'modern' American embryology include the Johns Hopkins gang of four." She goes on to list Edmund Beecher Wilson, Edwin Grant Conklin, Thomas Hunt Morgan, and Ross Granville Harrison, all of whom had been together in graduate school at Johns Hopkins and who remained close friends and colleagues (1981:98; see also Maienschein 1994). Mall knew all the major figures, of course (as well as the *other* gang of four, that is, the physicians featured in John Singer Sargent's famous 1906 painting, *The Four Doctors:* William H. Welch, William Osler, William S. Halsted, and Howard Kelly). Mall spent several summers at Woods Hole with the well-known embryologists Charles Otis Whitman, Frank Lillie, and Jacques Loeb, among many others.

Mall traveled in illustrious circles, yet he did not have the grand personality to match these other confident men. He was quiet and "physically unimpressive," according to one of his students, who said the other medical students referred to him (somewhat rudely and behind his back) as "Johnny" because he was so plain and unassuming (Corner 1981:38). Mall's excessive modesty was related to his pathological fear of public speaking, which left him disinclined to self-promotion. He was most comfortable one-on-one, demonstrating an anatomical detail or taking a long walk through the streets of Baltimore. Despite his shyness he had a "searching mind," said Corner (1981:38), and his colleagues held him in high esteem. He included among his closest friends Simon Flexner (1863–1946), the pathologist and first director of the Rockefeller Institute for Medical Research; Lewellys F. Barker (1867–1943), an anatomist who became physician-in-chief at Johns Hopkins Hospital; and the surgeon William Halsted.

Around 1910, while Mall and colleagues were turning toward human embryology, others were moving into the exciting field of experimental embryology. Ingenious experiments performed by embryological researchers Wilhelm Roux in 1888 and Hans Driesch in 1895 were tipping investigators away from descriptive morphology and toward the more fascinating problems of physiology. In the words of Adele Clarke, they were moving "from morphological to physiological approaches (from problems of form to those of function)" (Clarke 1998:46; see also Haraway 2004 [1976]). The "mad rush toward experimentation" (Maienschein 1985:33) involved dissecting, bifurcating, centrifuging, electrocuting, poisoning, and reassembling the living embryos of frogs, salamanders, fish, and sea urchins. Experimental embryology held promise for answering old conceptual questions about the relationship between vitalism (which stated that embryos were preformed and preordained) and mechanism (which tried to attribute the form of an embryo to mechanical or genetic causes) (S. F. Gilbert 2004:xii; Haraway 2004:2; Maienschein 1985:31–32).

Mall never joined the experimentalists. He remained convinced that simple, old-fashioned descriptive morphology could shed light on physiological problems. His reluctance to join the experimentalists might be interpreted as evidence of conservatism, but his job inside a medical school made him particularly attuned to human clinical problems. Ever since he had returned from Germany, he had been steadfastly committed to human embryology, and to replacing what he thought of as wrongheaded notions about human development with objective, empirical facts. He claimed that embryos could be accurately interpreted simply by looking at the material evidence, and he worked to collapse the distinction between "the way a thing is made intelligible [and] the thing itself" (Stormer 2000:109). Mall could not be distracted by experimental embryology as long as the job of describing human embryological morphology remained unfinished.

Even if Mall had been tempted by the experimentalists' techniques, he could not have used them on human embryos. His commitment to *human* embryology was unwavering, and he understood that advances in human embryology would be hobbled as long as specimens were in short supply (see Maienschein 1981:111). He could contribute by accumulating a much-needed repository of human embryo specimens. He envisioned a modern, twentieth-century model of scientific inquiry, in which investigators would be liberated from teaching and linked to one another through international collaboration. His vision for collecting was based, in part, on a lingering tradition that was held over from nineteenth-century comparative embryology, which emphasized the need for larger, better-documented specimen collections (Mall 1913a:1600).

COMPARATIVE EMBRYOLOGY

Comparative embryology was, as Hopwood says, a "central science of life" in the late nineteenth century (Hopwood 2004:170; see also Coleman 1971:36). In the fervor of theorizing that surrounded the publication of Darwin's theory of evolution, zoologists began to rely on comparisons between species (along with fossil evidence) to shed light on evolution and differentiation. One reason had to do with the well-known debate about whether ontogeny (the epigenetic unfolding of the embryo) recapitulates phylogeny (evolutionary history), as proposed by the German zoologist Ernst Haeckel. Haeckel had proposed that every embryo would pass through the entire history of evolution on its way to being born. Even if Haeckel was wrong, the comparative anatomists were convinced that lessons learned about the development of one species could shed light on the development of others, as well as on the mechanisms of evolution (see Hopwood 2006). Using this logic, embryologists assumed that what was true for other vertebrates would be true for humans, too. When in the course of explaining human embryology they would run into a hole in the data, they sometimes filled the gap by extrapolating from descriptions of rats or pigs, without necessarily informing the reader of the switch—as Keibel and Mall point out in their 1910 textbook

(Keibel and Mall 1910–12:xvii). Comparative anatomy and embryology were therefore enormously interesting, because it allowed them to compare related species. Some scientists—including His, his student Franz Keibel, Mall, and many others—hoped that eventually they would be able to build a complete compendium of data based on observations of human embryos alone, but even as late as 1900 there was not a sufficient supply of specimens to achieve that goal. They had no choice: much of what they knew about humans would have to come through comparative embryology.

Mall had a reputation for "zoological leanings," and in building a human embryo collection he was influenced by the comparativists' methods (Clarke 2004:87). Sociologist and historian of science Adele Clarke describes a few of the strategies the comparativists used to acquire specimens. First, they embarked on collecting expeditions to find eggs or pregnant females. They gathered locally available materials opportunistically whenever they could, including amphibian and invertebrate embryos by the thousands from woodlands and seashores. They gathered the embryos of northern hemisphere farm animals—cattle, sheep, pigs, hens, cats, and dogs—from barnyards and slaughterhouses. Second, they ordered specimens from biological supply companies, or—for the rare human material—requested it from surgeons who performed medical procedures. And third, they set up breeding colonies for the rodents—rats, mice, and guinea pigs (Clarke 1987:326). As they set about documenting and describing the morphological development of these readily available creatures, embryological science advanced very quickly in the 1880s. But many of the most exotic—and hence most prestigious—species could not be found in northern Europe or America.

To find such exotic vertebrate embryos, collectors had to be creative and resourceful. In the Netherlands, the embryologist A. A. W. Hubrecht (1853–1915) reportedly offered twenty-five cents for every hedgehog brought to him from the environs of Utrecht (Faasse, Faber, and Narraway 1999:584). James Peter Hill (1873–1954) literally hunted—gun in hand—for embryos, heading to Australia in search of bandicoots, wombats, and platypuses. He was enormously successful, at least from the human perspective. But hunting expeditions were expensive and risky, and the results could not be guaranteed. A collecting expedition to the Philippines, just after the Spanish-American War, returned without finding "a single pregnant uterus" among the 120 monkeys killed around Manila (Minot 1905b). Back in Baltimore, the embryologist and physical anthropologist Adolph H. Schultz relied on the kindness of far-flung colleagues to send him the nonhuman primate fetuses he coveted. Eventually, he counted among his treasures twin howler monkey fetuses sent from British Guiana, two "orang-utan" fetuses from the Philadelphia Zoo, and a "rare small gorilla fetus" brought back from a collecting expedition to the Congo. Finally, Schultz could not resist the temptation to take up the gun himself; in 1923, he ventured to "the wildest part of eastern Nicaragua" in search of specimens (Schultz 1971:3–4). Comparative embryology owed much to the marksmanship, bravado, and hubris of these men in the years before humans became cognizant of their role as species exterminators. As in the case of chick hatching, the success of their enterprise was predicated on hidden labor that took place behind the scenes, for example in colonial labor relations and privileged access to animal habitats (Haraway 1989).

Human embryology advanced more slowly than nonhuman embryology, and not only because assassination was an unavailable option. Human specimens were so rare and precious that each one could merit years of work. Virtually every early human embryo that had been found by eighteenth- and nineteenth-century anatomists had already been painstakingly described in the medical literature. Keibel and Mall observed that such isolated accounts of single specimens were fine, as far as they went, but did not allow researchers to "round out the whole story." Single specimens would reveal information only about themselves, whereas Keibel and Mall wanted more generic information about the human species and the process of embryological development. For that, they would require hundreds or even thousands of high-quality, well-preserved specimens. The "whole story" that they wanted to tell had nothing to do with today's embryo controversies. They never considered topics having to do with the personification of fetuses or women's reproductive decision making; they were concerned with evolutionary questions about the "biological substrate" of the species (see Waldby and Mitchell 2006:31).

There were other problems that hindered progress, in their view. They realized that other embryologists were unwilling to dissect and thus ruin precious human specimens in the absence of reliable techniques for preserving, slicing, and making accurate models (Keibel and Mall 1910–12:xiv). Although they did not say so explicitly, it was also clear that women's health-seeking practices hampered embryologists' collecting efforts. The embryologists had to depend on clinicians for most of their specimens, but doctors would never see any specimens if women did not consult doctors in cases of vaginal bleeding. Until miscarriage started to be regarded as a medical event, then, countless specimens would be "lost" to science. In this way, the success of embryo collecting was contingent on the medicalization of pregnancy loss.

Mall's dedication to human embryology can also be explained by his stubborn determination to discredit an explanation of human development that he knew was wrong—namely, the belief that an unborn child could be physically scarred by traumatic events experienced by the pregnant woman. Called "prenatal influence" or "maternal impressions," this was "the idea . . . that the growing child may be marked, injured or deformed in some way by the anger, fright, horror, depression or other emotional disturbance of the mother" (Reed 1924:17). Prenatal influence was a part of a widespread nineteenth-century idea that acquired characteristics could be passed from mother to child, and many people considered prenatal influence responsible for birthmarks and birth defects such as cleft palate or club foot, behavioral quirks, food likes and dislikes, personality characteristics, and so on.

The doctrine of prenatal influence was more than an idle belief in Mall's day; it was also a prescription for behavior. Pregnant women were not supposed to overstimulate, exert, or upset themselves for fear of adversely affecting their unborn children. They were advised not to ride in cars, have sexual relations, or allow themselves to become emotionally overwrought. The notion of prenatal influence coincided neatly with the late nineteenth-century social-purity movement, which mandated that women should control marital sex as a way to reduce male lustfulness. "No one should need to be told nature's plain law that women ought to avoid sexual relations during pregnancy. For by indulging their sexual appetites while their wives were pregnant, men implanted 'in the coming life the seeds of sensuality, besides greatly increasing the suffering of the mother before and during the child's birth'" (Kevles 1985:65, quoting Melendy 1914:313). Looking back, it appears that the theory of prenatal influence might have given women a modicum of control over their own activities and those of their husbands, when women held relatively little power in other realms. As a social ideology, prenatal influence held that reproductive outcomes could be improved by indulging women's desires, maintaining a temperate attitude toward sexual relations, and observing harmonious, peaceful social relationships.

But embryologists did not generally subscribe to this view. At a time when the embryological view of development was not yet fully accepted, they tried to replace the theory of prenatal influence with a biological view of human development that was both impersonal and asocial. Their struggle can be seen as a battle over who would be allowed to produce, organize, and disseminate embryological knowledge. Embryologists were allied with the obstetricians, who cast themselves as the people who would educate the ignorant and provide the facts about how babies are made. J. Morris Slemons, a professor of obstetrics at Johns Hopkins and author of a pregnancy manual for expectant mothers, was downright patronizing when it came to the subject of prenatal influence:

> Of course it is not essential that a prospective mother should understand what is happening within the womb. And upon those who prefer to be ignorant of the mechanism of development I would not urge another point of view, for not ignorance but the unchallenged acceptance of "half-truths" and of totally incorrect explanations is the chief source of harm. On the other hand, my own experience has taught me that women who wish to know about development should be told the truth. In accord with this is the fact that I never have more satisfactory patients than those who have previously been trained nurses and who, in preparing for that profession, received instruction concerning the reproductive function of human beings. (Slemons 1917:22–23)

Many embryologists regarded the idea of prenatal influence as unscientific, and they used scientific arguments to advance their views. They argued persistently and loudly that the placenta created an impermeable barrier between the mother and her unborn child. Although the embryologists' intention was ostensibly to improve women's scientific literacy, their message demanded an ideological shift: embryos should be regarded as autonomous entities, immune from social influences. Women should be regarded more as fetal "incubators," they preached, than as active participants in the production of new persons.[5]

> Superstitious mothers must be told that the infant from the very first day of its being is an *independent* being. The mother only provides its temporary dwelling place and supplies the necessary nourishment. *Heredity and influences of unknown origin are solely responsible for accidental birthmarks and malformations.* (Lamson 1916:87–88; emphasis in original)

> The scientific fact is that it is impossible for the mother to mark her offspring, either intentionally or by accident. Physiologists who have worked industriously on the problem declare unanimously that there is no nervous connection between the mother and the babe. There is no means by which a nervous or emotional impulse can be communicated to the child from the mother. Nutrition and excretion are the only functions of the umbilical cord which joins the child to the mother, and even through this the blood

from the mother does not pass back and forth directly. The nutritive particles and the waste are selected and separated out by the action of certain specialized cells in the placenta. It really seems as if Nature had purposely erected a barrier to protect the child in the womb from injury. *After the conception occurs the mother does not influence the babe. She merely acts as a highly specialized incubator.* (Reed 1924:17; emphasis added)

Mall derided the theory of maternal impressions. He had even less respect for doctors who advanced it. One of the early specimens in Mall's collection (no. 246) bears this note from the doctor: "The woman from whom this specimen was obtained is the mother of two children, the youngest about seven years of age. Since then she has had five miscarriages, all of about the same age as this specimen. No history of syphilis, but have started to give her iodine of potash, with the hope that she may give birth to a child. . . . It would be interesting if the great fire we had recently [i.e., the Baltimore fire of 1904] could have played any part in this trouble, as she felt well up to that time, and the fright due to the fear that the fire would burn out her neighborhood, too, kept her in a state of great excitement for about 24 hours" (quoted in Mall 1908:244–45). Such uninformed speculation gave Mall the opportunity to voice his scorn: "It may be noted here that the obstetricians and gynecologists of America as a class advocate strongly the theory of maternal impresses, due largely, no doubt, to their insufficient scientific education. . . . They continue their futile speculations over mere coincidences" (F. P. Mall 1908:4).

Embryologists denounced prenatal influence as fanciful and superstitious. Yet even while they ridiculed the idea in favor of "demonstrable causes," they were inflating the importance of their own interpretation of events. In the words of Charles Sedgwick Minot (1852–1914)—Harvard anatomist, embryologist, and Mall's good friend—"The stories which embryology has to tell are the most romantic known to us, and the wildest imaginative creations of [Walter] Scott or [Alexandre] Dumas are less startling than the innumerable and almost incredible shiftings of role and changes of character which embryology has to entertain us within her histories. I have been tempted to exclaim sometimes while pursuing my science that in embryology only the unexpected happens" (Minot 1906:11). The embryologists' stories about abnormal or pathological development emphasized "faulty implantation" or "germ defects." Genetic explanations had not yet been advanced, so Mall hypothesized that pathological embryos resulted from "normal ova" housed in faulty uterine environments (F. P. Mall 1908). This explanation was eventually discredited, but Sabin offered a generous interpretation of Mall's contribution: "The condition behind these abnormalities, a problem of great practical significance, was the one on which Mall was working at the time of his death. He played a conspicuous part in elevating it from the superstitions of maternal impression to the realm of objective pathology" (Sabin 1934b:307). Even though Mall's hypothesis was eventually proven wrong, Sabin emphasized that it was guided by scientific principles, which made it superior to the alternative: "Dr. Mall probably went too far in his stressing of the environment as the cause of all pathologic ova. Had he lived ten years longer, he would certainly have modified this emphasis. At least it was a demonstrable cause, and so much better than prenatal impressions which it supplanted, that one does not wonder at Mall's enthusiasm" (Sabin 1934a:111).

The embryologists' explanations stressed the primacy of biology. The embryologists did not talk much about how fetuses could be affected, protected, or perfected by human action. Whereas the theory of maternal impressions held that women could influence the physical and emotional character of their babies, embryologists taught that women were relatively powerless. Minot said all medical men must know "that there is no communication between the foetal and maternal circulation—no passage of the blood from the mother to that of the child; that there is no machinery for the making of so-called maternal impressions; that conception depends primarily upon the fusion of two living elements, the ovum and spermatazoon, which arise as living and integral parts of the parental bodies, and must know thus that there is a continuity of life, an earthly immortality, and that from generation to generation life is uninterrupted" (Minot 1906:12).[6] The embryologists insisted that healthy children, once conceived, developed on their own, through biological events largely beyond the reach of human agency.

By the mid-twentieth century, the belief in prenatal influence was finally fading. A mothering manual written in 1966 was sympathetic to the idea that pregnant women should give free rein to their emotions: "It was not many generations ago that high-minded pregnant women played soft music, walked on tiptoe, thought noble thoughts, averted their gaze from ugly sights, and strove mightily to contain their tempers for the entire duration of their pregnancy—on the premise that every action, emotion, thought, or experience they had might leave its imprint on their unborn baby" (Liley 1966:9). Now, Liley wrote, it is "ridiculous and unhealthy" to frighten young women in this way. "When an expectant mother laughs, rages, weeps, or shouts, it has about the same effect on her unborn baby as if she dropped a saucepan" (1966:33–34). Developing fetuses, in this view, were shielded from a woman's emotions and tempers. Good reproductive outcomes were located so deeply within the biological realm that pregnant women and their families could not affect them.

To return to the theme introduced at the beginning of this chapter, we can see certain parallels between ideas about chick hatching and ideas about human embryological development. The early twentieth century saw new kinds of discipline applied to the realm of reproduction, including human reproduction (Clarke 1998), which justified efforts to exert greater control. In the rapidly industrializing streets of Baltimore, it was impossible to ignore the social and health consequences of unregulated fertility. Waves of foreign immigrants from rural parts of Europe, combined with lack of access to voluntary means of birth control in the United States, meant that some poor women functioned essentially as breeding machines. In 1915, journalist Mary Alden Hopkins drew attention to the problem in a series for *Harper's Weekly,* in which she detailed the toll taken on women and their offspring. A thirty-one-year-old woman had been pregnant ten times in ten years; four of her children survived. A thirty-six-year-old woman had been pregnant ten times in twelve years; five of her children were living. A twenty-five-year-old woman had been pregnant seven times in six years; one child was still alive. And so on (Hopkins 1915:369). Such pitiful stories were intended to elicit upper-class compassion for the poor, and they underwrote a coordinated social movement to reduce infant mortality, improve child welfare, and legalize contraceptive devices (Preston and Haines 1991).

The desire to regulate breeding extended also to industrial-scale chick hatching and egg farming, which was becoming widespread in early twentieth-century America. Chicken farms were growing larger, and modern methods of capitalist production were introduced with the goal of producing more and better eggs. An analogous metaphor can be applied to the practice of embryo collecting. Scientists used language that turned women into incubators, where embryos could be generated and harbored until the embryologists entered the picture and transformed them into generic, mass-produced specimens. The effect of regarding women as incubators was to justify ignoring the details of their lives. Specimens could be collected, studied, and valued on their own merits, independently from the contexts in which they had been conceived, carried, and died. Like hen's eggs, embryo specimens were standardized and graded, and their collection into centralized locations under the watchful eyes of scientists was made possible only with large infusions of capital. In this sense, human embryo specimens were the industrial products of a highly impersonal form of social organization, a reflection of modernity.

Even as embryo collecting was a reflection of modernity, it carried vestiges of nineteenth-century comparative anatomy. This could be seen in the embryo collecting practices described earlier, and in popular literature that compared human reproduction to that of birds. Books written in the early twentieth century often portray the human womb as a romantic, protected place, akin to the fluffy nest of a bird: "When you were a tiny egg you had the best place in all the world to grow—a little nest in the body of your mother" (De Schweinitz 1929:33). The pictures in such books reinforced the association between avian and human growth. The point is driven home on the title page of a 1937 book called *Being Born,* which shows the relative sizes of the eggs of a human, black bird, hen, and goose (Strain 1937). A 1929 book called *Growing Up: The Story of How We Become Alive, Are Born, and Grow Up* shows a drawing of a "baby in the uterus or nest of its mother" alongside a photograph of the "eggs of a red-winged blackbird in their nest" (De Schweinitz 1929:33).

Embryologists drew on such popular culture referents when they hypothesized that the reproduction of humans would resemble the chicken model. To the extent that chickens were "a model for understanding biology" (Siegel, Dodgson, and Andersson 2006), Mall and some of his colleagues expected that the pattern of fertilization for humans should "agree with the results obtained from the lower animals" (1901b:794), and they looked to the chicken for insights. Given the presuppositions of comparative anatomy, Mall can be forgiven for relying too heavily on chickens for answers to questions about humans, but the mistake led to considerable confusion. Mall knew that "the eggs of hens are fertilized ten or more days after copulation" (F. P. Mall 1901b:794), but he did not know that in chickens the time of copulation bears no necessary relationship to the time of fertilization. He did not realize that rooster sperm can remain viable for up to four weeks after ejaculation, nor did he understand that hens store sperm in the oviduct for later fertilization. Based on the chicken comparison, Mall convinced himself that, in humans, ovulation took place during or immediately prior to menstruation (F. P. Mall 1914a:79). Mall's mistake was in taking the parallel between chickens and humans too literally. At the level of metaphor, however, and with the benefit of hindsight, chick hatching can teach us a great deal about the assumptions that produced our contemporary understandings about human embryos.

THREE

Building a Collection

MOST OF THE FETAL SPECIMENS I FOUND in the basement at Mount Holyoke College were donated by alumnae who had graduated in the 1930s and 1940s and gone on to become doctors and nurses. Their clinical work gave them access to embryo and fetal remains, as I learned from a 1943 graduate who remembered studying fetal specimens in an advanced embryology class. "I believe these were specimens sent in by MHC graduates," she wrote, "who had gone into medicine and passed on the results of spontaneous abortion and miscarriage among their patients to the college" (Wine 1999). She explained that she had personally inherited a small collection of fetuses from her father, who had practiced obstetrics as a country doctor in the 1930s. When she graduated, she left her father's collection to Mount Holyoke.

A gift of dead fetuses may seem like an unusual choice to today's alumnae, who might be more inclined to donate benches for the gardens or money for international internships. But there was a time when a gift of exotic specimens—including human fetuses—would have been considered quite prestigious. Ever since its inception in 1837, this small undergraduate college in rural Massachusetts has prided itself on educating women for careers in science (Levin 2005). In the late 1880s, an extensive natural history collection provided teachers with ready teaching specimens, and students as well as professors liked to bring back curiosities from around the world. These collections were the nineteenth-century equivalents of European Renaissance curiosity cabinets, in which the world's marvelous objects could be displayed. Whereas the *Wunderkammern,* or "wonder chambers" as the cabinets were called, were meant to incite a sense of wonder, Mount Holyoke's collection was designed to demonstrate how scientific rationality would bring order to the natural world through classification, categorization, and description (Benedict 2001; Daston and Park 1998).[1] Exotic specimens donated to Mount Holyoke's zoological collections in 1880 included such irreplaceable treasures as corals from Micronesia, stuffed birds from India, shells from South Africa, the skins of a baby ostrich and of a "Cape Tiger," and an insect collection purchased for the handsome sum of one thousand dollars (Clapp 1880). A famous dinosaur fossil was the prized possession. Wet tissue biological specimens began to be added after the invention of formaldehyde as a preserving fluid in the late nineteenth century.

In 1917, just before Christmas, the Mount Holyoke science building burned to the ground. The flames consumed the birds, shells, coral, "Miss Talbot's remarkable dinosaur fossil," and the very expensive bug collection (Turner 1918). The microscopic teaching slides were lost, as well as the mineralogical samples. Professors, students, alumnae, and friends of the college rushed to replenish the collections, donating whatever they could. Given the attention to embryo collecting that had been escalating in Baltimore since 1913, it should come as no surprise that gifts to the college would include human fetal specimens. In fact, the college developed *two* separate fetal collections—one each in the departments of zoology and physiology. In the 1920s, the professors set up a small display of fetal development in the hallway to coincide with the introduction of embryology into the zoology curriculum. The Mount Holyoke zoology department offered two embryology courses in 1921, "one dealing with the chick and mammals and a new course, 'General Embryology,' planned by Elizabeth Adams, [class of] 1914, which links up more closely with the problems of heredity" (A. H. Morgan 1921:18). Adams and her sister had both attended Mount Holyoke as undergraduates. The sister later married Charles S. Flagler, a physician in Stroudsburg, Pennsylvania, who over the years donated more than a dozen fetal specimens to the zoology department, presumably from the hospital where he worked. These specimens were a regular part of the curriculum well into the 1940s. Students studied them and drew sketches, as is evident in a photograph taken at nearby Smith College of a student sitting at a lab bench, examining a fetal skeleton alongside a wet tissue specimen. At Mount Holyoke, fetal specimens were donated

Figure 1. Student writing in notebook during zoology lab, c. 1949–50. Note fetal skeleton and wet-tissue specimen on the table. Smith College Archives, Northampton, Massachusetts.

at an average of about six per year from the time of the 1917 fire through the 1950s; the total number of specimens in both departments numbered around three hundred by 1960.

Fetal specimens kept arriving at the college long after embryo collecting went out of fashion in the 1960s, if only because no one had the temerity to refuse them. Donations were hard to turn down. As the chair of the physiology department at Mount Holyoke noted in her annual report, "Specimens of human embryos and fetuses have come to our collection at various times from one of our alumnae, Dr. Grace Gorham, an obstetrician. She arrived at her reunion this June with a gift of more of them for us!" (Haywood 1954:4). Little by little, jars accumulated on the shelves. Some of the specimens were displayed in the hallway until the late 1960s, when two were stolen, allegedly by Amherst College "boys." After that, they were moved to a locked cabinet and taken out less and less frequently, until they were pushed to the far recesses of a storeroom and forgotten.

In one sense the motley Mount Holyoke collection was something of an accident. The specimens proliferated, not because anyone necessarily wanted many of them, but because it was awkward to refuse a well-intentioned gift. They were the zoological equivalent of the frumpy garish sweaters one receives from a lovely but clueless aunt. No one at Mount Holyoke set out to build a systematic or orderly collection of three hundred specimens, nor was the "collection" the result of a deliberate effort to represent every stage of prenatal development. In another sense, though, Mount Holyoke's collection is tangible evidence of what was happening in Baltimore, where the embryo-collecting enterprise was considerably more methodical and purposive.

This chapter considers the elaborate scaffolding that had to be erected before embryo collecting could become systematized, widespread, and routine. In other words, it considers the intellectual, social, and civic work that had to take place before a haphazard collection of fetal specimens could start taking shape at Mount Holyoke College. In no particular order, a legal apparatus needed to be constructed to allow anatomists to acquire sufficient numbers of cadavers and fetal tissue to realize their educational and research goals. An embryo economy needed to be established, consisting of physicians who were linked to the embryo collectors through ties of reciprocity sustained through personal connections, professional courtesies, and other kinds of incentives and inducements. The consolidation of embryo collecting at Johns Hopkins required the embryologists to breathe metaphoric life into their coveted specimens, to convert them from useless waste material into valuable, productive objects. In the process, they changed the ontological status attributed to embryos. Embryo and fetal specimens went from being "abject tissue, designating neither mother nor child" (a point made by Waldby and Mitchell 2006:110, referring to the changing status of umbilical cord blood), to what might be called "activist" tissue, that is, to tissue that had the power to generate new discoveries and to incite social action. As part of this process, the embryologists rendered pregnant women and families irrelevant to their concerns. These are the themes taken up in this chapter.

The routinization of embryo collecting coincided with and facilitated the rise to dominance of the embryological view of development. In her magnificent book *On Longing: Narratives of the Miniature, the Gigantic, the Souvenir, the Collection, and Nonsense,* poet and literary theorist Susan Stewart argues that collections are groupings of ordinary objects used to realize or animate particular visions of the world (Stewart 1984). Her insight describes perfectly what happened when medical personnel were gripped, seemingly en masse, by the embryo-collecting frenzy. They were not necessarily passionate about embryos per se, but embryo collecting was a reiterative practice in which medical professionals became used to looking for embryos, holding onto them, and putting them in formalin. In short order, they became attuned to the existence and value of specimens, and were converted into enthusiastic participants in the embryo-centric vision of how we came to be. Embryo collections are the tangible evidence of this view, which was promoted most fervently by the class of educated elite that included medical personnel. Embryo collecting exemplified their desire to transfer reproductive waste material from the clinic, where it was abundant but useless, to laboratories and educational institutions where it could be transformed into the knowledge that would underwrite (again according to Stewart) a particularly embryological vision of the world. Mount Holyoke's collection provided palpable evidence of the rising collective interest in this cultural interpretation of the meaning of nascent human life.

ACQUIRING CADAVERS

The embryologists were all trained as anatomists, a simple fact that turns out to be quite important to the story of embryo collecting. Today, anatomy is understood as that branch of medicine that deals with the structures of the body, yet in the nineteenth century it was a much broader field. Anatomy was one of the central branches of science equipped to investigate the significance of Darwin's theory of evolution. It encompassed comparative anatomy (that is, the comparison of anatomical structures of different species), embryology (the study of developing organisms), and comparative embryology (the comparison of embryological development across species). Because the theory of evolution required such a radical rethinking of worldviews, anatomical and embryological evidence were central to ongoing controversies over religion, national identity, and the nature of nature (Hopwood 2006). Medical historian Michael Sappol argues that anatomy was also central to changing notions of class, race, gender, and other axes of social and sexual identity. Quoting the philosopher Rom Harré, he says,: "Our social identities, the kind of persons we take ourselves and others to be, are closely bound up with the kinds of bodies we believe we have" (Sappol 2002:1; quoting Harré 1991:14). As a historian, Sappol shows how nineteenth-century anatomy turned corpses into specimens and provided new interpretations of the bodies' significance, and how anatomy challenged, reinforced, and redistributed social power *and* inequality. The scientific assumptions and practices of these same anatomists gave us—quite literally—the embryos we know today. By describing how Franklin Mall acquired bodies for dissection and how this set the stage for embryo collecting, my goal is to reveal to the reader the historical steps that led embryos to become naturalized, and to show how "one person's scientific work can become another's unmarked . . . assumptions" (Landecker 2004:139). Embryo collections are directly descended from anatomical collecting and the professionalization of anatomy, as Mall's career clearly demonstrates.

When Mall arrived at Johns Hopkins in October 1893, he faced a big problem. The gross anatomy course he was to begin teaching on November 15 was designed as the cornerstone of the new medical school curriculum, but the dissecting rooms were empty. There were "no cadavers on hand" (F. P. Mall 1905:38). Even if several students were assigned to a single corpse, there were not enough bodies for students to learn basic human anatomy or the techniques of dissection. Somehow, Mall had to find more cadavers and—equally importantly in those days before refrigeration—figure out how to keep them from decaying. Previous dissection courses had always been scheduled for the winter, when cool temperatures slowed putrefaction. The new curriculum called for students to begin dissecting at the start of the school year, which meant that Mall would have to acquire bodies over the hot Baltimore summers and keep them from rotting until students arrived in the fall.

Ever the pragmatist, Mall reluctantly resorted to the common practice of buying cadavers, even while he simultaneously worked to clear anatomy of its unsavory association with grave robbing. Mall's published descriptions of anatomical acquisitions are deliberately vague on the question of how he obtained cadavers. He writes in the passive voice: "Late in the evening, a subject was left in the basement. The next day one came from the State, and a few days later another appeared in the basement" (1905:38). For five years, until the summer of 1898, approximately 60 percent of the cadavers Mall received were from unspecified (and probably illegal) "outside sources" (Blake 1955:436). Most of us might be disturbed to find bodies "appearing" in the basement, but of course this was no fluke and there was nothing passive about it. Mall employed a janitor with a shady reputation, William Hartley (called "King Bill" behind his back), who had a stable in the basement of the anatomy building. There Hartley and his wife kept a sorrel mare, carriage, and sleigh, allegedly for the purpose of picking up bodies whenever—and however—they became available (Heard 1979). When Mall's first bodies appeared overnight in the basement, it was because King Bill had been doing his job. And he did his job well. By the spring of 1894, Mall had twenty cadavers stored in an ice box built to hold five.

The cadaver storage problem was acute, but in the spring of 1894 Mall had other things on his mind. He was engaged to be married. He had fallen in love with one of his students, the young Mabel Stanley Glover, who was one of just three female students in the first admitted class of Johns Hopkins medical students. Mall became enchanted with her, it was said, when her hair escaped from its clip and swept across his face while they were leaning over the dissection table (Osborne 1935). They married in March. Every year on their wedding anniversary, whenever they could, Frank (as she called him) and Mabel would hike in the woods and look for frog eggs. They would stroll hand-in-hand, pointing out the skunk cabbage and squatting to look for frogs in action-packed vernal pools. "What happy days they were!" sighed Mabel (M. Mall 1933).

Back in the anatomy lab, Mall tried different methods of preserving cadavers to withstand the heat. In 1893 he had had varying degrees of success with dogs: "During the six weeks these experiments were being made the bodies of all the dogs putrefied with the exception of those embalmed with carbolic acid. At this time the weather was unusually hot, even for Baltimore, and I made a sufficiently large number of experiments to decide in favor of a carbolic acid mixture as the best embalming fluid" (F. P. Mall 1905:38). Eventually he was able to commission the construction of a large cold-storage vault to alleviate the cadaver storage problem. This was part of his strategy to make it easier for medical schools to acquire bodies for dissection. The new vault allowed him to recommend to the Anatomical Board that all "subjects received" in the city of Baltimore could be stored in the Johns Hopkins Anatomical Laboratory. From this point on, Mall worked with the Baltimore Health Commissioner and the Anatomical Board to ensure that the bodies of paupers and "unclaimed dead" would be donated to medical schools. "Heretofore these had been buried and were just so much loss to the Board" (F. P. Mall 1905:38). This was a classic win-win situation: the city was spared the expense of burying unclaimed bodies in the pauper's cemetery, and the medical schools' need for cadavers was soon satisfied.

The shelves of contemporary booksellers attest to the popularity of accounts that sensationalize the treatment of cadavers (Andrews and Nelkin 2001; Cheney 2007; Roach 2004). But it would be unfair to dwell on the prurient aspects of anatomy and dissection a hundred years ago, because that would minimize the social and legal struggles waged over who would control the uses of the dead. Ruth Richardson, a self-designated "historian of death," set the bar quite high when she argued that an understanding of the 1832 Anatomy Act in Britain is critical to appreciating organ transplantation in the present (Richardson 2000:410). When Mall was working, there was considerable confusion about the legal standards that might govern the acquisition, transportation, and dissection of cadavers, and many existing laws were observed in the breach (see Sappol 2002). Cadaver acquisition practices had been affected by the horrific rates of battlefield mortality in the Civil War. Also, as religion scholar Gary Laderman points out, "profound social and economic transformations" affected the meanings associated with corpses. "Among these changes," he writes, "was the growing legitimacy of scientific thinking in nearly all aspects of social life, including public health and anatomical studies" (Laderman 1996:164).

Mall was something of a standard bearer in the movement to legitimize anatomical thinking. His mission as chief anatomist was to professionalize the collection of cadavers, securing a steady supply while ridding all medical schools of the taint associated with grave robbing. As one of Mall's employees put it, "These obnoxious practices [of acquiring bodies illicitly] finally became intolerable to the more advanced men, who saw that such things were bringing medical schools and medical teachers into disrepute with the public" (Jenkins 1913:387). Mall might have seen some of these obnoxious practices in operation when he was in medical school at the University of Michigan at Ann Arbor. In 1878, just two years before Mall enrolled there, three resurrectionists (that is, body snatchers) had been arrested in Toledo and "confessed to a contract for seventy bodies for Ann Arbor" (Holtz 1967:95). The illegally acquired cadavers—unearthed from graveyards across the Midwest—arrived at the anatomy laboratory in barrels marked "pickles," giving rise to a campus wisecrack that "a medic is never happier than when he finds a fellow man in a pickle" (Holtz 1967:95).

Outside of anatomy circles, grave robbing was no laughing matter. Baltimoreans had seen their share of grave robbing and "burking" in the late nineteenth century. (The term *burking,* after the Irish murderer William Burke and his accomplice, William Hare, referred to killing people by sitting on their chests while covering their noses and mouths. Because the smothered cadavers showed no implicating signs of trauma, Burke and Hare could sell them for a tidy profit to medical schools.) As a result, some citizens—especially those who were poor and black—lived in mortal fear that they would be abducted and killed for the purpose of being dissected, or that their bodies would be unearthed from the grave by the resurrectionists. Baltimore journalist Henry Louis Mencken wrote in his memoirs about an elderly black woman called Aunt Sophie, who attended all the funerals in west Baltimore:

> Sophie's fear of [burkers] actually had some ground in logic, for in the early eighties [actually 1886] one Emily Brown, another respectable old Baltimore colored woman, had been murdered by two thugs, and her remains sold to the janitor of the University of Maryland Medical School for fifteen dollars. The pursuit and trial of the assassins gave Baltimore, white and black, a show that was remembered for years afterward. They had represented to the janitor that they were undertakers trying to get rid of an insolvent client, so he was cleared of all guilt, but they themselves were hanged. The janitor was very careful after that, but most colored people believed that he still had murderers in his employ, and only the bravest or craziest ever ventured to pass the Medical School after dark. (Mencken 1940:294–95, cited in Gindhart 1989)

Aunt Sophie had ample cause for concern, given the history of grave robbing in the United States and the strong incentive to prey on the bodies of blacks and paupers. Dissection was still widely considered an "abomination to the popular mind" (Dwight 1896a:75), and with rare exceptions the rich and powerful did not donate their bodies to science (Laderman 1996:165). In practice, then, "dissection remained a humiliation imposed on social outcasts" (D.C. Humphrey 1973:824). There was a predatory dimension to anatomical dissection, in part because the cadavers sent to Johns Hopkins belonged disproportionately to the poor, black, and downtrodden. In the nine years between October 1895 and October 1904, Mall catalogued 1,655 adult bodies received for dissection. The total number of bodies was overwhelmingly "negro" (64.5 percent), at a time when only 16 percent of the total population of Baltimore was black (Howard 1924:173). More than two-thirds of the cadavers were male, in spite of the fact that female bodies "are eminently desirable for teaching purposes" (Jenkins 1913:396), presumably because medical students needed to be educated in matters of women's health and gynecology. White females were least likely to be subject to dissection: only one in twenty bodies in the anatomy laboratory at Johns Hopkins was that of a white female, while one in three of the "negroes" sent for dissection was female. The gender disparity can be partly attributed to the fact that many cadavers were those of criminals and the unclaimed dead, or what Jenkins flippantly called "the genus commonly known as tramps" (1913:391), but it also shows the intersection of racism and sexism. Mall saved what he considered the best specimens for his own laboratory, but as chairman of the Anatomical Board (in 1898), he was authorized to sell surplus cadavers to other medical schools. The price, at four dollars per body, was considered a bargain compared to rates in other cities (F. P. Mall 1905:39). The commodification of bodies and body parts is usually considered an unsavory subject (see Sharp 2000b), but Aunt Sophie was acutely aware that, once dead, rich white women had a much better chance to remain in their graves than she did.

When Baltimore city officials began to exert greater control over the disposition of corpses in the early twentieth century, Mall proved adept at persuading them to guarantee the anatomists' legal right to gather specimens. These corpses were, after all, the "silent teachers" without which medical students would not be as well trained (Cheney 2006:40). Mall cultivated alliances with city officials, even collaborating with them to write and rewrite the registration requirements for births, deaths, and burials. In 1905, Mall expressed concern that "a certain type of burial society" threatened to "cut into our supply" (F. P. Mall 1905:39). He might have been referring to the growing number of cremation societies being established by German immigrants (Habenstein and Lamers 1955:455). To guard against such threats and to protect himself from charges of grave robbing, Mall maintained a close alliance with Dr. C. Hampson Jones, the Baltimore commissioner of health. He kept records of the acquisition and distribution of cadavers, and produced a surplus for the Anatomical Board treasury through careful accounting. Mall also hired the anatomist George B. Jenkins to do a survey of state laws concerning dissection. Jenkins made concrete and quite canny suggestions about how state boards of health should be configured. He wrote, "A member of the state board of health should be also a member of the state anatomical board as should a representative from the attorney-general's office, so that the one could see that all matters bearing upon public health could be adequately cared for and that legal advice and aid could be secured to the board upon need" (Jenkins 1913:394). By putting themselves on state boards, the anatomists insured that their interests would get a sympathetic hearing.

Maryland's Anatomy Act of 1882 was a compromise. It regulated the disposition of cadavers and institutionalized state protection over the cadaver supply, but in the process anatomists lost some of their professional flexibility and control over corpses. The act specified that any deceased person "required to be buried at the public expense" could be turned over to "any physician or surgeon . . . to be by him used within the State for the advancement of medical science" (Laws of Maryland for 1882:222). Mall had to live by the anatomy laws, even when it meant he had to turn down requests to help other anatomists. When he received a letter from a former student asking for three cadavers to supply a new tuberculosis-treatment school, there was nothing he could do. He had criticized the shipment of a body to Sioux City, Iowa, in 1900 and was on record with the mayor against interstate trafficking in corpses (Hayes 1900). Mall advised his student,

> I have consulted with Dr. Lewis, who is chairman of the Anatomy Board here, about sending you anatomical material, but he says it is absolutely out of the question as our law is very carefully written to include Maryland only. The penalty for sending cadavers out of the state is as much as seven years in the penitentiary. I think if you apply to the proper board in New York City, you will get what you need. Have them send you embalmed cadavers, lay them out until they freeze, and then cut them up with a saw as Hartley does here." (Brown 1916; F. P. Mall 1916a)

Mall and his colleagues did eventually enhance Johns Hopkins' reputation for integrity in the realm of anatomy. They professionalized the badly maligned profession of anatomy by regularizing the acquisition of cadavers, and they put the state Health Commission on a higher footing by eliminating grave robbing and the interstate commerce in cadavers. By figuring out how to guarantee a steady supply of honestly acquired cadavers at low cost for Baltimore's medical schools, they saved the state the expense of burying the pauper dead. Mall designed the preservation, embalming, and storage techniques that saved medical students from being assigned to work on decomposed cadavers. He implemented accurate record keeping for all transactions. He designed airy dissecting rooms and required students to work quietly, respectfully, without smoking, and in small groups. As Mall later told one of his students, "in the early days of the school, the students in anatomy were rather rough and boisterous and that it was not unusual for a pedestrian passing the Anatomy Building to find a kidney or a piece of liver hurled at him from one of the windows of the dissecting room" (Koontz 1954). When Mall took over the dissecting rooms at Johns Hopkins, "he instituted a general housecleaning in manners and methods, developing the means of preserving and storing bodies that are in general use in medical schools today" (Clapesattle 1941:199). Mall's colleagues were profoundly grateful for his contributions, and his honesty and decorum reflected well on all of them (Huber 1918; Keith 1916). His efforts to regularize the acquisition of cadavers helped to facilitate his access to embryo and fetal specimens, the timing of which was fortunate (if not fortuitous) because his interests were turning increasingly to embryology. “Gross anatomy as a science is bankrupt,” he wrote in 1911. “It is made solvent through embryology, which alone illuminates it” (1911a:348).

EMBRYO ECONOMIES AND EXCHANGE

Before there was a culture of embryo collecting in the United States, human embryo and fetal remains were socially invisible outside the anatomists’ laboratories. By this I mean that “they”—human embryos and fetuses—did not exist as a unified, socially recognized class of objects, even in death. Obviously there were women who miscarried and had to decide how to handle the remains, but in the early twentieth century they did so privately. Disposition was for them a personal rather than a social problem. Nor did they memorialize their children who died before birth (although there was a time when photographic portraits of dead infants were popular; see Sánchez-Eppler 2005). Anthropologists and historians have written about the disposition of the dead unborn outside the United States (Duden 1991; Kaufman and Morgan 2005), but the early twentieth-century American historical record is virtually silent on the question of what women did with fetal remains after miscarriage or abortion. One of the few accounts I found was written by a doctor in 1907, who made reference to parents who “often refuse to surrender” their “later foetuses” to collectors (C. M. Jackson 1907:477). Other than this comment, I found no evidence that parents objected to having embryo or fetal remains turned over to the Anatomical Board. Of course it is possible and even likely that they were unaware that dead fetuses might end up in a jar of formaldehyde. But if they did know it, they did not seem to mind. Sappol cites several examples in which crowds rioted against medical schools between 1765 and 1884, in protest against the confiscation or treatment of dead adults (Sappol 2002:106), which suggests that if people disapproved of how fetal remains were handled by the anatomists, they would have made it known.

Apart from the embryologists, the only other people who might have been interested in fetal remains were professors who wanted them for medical school teaching collections; a few specialized museum curators; carnival operators who might charge a nickel for a sideshow of a two-headed fetus; or private physicians who kept a few odd specimens on their shelves, mostly for curiosity value. As for normal dead embryos and fetuses, nobody much cared. This left the embryologists free to gather their specimens without anyone questioning whether it was ethical or necessary. What are we to think of their behavior? From today’s vantage point, it might seem like they callously exploited women, ignoring their feelings and absconding with their biological property. Call them grave robbers of the womb. There is evidence that they excluded "mothers" (as they were called) from participating in decisions over how fetal remains should be handled. But it is unlikely that they had evil intentions. They were operating from a background of comparative anatomy rather than fetal politics, and they treated human specimens just as they would nonhuman specimens, in a manner consistent with their training and responsive to the evolutionary questions they wanted to address. Only later, and as a result of their work, did an articulation begin to develop between embryos and the "kinds of bodies we believe we have." Bruno Latour, in a provocative essay called "The historicity of things: Where were microbes before Pasteur?" argues that the notion of articulation helps to explain the relationship between substances (such as embryos) and those who claim to discover them. "The more activity there is from one," he explains, "the more activity there is from the other" (Latour 1999:147).

Mall was by no means the first to collect embryo and fetal specimens, but he was one of those whose activities called human embryos into social existence. And he was one of the early proponents of amassing a large and systematic collection of normal human specimens. Unusual and pathological specimens, especially those that exhibited dramatic deformities, had long been collected by famous doctors. Sometimes such specimens were used as prestige items, circulated as a medium of exchange among the leaders of the major medical institutions. One marker of their prestige was their use in reciprocal exchange between medical peers at different institutions. In 1912, Johns Hopkins Medical School director William Welch exchanged valued anatomical specimens with William Osler at McGill. The following excerpt, take from a 1939 bestseller about medical student life at Johns Hopkins in 1912, is a parable for the close relationship between these leaders.

> "The prize exhibits were in sealed glass containers. One such jar contained a pair of Siamese twins, which bore a card, 'Gift of McGill University.'
>
> 'Gee!' Clay said. 'Think of having 'em to give away.' 'Probably already had an exhibit themselves,' Alex said, 'and when these were born—and died—they just passed 'em on to [the Johns Hopkins Medical School]'" (Tucker 1987 [1939]:197).

The main obstacles to collecting normal specimens were not legal but logistical. Procurement of sufficient numbers of specimens was the biggest problem. The "very practical question of whether material could be obtained readily and abundantly" was an issue that sorely hampered the viability of human embryology as a professional specialty (Minot 1905a:499). Embryologists were aware that the embryos and fetuses they wanted were both tantalizingly plentiful and frustratingly inaccessible. Every day, the coveted specimens-to-be were appearing in operating rooms and doctors' offices, yet clinicians threw them away, oblivious to the embryologists' desire. As one of Mall's advisees complained, surgeons daily "cast aside" and discarded material that "[was] of the very greatest value to workers in embryology" (Evans n.d.).[2] The embryologists' primary challenge, then, was how to convert clinicians to their cause.

When Mall set out to create a culture of embryo collecting, he did not have nearly the power of a Welch or Osler. He was just a young, green anatomist at Clark University who had not had time yet to develop a professional network. Collaborators would therefore have to be recruited. At first, Mall published notices in scientific and medical journals, appealing to the sense of shared mission among physicians. Physicians, after all, would have been trained to believe that anatomy was medicine's rightful prerogative. They would only need to be informed, not convinced. "Only the new secular religion of science," says anthropologist Orin Starn, "allowed for the organs of the dead to be pickled for the purposes of study" (Starn 2004:262). Mall especially addressed himself to doctors who might be sympathetic to the value of anatomical research. As mentioned earlier, he mailed circulars to doctors, advertising for embryos. Here is the text of one of his first "Dear Doctor" circulars, from sometime around 1890:

> My dear Doctor,
>
> During the last few years the kindness of several physicians has enabled me to procure for study about a dozen human embryos less than six weeks old. As a specialist in embryology I ask if you can aid me in procuring more material. It is constantly coming into your hands and without your aid it is practically impossible to further the study of human embryology.

He went on to give detailed instructions about how to preserve the "material."

> Any material which may come into your possession should not be injured by handling nor should it be washed with water. Carefully place it in a tumbler and as soon as possible preserve it in a bath of alcohol . . . at least five times as large as the ovum. If the ovum is not larger than a pigeon's egg do not open

it before hardening. When a specimen is to be sent by express it should be placed in a bottle completely filled with alcohol, with a very loose plug of absorbent cotton both above and below it.

Thanking you in advance for any aid you may give me in procuring material, I am,

Very Truly Yours, F. Mall. Clark University, Worcester, Mass.

Mall sent out several such circulars in the following years, while other researchers issued similar appeals. This poetic plea is from an undated pamphlet published in the early years of the twentieth century: "It is a most beautiful thing to study the different changes of life from the microscopic changes of conception to the more apparent ones of maturity and old age. The mass of people look upon the early illustrations of the embryo as repulsive and ugly. But it is just as truly beautiful to the physiologist as the maturer development, and takes just as high a place in the evolution of human life" (Greer n.d.:59). Mall's circulars all followed the same form. After explaining the scientific value of human embryos and highlighting the uniqueness of his collection in particular, he asked doctors to save all "material" (scrapings, ova, embryos, fetuses, etc.). Over the years, he provided ever more specific instructions about how to preserve and ship specimens so they would arrive undamaged at the laboratory. This publicity strategy, combined with the spread of a culture of collecting, meant that by 1921 specimens were arriving at such a rate that the Carnegie embryologists could encourage "active physicians" to wait until they had accumulated several specimens, and to call the lab for a messenger only when "half a dozen or more [containers were] filled" (Mall and Meyer 1921:25).

If embryo specimens were to become readily and abundantly available, embryologists would need to convince doctors to be vigilant, and to save, preserve, and put embryos into motion to move them from the clinic to the lab. In order words, they needed to convert embryos into substances that held value. This might seem like a difficult task, but Mall had picked the right historical moment to devote himself to it. He claimed that embryonic tissue was waste material, useless except in the hands of a trained embryologist. This had the effect of vesting embryonic tissue with "a covert or latent form of value, all the more valuable for being unacknowledged" (Waldby and Mitchell 2006:117). Mall was undoubtedly sincere but his position was also self-serving, because it allowed him to emerge as a resourceful entrepreneur who could provide a service by churning value from worthless scraps of biological tissue. As a strategy, it certainly kept his costs low at a time when medical education was becoming increasingly expensive to provide (Starr 1982:118).

This was an opportune moment for embryo collecting also because medical education and clinical medicine—attending to patients—were becoming increasingly separated from medical *research.* An emphasis on medical research had been built into the Johns Hopkins Medical School from its inception and was reinforced with the publication in 1910 of the Flexner Report. Sociologist Paul Starr shows that medical research was increasingly rewarded in the subsequent decades, through the imposition of "a model of medical education more closely wedded to research than to medical practice" (1982:121). Mall was adept at negotiating the transition between these clinical and research models of medicine. He wooed doctors who might potentially donate embryos by stressing his role as researcher and promising that the knowledge gleaned by examining specimens might reveal the causes of miscarriage and thereby enhance clinical care. He found it convenient to hint at the practical applicability of embryo studies, once stating that his work was valuable "so that we may ascertain the causes of abortion and possibly throw some light upon the question of sterility" (F. P. Mall n.d.).

When they were not trying to curry favor with potential donors, however, embryologists such as Mall and Minot thought of themselves primarily as bench scientists. They tried not to concern themselves with sickness, suffering, or the social problems of the day. Minot expressed it like this: "Applied science is a congery *[sic]* of fragments, of isolated problems, which lack cohesion and are without any necessary connection with one another" (Minot 1911:119). When Minot gave a speech about the beauties and rewards of what he called "abstruse science," Mall responded effusively: "I have read the speech and am much pleased with it. It is time to call a halt on the utility of science. As though it was of no importance to us to understand or to think unless some old financial tyrant could rob mother earth or his fellow man a little more. Or ridding the earth of superstitions, like witchcraft or maternal impressions, were not of far greater value to us than to cure some man sick" (F. P. Mall 1911b). They could pride themselves on being engaged in a noble, enlightened enterprise, far from crass capitalism and the quotidian problems of clinical medicine.

Lax enforcement of civil regulations pertaining to birth registration and the disposition of dead fetuses and infants made it relatively easy for embryos and fetuses to circulate within medical networks and under the proverbial radar of civil health inspectors (see L. M. Morgan 2002). Stillborn infants and those who died in the first months of life were treated as liminal beings, whose ontological status hovered between nothingness and not-quite-something-ness (Squier 2004). Poor families could not afford elaborate funerals for infants, who might not be considered full persons in any case. Anthropologists have studied the tangled relationships between burial customs, infant mortality rates, and the cultural willingness to grant personhood to newborns, and have found that adults sometimes hold off from ascribing personhood to infants when many are expected to die (L. M. Morgan 1989; Scheper-Hughes 1992). In early twentieth-century Baltimore, the disposition of infant remains was usually left to family members, and many infants were buried quickly and without ceremony. Catholics would not bury unbaptized people in sacred ground, so fetal remains could not be buried in Catholic cemeteries. There were no standardized social conventions for disposing of fetal or infant remains, but many rural families buried them near the house, in what amounted to small family cemeteries. In Charleston, not far from Baltimore, a study showed that the rate of still-birth among "Negroes" was six times as high as among whites, and that did not include "'the large number put away in vaults, gardens, and rivers'" (quoted in Haller 1970:161).

The growth of American cities after the Civil War posed new challenges for those who needed to dispose of small corpses. Gardens and rivers were no longer quite as accessible in the cities, and the abandonment of bodies posed an emergent problem for civil authorities. As health commissioners tried to devise workable solutions, the anatomists were left with considerable flexibility in acquiring the "material" they wanted for dissection. In about 1913, when Mall asked his associate George Jenkins to review the nation's laws pertaining to the acquisition of cadavers, he did not feel it necessary to instruct Jenkins to inquire about the disposition of infant remains (Jenkins 1913). He simply kept them. There were hundreds of infant corpses in the anatomy laboratory. Mall never published age or race data about them, nor did he indicate where they came from or how they were procured. Because infant remains could be obtained "readily and abundantly," they were considered less valuable than those of either adults or the scarcer and more precious embryos.

Embryologists worked closely with civil authorities to ensure that they could keep control over embryo and fetal tissue. This was a time, according to the health commissioner, when Baltimore residents usually buried miscarried fetuses unceremoniously in the backyard or threw them down the privy (F. P. Mall 1917). As other states began to instruct citizens in more hygienic means for disposing of fetal and infant remains, a Kentucky judge wrote in 1912, regarding "the less than orthodox burial of a premature infant that had survived only two weeks," that the appellant "may not cast it into the street, or into a running stream, or into a hole in the ground, or make any disposition of it that might be regarded as a nuisance, be offensive to the sense of decency, or be injurious to the health of the community" (Terry 1986:426–27). The judge's statement condemned the casual disposal of an infant corpse and offered a prescription for future comportment. His wording suggests that it was common to treat miscarried fetuses as a form of refuse (see also Hogle 2000:8). When Baltimore officials decided to crack down on the unhygienic disposition of dead bodies, the embryologists persuaded them that embryos and fetuses should be exempt from some of the vital registration and burial requirements. If dead fetuses and embryos were defined as "medical waste," they argued, and made available to medical schools, they would be put to good use (L. M. Morgan 2002).

Mall's goal was not just to accumulate specimens but to create a full-fledged culture of embryo collecting. He worked on both goals simultaneously by sending his circulars to doctors far and wide, while lavishing personal attention on his local contacts. Because doctors were more willing to collect embryos for him if they could see the results for themselves, he made a policy of being available to any doctor who stopped by his office. That way, he could "show him what is done with [the specimen] and thereby increase his interest" (Mall and Meyer 1921:18). The collection itself, Mall mused, would become "a central point of interest for the physicians of the community who are scientifically inclined" (Mall and Meyer 1921:18). Doctors would stop in to look at one of Mall's wax models or to drop off a specimen, and leave fascinated with the project. "Soon I found a large number of physicians willing to cooperate with me. . . . Thus it came about that collaborators were secured and many pleasant hours have been passed in conversation and discussion with them. This interest is by no means confined to physicians with whom I have personal acquaintance, but includes many whom I have never seen" (F. P. Mall 1908:343–44). After a doctor donated a specimen, Mall would periodically remind him to stay vigilant: "In looking over the list of the Embryological Collection, I find that we owe to your kindness Specimens No. 21, 50, 439, 449, 460, 472, 481 and 486. I should appreciate your continued help in the future" (F. P. Mall 1911c). This personal attention must have been time consuming, but it paid off. Nearly half (45 percent) of the first six hundred embryos in Mall's collection were sent to him from hospitals in and around Baltimore.

Painstaking and continual effort was required to reinforce and extend the embryo-collecting network. Around 1905, Mall sent his circulars principally to Johns Hopkins alumnae, appealing to their fraternal loyalty. He dispatched clinically connected emissaries to drum up business for him, and he advised his friend Minot in Boston to do the same. "Here" in Baltimore, he said, "I have Cullen and Knower working for me & they can tell the physicians of the 'importance' of my our *[sic]* work better than I can do it" (F. P. Mall 1904). Mall was particularly interested in appealing to the obstetrical surgeons, who were in a unique position to find fresh embryo specimens when they performed hysterectomies on women who turned out—in this time before pregnancy testing was available—to be pregnant. The obstetrical surgeons were potentially the embryologists' best donors because they could provide the freshest specimens directly from the operating room. In 1913, flush with Carnegie funding, Mall persuaded the eminent Johns Hopkins gynecologist Thomas S. Cullen (1868–1953) to write 125 handwritten embryo appeals on his behalf. Cullen was enthusiastic about the project. He told Mall, "I have already dictated one-hundred and twenty-five letters and naturally it will take quite a length of time for the individual ones to be written. I have found in the past that mimeographed letters do not pay. All that I get are immediately thrown into the waste-paper basket and if we ask for anything worth while then the least we can do is to send personal letters to each man. Do not be in the least bit worried about the delay *[sic]* we will get better results" (Cullen 1913).

In addition to making good use of professional contacts, Mall offered a series of incentives to potential donors. They would enjoy the prestige of being associated with Johns Hopkins, which was quickly becoming the most distinguished medical research university in the country. He provided bottles in which to store specimens, paid the cost of shipping specimens, and even offered to send a messenger to their clinics at any hour of the day or night. He published the names of every doctor who donated specimens (at least for the first several hundred specimens). This ensured that history would record every one of them as a contributor to this important project. From one of these lists, we learn that the first five hundred embryos in Mall's collection were donated by 212 different individuals (F. P. Mall 1911a). He singled out the habitual donors for special thanks, including Casper O. Miller, Herbert C. Boldt, Max Bröedel, Dr. Ballard, Dr. West, Charles S. Minot, and D. S. Lamb (F. P. Mall 1908). While some of those named were clinical practitioners, others were practical pathologists and collectors for anatomical museums who appreciated the value of a good specimen. Dr. Daniel Smith Lamb (1843–1929) was one of the latter.

Lamb was an anatomist and pathologist who taught at historically black

Howard University in Washington, DC. He had a long association with the Army Medical Museum, where from 1883 to 1917 he acted as de facto curator of anatomical collections (Cobb 1958:62). Lamb is best remembered today as the doctor who performed the autopsy on President James Garfield after he was assassinated in 1881. Lamb was an avid collector of anatomical specimens, and it was a measure of his dedication that he willed his own body to the anatomists. His obituary in *Time* magazine begins, "His brain to be crocked in glass at Cornell University, his skeleton to be mounted and displayed at Washington, his vital organs to be disposed here and there—such was the will of Dr. Daniel Smith Lamb, 85, Army autoptician, who died at Washington last week of pneumonia" (*Time* 1929). By 1911, Lamb had donated twenty embryo and fetal specimens, some of which he found while performing postmortems at Freedman's Hospital, then a hospital for freed slaves.

In 1904, Lamb recounted the tale of an autopsy he had performed on an unnamed woman who died of "some gastric trouble" compounded by "melancholia." (When it came to talking about out-of-wedlock pregnancy, early twentieth-century doctors were masters of euphemism and innuendo.) On autopsy, Lamb found that she had been three months pregnant when she died. He decided to preserve the fetus surreptitiously, not relinquishing it even when the "well-known business man" who requested the autopsy—and in whose home the woman had resided before her death—found out and asked him for it (Gindhart 1989:889–90; quoting Lamb 1904:397). It was obviously a complicated melodrama, and Lamb does not provide enough details for us to figure out exactly what happened. But Lamb apparently suspected that the businessman was responsible both for the pregnancy and for the woman's death. Lamb does not explain why he was unwilling to give the fetal remains to the presumptive father, although he later explains, "The time was that, at least in the hospitals, if we wanted a post mortem examination we simply made it without asking leave of anybody" (Lamb 1904:385). We can only speculate about his motives: if the man was not married to the victim, perhaps Lamb felt that the businessman had no legitimate claim to the fetus. For Lamb to treat the fetal specimen as his own property, though, would not have been unusual. Starn explains that anatomists and physical anthropologists felt that their scientific credentials gave them the right to claim whatever buried or unclaimed cadaver they might want. "Hrdlička [one of Lamb's associates] and other men of learning of that time," writes Starn, "assumed that the imperatives of science trumped any other consideration" (Starn 2004:180). Lamb says he kept the specimen until the businessman died, "and then gave it away" (Lamb 1904:397). Perhaps he donated it to Mall's collection; he does not say.

In 1910, Mall was bothered by the fact that small, haphazard collections of human embryos were cropping up in medical schools all over the country; it would be so much better if they could be centralized in one repository, preferably at his own institution, where they would be well cared for and within easy reach. To keep tabs on the location of the various specimens around the country, he published a list of those "in various laboratories, museums and private collections in the United States" (F. P. Mall 1910:355). The list served several purposes. It allowed other researchers to locate specimens, it gave Mall a chance to thank the donors and encourage new collaborators, and it demonstrated Mall's obvious skill at collecting and synthesizing. The list showed that Mall held a third of the three hundred specimens then in existence in the country, a revelation he hoped would bolster his case for an embryological institute. He did not want to alienate any of his colleague-competitors—he knew full well that embryo collecting needed to be a cooperative effort—but he wanted potential funders to understand that he stood at the forefront of the movement. Other (less) significant collections, he noted, were housed at Harvard University, the University of Michigan, Cornell University in Ithaca, and the University of Minnesota. Here a brief digression will serve to describe the collecting efforts underway at each institution and to show how Mall forged professional alliances at the same time that he worked to position himself as a leader in the field.

At Harvard, Minot had fifty-seven human embryo specimens. Minot was ten years older than Mall and a dedicated comparative embryologist. Some anatomists regarded him as the father of American human embryology because he had published a daunting eight-hundred-page medical textbook on the topic in 1892, while others were skeptical of his credentials because he was not trained as a medical doctor and his textbook, as one reviewer noted, provided a little too much extraneous information to be useful to the average clinical doctor (Two text-books of human embryology 1893). Whatever his stature in the field, Minot was curator of an important comparative (that is, human and nonhuman) embryo collection and friendly with Mall; the two shared the conviction that embryo collecting must be systematized. Over the years, Minot and Mall worked closely to promote human embryology in the United States. From as early as 1904, they conspired to find a donor to fund an embryological institute, reasoning that their combined collections and expertise might be persuasive. Negotiations reached a climax in 1912, when Mall was offered a position at Harvard. He declined the position, but had he accepted, the two men would have succeeded in creating a kind of embryological empire by uniting their respective collections under one roof.

Minot's experience shows how, given the paucity of specimens, it was difficult to move forward. Minot's vision was to concentrate on the embryos of ten mammalian species (including "man") and twelve amphibian species. Once he had collected enough material, he planned to make three sets of serial sections for each stage of development of each species. He was relatively optimistic about his ability to acquire all the specimens, with the exception of the humans. He found, though, that human embryos were even more rare and difficult to acquire than he had anticipated, and by 1904 he despaired of finding three of each stage of development. He stepped up his search, appealing to Boston physicians to send their specimens. When they arrived, however, he was discouraged by the "poor specimens beginning to come in." He persevered patiently, confident that "the good one will appear I suppose" (Minot 1904). But progress was slow and unpredictable. By 1905 Minot had just forty-two human embryos, of which he considered only five to be in "first-class condition" (Minot 1905a).

At the University of Michigan in 1910, Mall counted fifty-three human specimens. Embryology had been introduced into the anatomy curriculum there by Gotthelf Carl Huber (1865–1934). Huber had built a large collection of rat embryos, which was an astute choice given how easy they were to obtain. Huber started acquiring human embryos in the 1890s, becoming the first scientist at Michigan to prepare a serially sectioned human embryo (Burdi 1985). Huber used the human specimens for teaching purposes, but also to figure out the structure of the kidney (what anatomists called the "uriniferous tubule"). Huber's research moved into the closely related field of neuroanatomy, and although he maintained a lifelong interest in embryology he did not continue to collect human specimens after 1910. In later years, he collaborated with Elizabeth Crosby (1888–1983) to study the comparative structures of the brain in different animals. What became known as the Huber-Crosby collection of anatomical material contained the sectioned brains of many animals, including alligators, panthers, and panda bears.

Huber's work in human embryology was taken over in 1936 by Bradley M. Patten (1889–1971), who was the author of several textbooks on the embryology of the chick, the pig, and humans. The popularity of Patten's best-selling textbooks kept the University of Michigan's name prominent in the field of embryology. After Patten's death, responsibility for the collection was inherited by developmental biologist Alphonse R. Burdi (b. 1935), who continued to add to it as director of the Center for Human Growth and Development at the University of Michigan Medical School. Burdi used the collection primarily to study birth defects, especially craniofacial disorders such as cleft palate. By the end of the twentieth century, the Michigan collection contained twenty-five hundred serially sectioned human fetuses (which Burdi called "prenates"), mostly from the second and third trimesters of pregnancy rather than the embryonic period. The Burdi-Patten Michigan Embryology Collection, as it came to be known, was recently added to the Human Developmental Anatomy Center collections in Washington.

At Cornell University in Upstate New York, Mall's good friend Simon Henry Gage had just eleven hard-earned human embryos in his collection. Gage was following in the tradition established by his teacher and colleague Burt Green Wilder (1841–1925), who had his anatomy students dissect the woefully plentiful bodies of stillborn infants (Bardeen 1905a:79). Wilder was a prolific collector of anatomical materials, especially brains. By the time he died, he had in his possession hundreds of brains of apes, monkeys, other mammals and vertebrates, as well as the brains of 430 human adults and children and 218 brains of embryos and fetuses. Wilder's insistence on studying the brains of normal, intelligent, "orderly" individuals led him to start the famous Cornell Brain Society in 1889. Under the auspices of the Brain Society, he invited pupils and colleagues to pledge their brains for study after they died. And, because "it was characteristic of Doctor Wilder that he would not ask others to do that which he would not be willing to do himself," Wilder arranged for his own brain to be donated to the collection. And so it was. Wilder's brain was described in print by the young neuroanatomist, James W. Papez (Papez 1929:289). The physical specimen rests today in a jar of formaldehyde at Cornell University, where it serves as a relic and reminder of a bygone era when scientists promoted "the improbable search for meaning in the matter of famous minds" (Burrell 2005).

Gage was thoroughly steeped in this collecting tradition. A comparativist like Wilder, he collected all kinds of locally available anatomical material: pigs, rats, mice, and guinea pigs. Human embryos were as rare in Ithaca as elsewhere in the country but he collected them, too, subjecting them to the latest research methods. In 1900, he tried the new wax-plate modeling techniques to model a serially sectioned human embryo. The so-called Börn method, after the German embryologist Gustav Börn (1851–1900), involved making a wax plate of each serial section and stacking the plates atop one another to form a scaled model. Gage's wife, Susanna Phelps Gage, also a scientist, was in charge of making the model, which Gage in a note to Mall referred to tongue-in-cheek as "the baby": "Mrs. Gage is wrestling with the baby and has got him most ready to wax up into an idol" (S. H. Gage 1900). Susanna Gage found the work immensely tedious. She later described wax modeling as "a much dreaded piece of drudgery to be done in the basement" (S. P. Gage 1907:166). But she would not be deterred. She kept experimenting with better techniques, eventually finding that she preferred to build models from stacks of blotting paper rather than the unstable and sticky medium of wax.

Only with willing collaborators could Mall have succeeded in building such a vast collection of human embryos. After a slow start, the collection and investigation of human embryos became a far-flung, collaborative enterprise, involving scientists from all major cities and prominent universities. In addition to those already mentioned, Mall counted twenty specimens in the possession of Clarence Martin Jackson (1875–1947), director of the department of anatomy at the University of Minnesota. He also worked closely with Lewellys Barker and George W. Bartelmez, who were developing a human embryology collection at the University of Chicago, and Charles R. Bardeen at the University of Wisconsin, among others. The embryologists were remarkably collegial, with intensive networks of collaboration and cooperation. Sociologist Adele Clarke attributes this collegiality to the climate fostered by the Carnegie Institution of Washington, which had a strong philosophy of collaborative research (Clarke 2004:83). That is doubtless true, but it is also the case that Mall worked hard to forge and strengthen those networks well before the Carnegie Institution of Washington Department of Embryology (CIWDE) was formed. Mall's ability to build an enormous collection of human embryos was entirely dependent on his success in producing a collecting network that included anatomists, obstetrical surgeons, clinical doctors, and pathologists.

The embryo collectors constituted a kind of embryo enclave economy, in which the resources needed for producing and materializing embryos were contained with, and confined to, their own laboratories (see Thomas 1991:27–28). Within the boundaries of this enclave, embryo specimens were exchanged to build prestige and power. Mall worked hard to position himself as the best recipient of specimens and the CIWDE as the primary purveyor of knowledge about them. He sought to control the appropriation and circulation of embryonic tissue and to restrict others' access. He determined who would be authorized to possess and exchange specimens and who would not. Working with colleagues from other institutions, he established the pathways along which the specimens would travel.

There was one significant constituency that existed entirely outside the embryo-collecting enclave, and that was the pregnant women upon whom the collectors were entirely dependent. And yet there was an articulation, to use Latour's term, between the activities of the embryologists, the emergence of embryo subjects, and the behavior of women whose pregnancies were delivered dead. Although the embryologists rarely credited the role of women's labor in creating their vast collections, still the embryologists' activities (along with the increasing subjectivity granted to embryos) acted to modify women's behavior. Women learned not to toss dead embryos and fetuses into the garbage or down the privy, and not to bury them in the backyard. Increasingly, women learned that only acceptable course of action was to place dead embryos and fetuses into the hands of doctors, who in turn would quietly bottle them and turn them over to the embryologists. There, within the closed realm of medical science, the embryologists would retain exclusive control over their valuable "material." In this way, embryos came to belong—literally and legally as well as metaphorically—to medical science.

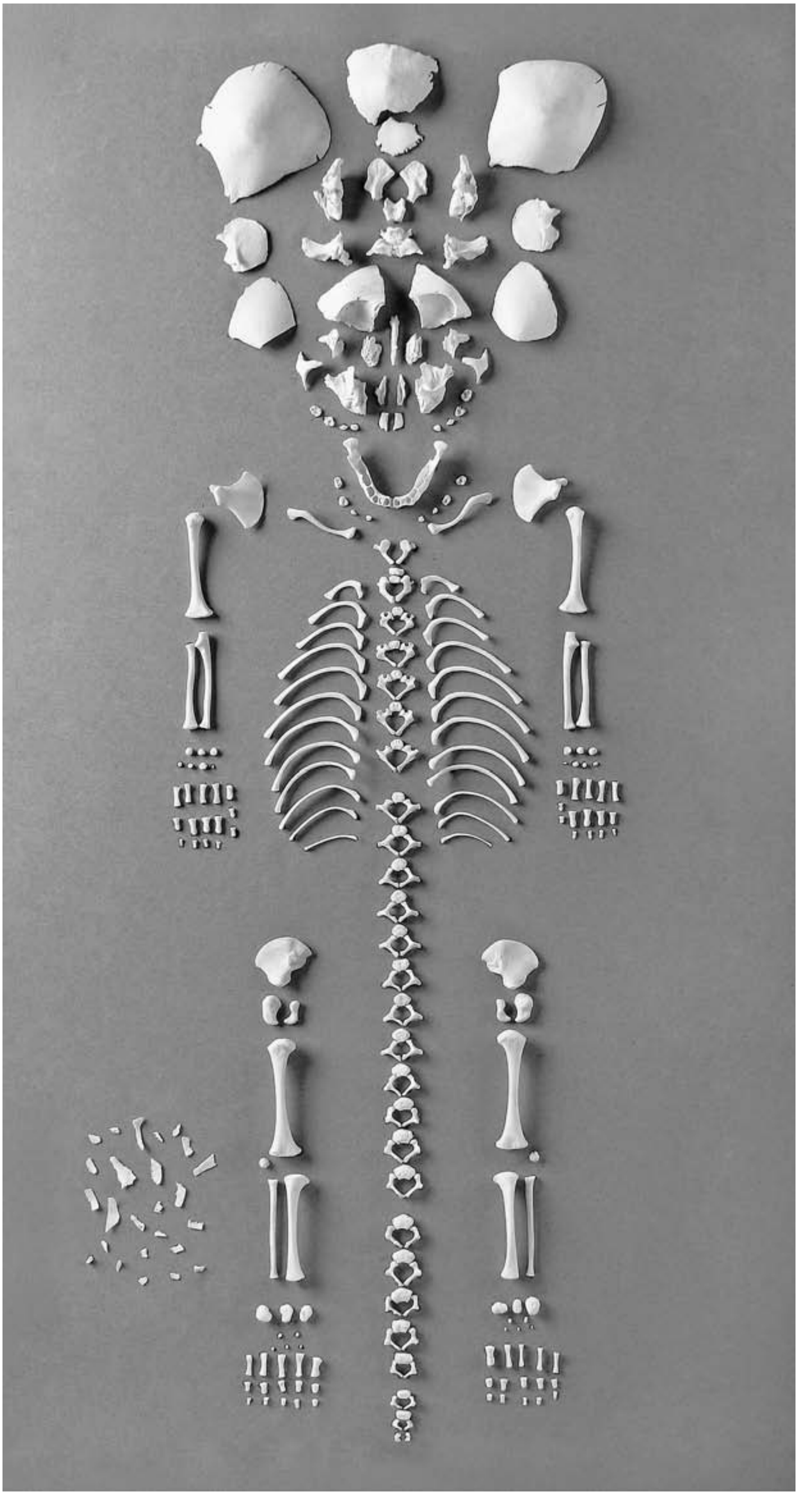
GIFTS AND COMMODITIES

In Mall's view, embryo exchange would ideally be organized as a gift economy rather than a market. This might seem an obvious choice: what respectable scientist would encourage the buying and selling of human embryos? But the context of embryo exchanges was markedly different in the early twentieth century, before the widespread appropriation for monetary gain of human biological materials including organs and cadaveric tissues (Hoeyer 2007; Sharp 2007). The alienation of labor and the ravages of capitalist markets were always lurking in the background of Progressive Era America, and in fact this context made industrial-scale embryo collecting possible. Were it not for the industrialist Andrew Carnegie (1835–1919), one of the legendary nineteenth-century robber barons who became immensely wealthy through his control of the railroad and steel markets, the Carnegie Human Embryo Collection would not exist. In his younger years, Carnegie had a reputation as a businessman who viciously exploited his workers while buying up ever larger tracts of iron and coal. After Carnegie retired, he used his fortune to fund numerous philanthropic and cultural enterprises, including most notably a system of public libraries and the Carnegie Institution of Washington, established in 1902. The latter eventually came to include several innovative scientific research institutes, including an astronomical institute to look at the outer reaches of the universe, and in 1913 a department of embryology, to examine the innermost recesses of the human anatomical universe

(Maienschein, Glitz, and Allen 2004). Although Mall was never in a position to criticize Andrew Carnegie or question his largesse, one wonders whether Mall's mention of the "old financial tyrant" who "robbed mother earth" was a veiled reference to his benefactor, and if so whether Mall saw any irony in the fact that his mass-produced embryo specimens—as an instantiation of the alienated labor of so many mothers—was made possible by Andrew Carnegie's investment.

When Mall imagined embryo exchange as a gift economy rather than a market, he was not thinking about the distinction between person and property; he meant primarily that embryo specimens should not belong to the monetized economy, they should not be bought or sold.[3] Recent incidents of grave robbing fueled a continual fear about the indignities that could result from buying and selling human bodies. Mall wanted no part of it. For this reason, he distanced himself from buying and selling anatomical specimens for the purposes of display. He knew that some of the nineteenth-century anatomical museums had purchased specimens from itinerant peddlers who sometimes crossed the sea from Europe with satchels full of skulls and skeletons. As late as 1921, the director of the Carnegie embryology collection received a letter from the physical anthropologist Aleš Hrdlička, who was curator at the museum now known as the Smithsonian. "This will introduce you to two Czechs from the University of Zagrab, Croatia, who have brought to this country a series of wonderful preparations of the fetal skeleton. I am sure you will be glad to see the series which is for sale" (Hrdlička 1921). Biological supply companies such as Ward's Natural Science Establishment based in Rochester, New York, provided various skins, busts, and bones that researchers and educators might want, including skulls and skeletons of the races (twelve dollars for a Nubian skull, eight to ten dollars for the skull of a Siamese) (H. A. Ward n.d.). Ward's catalog did not explicitly list wet-tissue human specimens, but readers were informed that Mr. Ward would willingly answer inquiries about the possibility of acquiring "alcoholic specimens" (that is, those preserved in alcohol). This method would Mr. Ward the opportunity to assess the inquirer's credentials and respond with appropriate discretion.

The embryologists opposed the overt commodification of embryo specimens for several reasons. In addition to their need to distance themselves and their profession from the taint of body snatching, noncommercial exchange networks would intensify and extend their bonds with men from the same professional and social-class backgrounds. They cultivated gentlemen's agreements with fraternities of doctors who traded and donated embryos to one



another without engaging in overt monetary transactions. By suggesting that embryos would advance medical science, they elevated the donation of specimens almost to a moral obligation, which allowed them to talk about it as a manifestation of spiritual goodness. For example, Simon H. Gage at Cornell wrote to Mall in 1901 about how he acquired his first human embryo specimen: "Buxton is a gentleman and a Christian. He would not sell his embryo, but he gave it outright to the University, so we have that beautiful specimen" (S. H. Gage 1901). To lend a beautiful specimen to a colleague was evidence of the greatest respect and trust. In 1905, Charles Russell Bardeen sent some specimens back to Mall from Wisconsin with this note: "I am sending you to-day the embryos you lent me and I shall breathe easier when I hear that they are safely lodged in their Baltimore home. I hesitated a good deal about asking for them and should not have done so had there not been in your collection essential duplicates so that their loss would not have been so deplorable as it otherwise would be. I am greatly obliged for them" (Bardeen 1905b).

The boundary that separated gift from commodity was porous and difficult to sustain, however, and market mechanisms sometimes won out over gentlemanly reciprocity in spite of Mall's intentions. Scarcity is a great motivator in a market-driven system, and for that reason Mall's assistant was not above making a little money from the sale of infant bodies. The following story is told in the memoirs of Bertram Bernheim, who had been a medical student at Johns Hopkins in the early years and who disliked Mall's inductive teaching style. After his first year in Mall's class, Bernheim was still insecure about his anatomy skills. In hopes of doing some remedial homework over the summer, he spent five hard-earned dollars to buy "an embalmed and carefully wrapped infant" from Mall's *diener* (literally "janitor" in German, but an anatomist's *diener* was essentially a laboratory technician [Frank 1987:33]). "The specimen made an uneventful journey out to our Kentucky farm in my suitcase—right under the eyes of the Pullman conductor and porter of the dear old C. & O. Railroad—and I spent one whole summer in the hayloft of my father's barn getting knowledge that was denied me at Mall's great University department. Not till years later did I learn that my actions constituted a penal offense!" (Bernheim 1948:59; see also Corner 1981:39).

Figure 2. Disarticulated fetal skeleton, similar in aesthetic presentation to those purchased by anatomical museums in the early twentieth century. Courtesy Bone Clones, www.boneclones.com.

How can we understand the logic of embryo exchange when embryo and fetal specimens functioned sometimes as gifts and sometimes as commodities? A classic anthropological essay by Igor Kopytoff, "The cultural biography of things: commoditization as process," helps to show the way. Kopytoff focuses on the "cultural biographies" of things that are exchanged, examining "the way they are culturally redefined and put to use" (1986:67). Looking at the social lives of objects allows us to interpret embryo collecting, for example, as a set of social processes that converted the small scraps of human tissue known as "embryos" into other things that the embryologists valued. The acquisition, exchange, and circulation of embryos transformed or "converted" this anatomical material into a number of things the embryologists valued, including professional networks, relationships, authoritative knowledge, prestige, and sometimes money (in the form of foundation support to do one's work). The value of an embryo specimen was not only in the object itself, but in the social bonds that it created and reinforced and in the secondary resources that it made available to the collectors.

Kopytoff also points out that some kinds of things are "confined to a very narrow sphere of exchange" (1986:74). This insight is critical to understanding the circulation of embryo specimens, because Mall and his colleagues were careful to represent embryo specimens as cultural material that would be enormously beneficial to them but absolutely useless, as we have said, to anyone else. In this sense, embryo specimens had what Kopytoff refers to as "singular value," because they could only be appreciated properly by a special set of people, namely, the embryologists themselves (1986:74). This helps to explain why embryo specimen collecting remained restricted to the realms of medical research and education, and why embryo specimens never acquired the status of popular collectibles. The desire to confine embryo specimens to a narrow sphere of exchange helps to explain why embryologists developed a specialized vocabulary that functioned almost like a secret language or code that embryologists used to distinguish themselves from outsiders. They started their own journal called *Carnegie Contributions to Embryology,* and they dispensed training to nonspecialists and novices. All of these were mechanisms that served to keep embryos (and knowledge about them) circulating within a narrow sphere, and to convert specimens into other things the embryologists valued.

When the embryologists rejected commodification and exchanged embryos only among others whom they defined as similar to themselves, they were marking a social boundary between serious clinicians and researchers on one side and vulgar body snatchers and salesmen on the other. The bones and specimens sold by peddlers were "contaminated by having circulated in a monetized commodity-sphere," while the gifts exchanged and circulated among the embryologists (or other so-called Christian gentlemen) were by contrast pure and untainted. It was not until much later, as we shall see, that embryos began to be culturally redefined in the service of social and political uses such as "choice," "life," or "stem cell cure." This should remind us, says anthropologist Nicholas Thomas, "of the crucial role of material culture and of the optical illusion that it constantly offers us: we take the 'concrete and palpable' presence of a thing to attest to the reality of that which we have made it signify; our fantasies find confirmation in the materiality of things that are composed more of objectified fantasy than physical stuff" (Thomas 1991:176). These insights reveal embryo collecting and exchange, not as an inevitable or natural step in the march of scientific progress, but as a social process that allowed a specific kind of human bodily tissue to be converted into other social goods. And that, in turn, had an impact on how we think about the ontological status and historicity of the thing called "embryo."

Part of Mall's strategy was to make sure that donors would get the credit for making a donation, but that *he* would get to keep the specimens.[4] This led him sometimes to be insincere in his gratitude. Mall could easily tell a good specimen from a bad one, but he nevertheless continually told his donors that all these gifts were valuable. An article published after Mall's death admitted that the first specimens he received were "badly preserved and of little scientific value, not only because the tissues were unfit for microscopic examination, but because histories were entirely lacking. *Nevertheless we always thankfully receive such specimens, and in return gladly send fixing fluids, write letters, and also send reprints of embryological studies to donors.* In this way we have learned that a physician who will take the trouble to send one specimen is always willing to preserve carefully the next that falls into his hands, and, in the course of time, he naturally becomes a regular contributor" (Mall and Meyer 1921:16; emphasis added). Mall observed the etiquette of reciprocity to a fault. He always acknowledged receipt of a specimen, and he sent reprints of his published studies "to all our contributors" (Mall and Meyer 1921:18). He emphasized the need to give back to the local medical community and to acknowledge his obligation to local doctors.

> It is impossible to adequately express our obligations to our many contributors, many of whom are practically unknown to us; but we feel that in many cases *we have made lifelong friends through an extensive correspondence.* In

> general, *the work on the part of these physicians is entirely altruistic,* for they hold the firm belief that the material they gather will be of greater value to science if sent to an active laboratory than if retained as fine specimens in their own small collections. *We have availed ourselves of every opportunity to accord recognition to the contributor whenever a publication, dependent upon his specimen, is made. Adequate return for the trouble he has taken can never be made, unless our work proves to be of sufficient value to make him feel that he has materially helped the progress of science.* (Mall and Meyer 1921:22; emphasis added)

None of the anatomists of that period were as generous in their acknowledgment or appreciation of the women and families from whom specimens came. In the book *Tissue Economies: Blood, Organs, and Cell Lines in Late Capitalism,* Catherine Waldby and Robert Mitchell write that "the forms of circulation characteristic of any particular tissue economy both presuppose and constitute certain kinds of social relations" (Waldby and Mitchell 2006:33). Mall's embryo-collecting networks are a clear illustration of this point. Mall presupposed that by approaching doctors, he would not have to justify his need for specimens except to explain how crucial they were to the advancement of science. By limiting his appeals to doctors, he guaranteed that the lay public—including pregnant women—would never need to concern themselves with what happened to nonviable embryos and fetuses that issued from their bodies. Anthropologist Nancy Scheper-Hughes points out that all transactions of organs and body parts have in common "the division of society into two populations, one socially and medically included and the other excluded. . . . The 'givers' are an invisible and discredited collection of anonymous suppliers of spare parts" (Scheper-Hughes 2001:4).

There was one important difference, though, between embryo specimens and the cadavers, organs, human tissue, and body parts that figure in today's debates over uses of human tissue. No one seemed to regard embryo or fetal tissue as "something intrinsically human," in the contemporary sense of standing for one's individual or collective self (Hoeyer 2007:327). Embryos did not represent or "stand for" their biographical adult selves. The embryologists took embryos to represent the species as a whole, but because they did not consider them as "persons" they cannot be accused of depersonalizing the specimens. We can be sure that some women and families mourned the loss of the pregnancies that provided the specimens, but without a social vocabulary for attributing personhood to embryos and fetuses, the embryo collectors had no reason to question the wisdom or ethics of collecting. Quite the contrary, they were convinced that collecting would help them, as Mall said, to rid the earth of superstition. Their contributions would be an important lesson in what historian Michael Sappol calls "the curriculum of bourgeois self-making" (2002:238). Embryo collecting was an eminently progressive enterprise.

The trade in embryos depended on personal relationships, largely among men. There is no getting around the fact that embryo collecting was a patriarchal project, as men circulated the most intimate contents of women's bodies among an old boy's network. In the way that specimens were culturally defined and collecting was practiced, embryos were made to be absolutely alienable from women and absolutely inalienable from the embryologists. This theme will be expanded in later chapters, but because we are focusing here on the social scaffolding that made embryo collecting possible, it makes sense to show how the embryo-collecting enterprise resembled the scientific exchange of diseased brain tissue samples during the investigations of the kuru epidemic, as described by medical historian Warwick Anderson (2008). Kuru was a fatal, neurodegenerative brain disease found to be traveling through an indigenous population of people in New Guinea during the 1950 and 1960s. Scientists around the world were eager to examine the sectioned brains of those who had died from this disease. The scientists who controlled the samples expropriated material from people's bodies without crediting the donors, without acknowledging the debt the scientists owed them, and (in many cases) without asking permission. Embryo specimens were similarly appropriated from women's bodies without acknowledging their contributions, and women were systematically written out of nearly everything the embryologists had to say about embryos. In this sense, the practice of embryo collecting was akin to the practice of collecting and circulating the brain samples of kuru victims, which Anderson calls a simple case of "extraction and appropriation, an insertion of previously valueless objects into a scientific exchange regime with the messy influences of local sociality and politics erased" (W. Anderson 2000:715). Certainly this was not the first time that women were sidelined from the story of creation.

This history shows that the process of extracting embryos from the physical and social contexts of women's lives began at least a century ago, long before the advent of ultrasonography and other intrauterine imaging technologies. In this sense, embryo collecting was an early stage in the process of developing a modern embodied self that would be rooted in objectified, personified, biologized understandings of embryo and fetal subjectivity. Before that interpretation became available, however, the embryo collectors worked to divorce specimens from the social circumstances and human relations that produced them, to cast embryos as biological products rather than as spiritual or social beings, and to emphasize the anonymity and biological autonomy of the specimens. In all these ways, the embryo collectors initiated a shift in the ontology of embryos—that is, in what people understood embryos to be. They began to transform embryos from worthless reproductive detritus to "natural" organisms and the foundation of our biological selves. The irony, of course, is that this natural form had a social genesis.

From around 1890 until the early years of the twentieth century, the embryologists worked to convince doctors and civil authorities that embryos were worth saving, for the sole purpose of embryological research. By 1920 they had won that battle. Specimens were arriving at the lab in large numbers, and throughout the country doctors and nurses were beginning to save *all* embryonic and fetal tissue. This led to a spike in the availability of specimens. Finally, there were specimens to spare, to the extent that every hospital and educational institution could have its own collection. It is important to note, however, that the embryologists portrayed embryos as valuable *only* when they were destined for embryological collections. When the embryologists talked to clinical audiences, they used treasure-hunting metaphors to stress how rare and valuable embryo specimens were. When they wrote scientific articles, in contrast, they stressed the inert, impersonal, asocial character of such "material." They left no room for the idea that dead fetuses might be important or valuable to anyone other than themselves. Their language and practices functioned not only to *describe* but to *constitute* the value they attached to early embryos. By the middle of the second decade of the twentieth century, the pendulum had swung from scarcity to plenty, and the subsequent flurry of embryo collecting activity was well under way. By the time the science building burned to the ground at Mount Holyoke in 1917, the most ethical, modern, and prestigious thing one could do with a dead embryo or fetus was to give it to a scientific collection.

WHERE TO DRAW THE LINE? THE SEMANTIC PRODUCTION OF EMBRYOS AND FETUSES

The embryologists' main accomplishment was to materialize the human embryo by showing that it had empirical substance, body, and form (Hopwood 1999; L. M. Morgan 1999). But before proceeding, it is important to question the fixity and historical stability inherent in the words *the human embryo.* It is important to pay attention to word choices to understand how anatomists (and others) struggled to make cognitive, social, and scientific distinctions between embryo/fetus and fetus/infant. Natural scientists have dealt with these questions for hundreds of years, yet establishing the demarcation between these concepts is still anything but straightforward. Harvard biologist John Biggers says that the distinction between the words *embryo* and *fetus* dates back as far as the fourteenth century. Since that time, he says, the two words have been used in at least four different ways. They can be synonyms or they can refer to "successive disjoint phases of prenatal life." At other times, one (either *embryo* or *fetus*) can be a subset of the other (either *fetus* or *embryo*) (Biggers 1990:1). What could be more confusing? Philosopher and historian of biology Jane Maienschein points out that definitions of *embryo* have been shifting for more than two hundred years. Once upon a time, she says, *embrio* referred to the early, unformed stages of intrauterine life in any animal, although biologists often used the term to refer "loosely to all development from fertilization on" (Maienschein 2002:13). The standard definition of the human embryo today is the developing organism between fertilization and the end of the seventh week of gestation.[5] But the fact that there are two words corresponding to two developmental phases begs the question: why is the nine months of gestation divided into two periods?

Some people have argued that the distinction between embryonic and fetal periods is arbitrary and unnecessary. "Biologists *arbitrarily* speak of the earliest stages of development of the fertilized egg as the embryonic period, which ends when the external form of the embryo begins to resemble clearly the newborn of the group to which it belongs" (*Encyclopædia Britannica* 2003; emphasis added). Patten explained it this way in his 1947 textbook: "Some time toward the end of the second or beginning of the third month of development, 'when it begins to look human,' it is usual to drop the term embryo and to speak of the product of conception as a fetus. There seems to be no very good reason to worry about the precise time when this change in designation should be made or to insist on the rigid following of this usage which is kept more as a matter of tradition than because it serves any useful purpose" (Patten 1947:198). Patten obviously saw no need to subdivide gestation. His position may have helped to justify his own focus on collecting specimens from the second and third trimesters of pregnancy. When Patten inherited the fifty human specimens in Michigan's embryology collection from Huber in 1936, he decided to focus on the later stages of pregnancy, so as not to overlap with the embryological specimens being collected in Baltimore. He eventually enlarged the collection to a thousand human specimens (Burdi 1985:135), which technically should have been called a "fetal" rather than an "embryo" collection.

Historically, the distinction between "embryo" and "fetus" corresponded to the distinction between organisms that did and did not look human, that is, that had human form. The word *formation,* after all, means both development and shape. In many cultures, people believe that to achieve human status an organism must first achieve a human shape. *Embryo* is the term traditionally given to organisms that have not yet achieved that form, while *fetus* refers to "the unborn young of any vertebrate animal, particularly of a mammal, after it has attained the basic form and structure typical of its kind" (*Encyclopædia Britannica* 2003). Keibel and Mall's textbook of human embryology explains that the transition from embryo to fetus is accomplished with the "better-formed" foot (that is, the separation of the toes from one another) and the "very shallow nape depression" (Keibel and Mall 1910–12:78). The distinction was based on how the embryo would appear to the layperson's eye. Cultural considerations rose to the surface even in this technical scientific account. By referring to the layperson's perception, Keibel and Mall were implicitly acknowledging that the anatomical features were important not for their physiological function but because they had cultural significance. Keibel said that by the end of the second month, "the development of the [human] embryo is so far advanced that the human in it is *recognizable even to the laity;* [Wilhelm] His designates this as the embryonic period and that succeeding it up to birth he terms the fetal period" (1910–12:59; emphasis added). To the naked eye, the human embryo looks wormlike at first, indistinguishable to the unschooled observer from the embryos of other vertebrates. As it grows, it turns into an alien-looking creature with eyes on the sides of its misshapen and ungainly head, stubby limb buds, and a conspicuously nonhuman tail. No wonder the women in rural Thailand, mentioned in chapter 1, did not think that everything that came from their wombs was human. They would not classify as human an entity that did not take human form. In a similar way, the embryologists saw continuity between the fetal and infant periods, which led the Harvard anatomist Charles Sedgwick Minot to refer to infancy as a "prolongation of fetal life" (Minot n.d.).

Anatomists at the Carnegie Institution Department of Embryology had a mandate to study *embryological* development, but in fact they collected specimens from the entire gestational period. The "embryos" in their collection eventually encompassed tiny, barely discernible one- and two-cell specimens through full-term fetuses. They thought they would need not just several hundred but several *thousand* specimens, and their appetite was insatiable. At one point, a young anatomist in Mall's lab sent an entertaining appeal asking doctors to send, not only young embryos or suspected embryos, but also "large embryos, in fact foetuses of all ages." "You will observe," he said, "that we are omnivorous" (Evans n.d.). In 1914 Mall set out deliberately to acquire older (over four months) fetuses. He wanted to double the number of older fetuses in the collection from three hundred to six hundred, so that the anthropologist on his staff could measure them to produce a normal fetal growth chart (F. P. Mall 1914c). Physical anthropologists made hundreds—thousands—of meticulous anthropometric measurements to determine rates of growth of the older fetuses.

In spite of their "omnivorous" appetites, the embryologists often applied the label "embryo" indiscriminately to all their specimens. An example can be found in the following sentence written by George Streeter, who succeeded Mall in 1917 as director of the CIWDE: "The observations recorded in this paper are made on human embryos and cover the period included between 4 mm. and 130 mm., crown-rump length, which is approximately equivalent to the period between the fourth and the sixteenth week of fetal life" (Streeter 1918:17). Nor did the passage of years resolve the semantic confusion. A 1951 study of bone development during "the first five prenatal months" preferred the word *embryo,* although at least in this instance the authors acknowledged the confusion: "The term *embryo* is used throughout this paper in its all-inclusive sense, although traditionally the term *fetus* is used for stages older than two months" (Norback and Robertson 1951:2, n. 2).

A striking example of slippage between the terms embryo and fetus is evident in the 1927 *Catalogue Of the First 400 Specimens of the Human Embryological Collection in the Department of Anatomy of the Peking Union Medical College.* This pamphlet documents the so-called "human embryological collection" amassed by North American anatomists at the Peking Union Medical College from 1917 to 1925. The catalog described the 358 Chinese specimens contained in the collection in 1925, of which 254 were classified as "normal" (i.e., not obviously pathological). A close look at the list, however, reveals that *only seven* of the normal specimens came from the embryological period. Fully 239 were fetuses, and 8 were infants who had lived for up to two months after birth (Fortuyn 1927:68). One wonders why the anatomists did not call it a fetal collection. The answer, I suspect, is that the catalog was compiled at a time when anatomists coveted bona fide human embryos. Fetuses simply did not have the same prestige. Calling it an "embryological collection" would inflate the status of the collection as well as the prestige of the collectors. The choice of terms reflects not just the objects that are named but also those who name them.

This persistent ambiguity about the distinction between embryos and fetuses is frustrating to some people, who expect that advances in scientific knowledge should be capable of resolving this semantic problem. After all, surely scientists who have figured out how to inject the genetic material from one organism into the denucleated cell of another can figure out how to agree on simple terminology. Yet more information only seems to inflame the debates. New terms—such as *pre-embryo* and *pro-embryo*—have been added to the lexicon and new definitions for existing terms proposed, but still the definitions remain unstable and refuse to coalesce (Biggers 1990). Philosopher and bioethicist Mary B. Mahowald insists that accurate use of terminology is essential, both to establish a speaker's credibility and to facilitate informed debate. She dislikes ambiguous terms such as *pre-embryo,* and argues that scientists, ethicists, and journalists should adhere strictly to accurate scientific definitions (2003). When she limits her arguments to new terms such as pre-embryo, however, she fails to acknowledge that the term *embryo* was (and arguably still is) also slippery and ambiguous.

Mahowald seems to think there is no contestation over the word *embryo,* but that is only because she is willing to overlook the historical process that leads us to focus solely on the first contested weeks of development. What we refer to as "embryo" is not a stable ontological thing, but a recent, tenuous, and ever-shifting social consensus about the meanings we are willing (though not without controversy) to ascribe to certain physiological properties. In the midst of this semantic contestation, people negotiate their power—and the ontological status of embryos—by appropriating terminology to suit their own goals. We can see this process in operation with the creation of new biopolitical forms, where the sites at which previously undifferentiated phases of the life cycle are negotiated: pre-embryos, pro-embryos, proto-embryos, and "regular" embryos. The *Oxford Dictionary of Biology* defines *embryo* as follows: "An animal in the earliest stages of its development, from the time when the fertilized ovum starts to divide . . . , while it is contained within the egg or reproductive organs of the mother, until hatching or birth. A human embryo . . . is called a fetus after the first eight weeks of pregnancy" (*Oxford Dictionary of Biology* 2000). If this definition strikes the reader as neutral, it is only because it is consistent with the biologized, depoliticized embryo encapsulated in the embryological view of development. That embryo, too, needs to be recognized as a social product. Mahowald misses the point: controversy about embryo matters will never be resolved simply by being more precise with language, because there is a dialectical dimension to embryo controversy. Controversy creates renewed attention to embryos in the form of new research, technologies, and representations, which in turn result in new understandings of what embryos are, which in turn generates further controversy. We shape the embryos, and embryos in turn shape us.

In all human societies, the beginnings of life are ambiguous and fraught with indeterminacy. In early twentieth-century Baltimore, even newborn *infants* were not always regarded as full persons. No one knows exactly how many infants died in the first year of life, because authorities did not count infant deaths with any regularity or precision. *Not* counting has to be seen an indication of the infants' tenuous claim to personhood, because the distinction between fetus and infant is irrelevant to people who expect significant numbers of their offspring to die. As Scheper-Hughes has shown in her research on infant death in Brazil, women may delay the ascription of personhood to babies they expect to die. To hasten the death of a doomed and sickly infant under these circumstances may be more akin to postpartum abortion than it would be to infanticide, because babies are not yet deemed as persons (Scheper-Hughes 1992). Anthropologists point out that the stages of the life cycle are socially determined. This applies as much to the gestational period as to adolescence or middle age. Embryo-ness is not located in the physical attributes of a tiny fertilized ovum or nascent human being but in our collective willingness to acknowledge those attributes as legitimate criteria on which to justify social action. Embryos are formed not by biological processes but by people (Conklin and Morgan 1996; Kovit 1978). Perhaps this explains why the distinction between "fetus" and "infant" was not as fixed among early twentieth-century embryologists as it may appear today. The cultural logic that distinguished the born (infants) from the unborn (embryos and fetuses) did not become fixed until much later, after infant mortality rates declined and a higher proportion of newborns could reasonably be expected to survive.

FOUR

Inside the Embryo Production Factory

Is the pathologist then so different from the poet, the composer or the painter who strives to solidify into art his secret delight?

RICHARD SELZER
Confessions of a Knife

I SHOULD HAVE GONE TO BED EARLY, since I was planning to visit the Carnegie Human Embryo Collection the next morning. I stayed up until one A.M., however, to finish Bobbie Ann Mason's 1993 novel, *Feather Crowns.* Mason tells the story of Christianna Wheeler, a hardworking farm wife in rural Kentucky who gave birth to quintuplets in the year 1900. As word got out about the unusual event, hundreds of strangers descended on the homestead to gawk at the five tiny babies. One by one the babies died, victim to fever, insufficient milk, opium-laced soothing syrup, and being "handled too much" (B. A. Mason 1993:267). By hinting at the indignities that burial might invite, the new undertaker in town convinced the grieving Wheelers to have the bodies embalmed and sealed in a glass case. Several months later the Wheelers, desperate for cash, agreed to accompany the corpses on a carnival tour. They traveled from town to town through the South, enduring the stares of coldhearted curiosity seekers who paid a dime to witness their misfortune. One night, they stole away with the quints and boarded a train to Washington, where they donated the bodies to the Institute of Man, which kept, in Mason's words, "a restricted collection, for research students and medical specialists" (B. A. Mason 1993:411).

The morning after staying up late reading, I entered the National Museum of Health and Medicine in the Walter Reed Army Medical Center. The public galleries of the museum, which had formerly been called the Army

Medical Museum, have on display a superb collection of microscopes, skeletal lesions sustained by soldiers during the Civil War, and artifacts (including skull fragments) from Abraham Lincoln's assassination. One gallery displays several fetal "monster" specimens and a series of fetal skeletons. The embryos I wanted to see were not on public display, so an intern at the front desk paged my guide. A few minutes later, a tall, laconic woman escorted me up the back stairs while I pondered how much space they must need to house ten-thousand-plus jars of formaldehyde. Imagine my confusion, then, when she ushered me into a large windowless room and pointed across rows of filing cabinets. "Here," she said, "is the collection."

The embryo collection consisted, not of whole, wet-tissue specimens as I had imagined, but of *sectioned* specimens. Each embryo had been painstakingly cut into thin slices, or sections, each of which was stained and mounted on a slide for viewing through a microscope. The filing cabinets were filled with small wooden boxes, each containing dozens of glass slides. "Here are the saggitals, over here we have the coronals, and these are the transverse sections," my guide explained. Because I was not trained as an anatomist, I struggled to keep up with the unfamiliar terminology. She pointed out a separate aisle of "comparative" (that is, nonhuman) embryo specimens, including guinea pigs, macaques, and opossums. The embryologists may have found it easy to see "life in a dead section" (Huber 1918:3), but I did not. I found all the information disorienting , especially in that windowless room on so little sleep, and by lunchtime I found myself looking forward to a break.

I had arranged to eat lunch in the cafeteria with two anatomical curators for the museum. They asked about my project, and we got to talking about attitudes toward miscarriage and infant death in the late nineteenth century. Because I suffer the professorial tendency to answer every question with the title of a book, I urged them to read *Feather Crowns* and gave a quick plot summary. As I did, they exchanged a knowing glance across the table.

"Would you like to see the quints?" one of them asked.

It turned out that Mason had been inspired to write *Feather Crowns* by an event that had taken place across the field from where she grew up in Graves County, Kentucky. On April 29, 1896, five boys—named Matthew, Mark, Luke, John, and Paul—were born to Mrs. Elizabeth Lyon in Mayfield, Kentucky. The "Mayfield quints," as they were known, did not live long; the smallest one died on May 4 and the last one just ten days later. Their mother was quoted in an unidentified 1935 newspaper interview: "My babies were all fully developed, but they just starved to death—that and the crowd.

You never saw the like of the people." The real Elizabeth Lyon had indeed taken the embalmed bodies on a carnival tour, but she hadn't run away to Washington. She took the quints' bodies home to Kentucky, where no one could blame her for being a bit unhinged by the whole ordeal. She reportedly kept dressing the corpses, which she stored in the barn and under her bed until, old and destitute, she offered to sell them to the Army Medical Museum. The museum bought them, at considerably less than the asking price, and kept them on display for several years.

The quintuplets are now stored in a Plexiglass case backstage (that is, not on public display) at the same museum as the ten thousand Carnegie embryo specimens. The embryos are upstairs in the Human Developmental Anatomy Center, while the quints are downstairs in the anatomical storeroom of the museum along with other anatomical oddities, including the shriveled remains of a fetal specimen type, known as lithopedium, that had been retained and calcified in a woman's body. Walking past row after row of bones from Civil War soldiers, we stopped to open a long shallow drawer. I peered at the five nude, mummified corpses, lined up side-by-side. They were not all the same size. I found myself sympathizing with Mrs. Lyon, who always dressed her babies, and with the fictional Mrs. Wheeler, who had felt the urge to cover up the babies' heads when they were displayed without bonnets in the funeral home.

A few weeks later, I wrote to Mason to share my astonishment at finding the quints' bodies in Washington the day after finishing her book. Her reply arrived quickly. She explained that she had visited the museum while she was researching the book, but hadn't been able to bring herself to ask to see the quints; she did not feel entitled. Literary scholar Barbara M. Benedict writes, "Curiosity is seeing your way out of your place" (2001:2). Mason could *see* her way out of her place—she had taken the trouble to travel to Washington, and one Sunday morning she found herself standing inside the museum. But as she circled the displays and realized that the quintuplets must be in another room, she was unable to utter the words that could open the door. She was tantalizingly close, but her resolve was wavering. It was not a lack of imagination or desire that held her back. Surely she must have realized that her name alone would have been sufficient to get her admitted. Yet she was up against a powerful, unspoken social boundary—a veritable electric fence—that separates those who are authorized to see from those who are not. She was held back, she said, by the sense that her curiosity was morbid.

One person's morbid curiosity is another's life work. The Carnegie embryo collectors gave themselves license to indulge their curiosity by defining it as their place to do so. They were self-designated members of an elite anatomical aristocracy, and they reasoned that *their* curiosity was motivated by dispassionate, rational scientific *need*. They could not survive without it, but more importantly they were convinced that it was a prerequisite for medical progress and that society, too, would benefit. Keeping their specimens sheltered within the laboratories, away from the curious gaze of laypeople, was one way to distinguish themselves from those who displayed fetal specimens in popular anatomical museums and carnival shows. Their rationale was similar to the distinction that Sappol describes between popular (read: vulgar) and professional (read: dignified) anatomical museums in early twentieth-century America. There was overlap in the kinds of exhibits on display in each, but the motives of collectors and patrons were different. "Then, as now," Sappol says, "there was a cultural hierarchy that placed reason and spirit at the top and the body at the bottom" (Sappol 2004:6). From the embryologists' imperial perspective, looking at embryo or fetal specimens was acceptable for scientific purposes, but crass if the purpose was to satisfy one's unanchored or prurient curiosity.

"Morbid" was quite literally in the eyes of the beholder. When Bobbie Ann Mason walked out of the museum without asking to see the Mayfield quintuplets, she was trapped by her own social location, kept in her place by a invisible force so strong that she could not break it. There was a certain paradox in her position: as a celebrated author she surely had the cultural authority to be allowed into the back room of the museum, but she had also written a scene in which Mrs. Wheeler remarked bitterly, "My babies was wooled to death—pure and simple. By people just like you" (B. A. Mason 1993:328). She thoroughly appreciated the radically different frames of reference that motivated her characters. Mrs. Wheeler grieved for her lost children. The fictional Dr. Johnson at the Institute of Man wanted "unusual medical phenomena for study" (1993:410). And Mason simply wanted a glimpse of the objects that sparked her glittering imagination. When anatomists and embryologists reserved for themselves the right to look at embryo and fetal specimens, they left the rest of us tainted by our own curiosity. Our wonderment may be laced with shame, but I wonder whether the surgeon Richard Selzer was right when he suggested, in the epigraph that opens this chapter, that the imaginations of the anatomist, the anthropologist, the museum patron, and the novelist are based on a secret delight we all share.

The German historian Barbara Duden writes that she became a historian out of curiosity; she "wanted to know how 'woman' came about" (Duden 1993:5). Likewise, we may look at the history of embryological laboratories to see how "embryo" came into being. Mall's laboratory at Johns Hopkins was the cloistered headquarters of embryo production, the principal American site at which embryos were worked up and "given body" (Hopwood 1999). From 1913 to 1944, about half a dozen professional embryologists and three to four technicians worked there at any given time. Their daily work was quiet and comfortably patterned: protocols were established, technical problems were resolved, students were trained. Their intellectual project was straightforward and respected, as they sought to document the development of tissues and organs, a process they called morphogenesis. Every day at noon, the professional staff gathered around a table for lunch. Someone poured tea. Yet such modest rituals of laboratory life belied the revolutionary nature of their project, because without their work the embryo and fetal subjects we know today might look quite different.

This chapter does not narrate a history of scientific progress or dwell on the embryologists' intellectual accomplishments or technical challenges. Instead, it shows how embryos came into being as cultural artifacts. The embryologists framed their work in ways that excluded women and ignored the social circumstances of pregnancy. Women were erased from embryo narratives much earlier than many authors have assumed. Duden, for example, says that the transformation happened "in the course of one generation" (1993:2). I argue, in contrast, that the erasure of women has long been embedded in scientific descriptions of prenatal development—that the process began long before Reagan-era abortion politics, ultrasound imagining, and culture wars. The early embryologists largely excluded women's experiences from their thinking, which allowed them to ignore conditions that led to miscarriage, abortion, and the deaths of pregnant women. Embryo collecting was thus predicated on something of a Faustian bargain; embryologists overlooked the poverty, disease, and violence that produced high rates of pregnancy loss. In exchange for their silence, they enjoyed access to a plentiful supply of specimens.

Two stories clearly demonstrate how little the embryologists were concerned with what happened outside the laboratory. The first is set in the early days of specimen collecting between 1897 and 1901, when a young Johns Hopkins medical student named Gertrude Stein was given an assignment to make a model of an "embryo brain." It shows what passed for success within the rarified context of embryo modeling, where precision and accuracy were paramount. It shows what happened to one young woman whose messiness was grounds for dismissal (although it did not keep her from excelling in literature). The story of Gertrude Stein's embryo encounter shows how embryologists constructed the boundaries that moved three kinds of phenomena into separate realms: embryo subjects (that is, those embryos we see and imagine); embryologists (that is, those who produce descriptions and authoritative knowledge about embryo subjects); and the stories we tell ourselves about what embryos are and what they mean (L. M. Morgan 2008).

The second story is a biography (or more aptly an "embryography") of a perfect young specimen known as Carnegie no. 836, interwoven with what remains of the long-forgotten biographical story of the woman, Mrs. R., from whose body it was taken. The story begins in Baltimore in 1914, when the embryo was discovered. I found it relatively easy to trace Carnegie no. 836 through scientific publications and archives, but to my chagrin most traces of Mrs. R. had evaporated through time. Paging through the genealogical and vital statistics registers in western Virginia, it bothered me to realize that I could learn more about the embryo Mrs. R. produced than about the woman herself. It is interesting to note how particular specimens in each of these stories were produced, paying attention to the laboratory techniques used to fix and preserve tissue. To quote feminist theorist Valerie Hartouni, the embryologists worked to stabilize "as a matter of (natural) fact what they also both presuppose[d] and compel[ed] into being" (Hartouni 1997:19). Today's iconic embryo has to be regarded as the cleaned-up descendant of the embryo collectors' efforts to satisfy their own nonmorbid curiosity.

GERTRUDE STEIN'S EMBRYO ENCOUNTER

Gertrude Stein (1874–1946) is known as a famously elliptical avant-garde author who entertained artists such as Picasso and Hemingway in her Paris salon. Many of her aphorisms (such as "There is no there there") have entered popular American discourse. But before Gertrude Stein moved to Paris and long before she became famous, she had been a medical student at Johns Hopkins Medical School. Enrolling in 1897, just four years after the school opened, she did well initially, but in her fourth year she flunked four courses and was not allowed to graduate with her class.

Stein spent the summer of 1901 in Europe, returning to Johns Hopkins in the fall for one final attempt to salvage her medical degree. Mall, who had been her anatomy instructor during her first year, agreed to supervise her because her previous advisor, Lewellys Barker, had moved to Chicago. Of all the professors Stein could have been assigned, Mall was the most sympathetic. Stein's biographer Brenda Wineapple says that Stein "delighted in Doctor Mall" during her first year, extolling his dry wit and praising his hands-off teaching style (Wineapple 1996:125). Mall also appreciated Stein. Both were children of German immigrants, and Stein's independent spirit was well suited to Mall's laissez-faire approach. Mall's assignment was for Stein to construct a model of the brain of a human embryo. She worked for four months on the project, and in January 1902 she submitted sixty-three drawings, "roughly twenty-five pages of text," and the model itself to Mall for his approval (Meyer 2001: 89).

This, in the words of Mall's protégé Florence Rena Sabin, is what happened next: "Doctor Mall . . . struggled a little, I think, to follow what she had been doing, [so he] asked me to take a look at it. The bizarre forms were terribly confusing to me, though, as you know, I had had a little experience in the subject" (Sabin 1933). Here Sabin is being coy, because at the time she was evaluating Stein's model she had just published a widely celebrated anatomical atlas and series of models of the human embryo brain under Mall's direction. In other words, "besides judging Stein's work, Florence Sabin also set the standard against which it was judged" (Meyer 2001, 85). Sabin continued: "But I soon found out that she had bent the spinal cord of the soft brain forward, so that it protruded just under the frontal lobes before fixation, and that accounted for the strange and bizarre course of the tracts in her model. Doctor Mall and I consigned the study, paper, model, and all, to the waste paper basket" (Sabin 1933). Slovenly, careless work was one thing Mall would not tolerate (Sabin 1934b:139, 173). Gertrude Stein took off for Europe.

When I learned that Gertrude Stein had been one of Mall's students, and that she had failed medical school on the basis of an embryo model, I wondered whether Gertrude Stein had indeed worked with an *embryo* specimen. The question was by no means easy to answer. There were, of course, various words used to describe young human specimens, and the specimen that Stein used has been variously referred to as an embryo, a seven-month fetus, a newborn babe, and (maybe) a six-month old child. Existing accounts that refer to Stein's specimen are contradictory and confusing. In 1899 Lewellys Barker reported that Stein "is now studying a series of sagittal sections through this region from the brain of a babe a few weeks old" (1899:725). One of Stein's classmates, Dorothy Reed Mendenhall, recollected that Stein's make-up assignment in 1901 involved the serial sectioning and reconstruction of "an embryo human brain" (Mendenhall 1939–53:25). Sabin told a classmate in 1934 that Stein had been assigned to work on a "fetal brain of seven months." Contradicting herself some years later, the seventy-six-year-old Sabin recalled that Stein "did not work as far as I know with the Hewetson slides [of a "new-born babe," that Sabin had used] but rather with a baby's brain of a little later stage" (Sabin 1947). Meanwhile, Mall had written to Barker in November 1901, saying, "Miss Stein: diligent at work with her model. She needs [undecipherable] the brain of a child 6 months old in order to connect her work with Miss Sabins! Can you not supply it? I told her that I would write to you asking for such material" (F. P. Mall 1901b). When Stein described her work, she mentioned an "embryological series" as well as "the adult series I finally made" (Stein n.d.; reprinted in Meyer 2001:94–95).

How might we disentangle these inconsistencies? Many missing details in the historical record have been provided by Brenda Wineapple's biography, *Sister Brother: Gertrude and Leo Stein* (1996), and by Steven Meyer, whose *Irresistible Dictation: Gertrude Stein and the Correlations of Writing and Science* (2001) is the most rigorous investigation to date of Stein's scientific work. Yet even Meyer, who weighed contradictory evidence and struggled mightily to interpret imprecise language, could not say whether Stein in fact built a model of an *embryo* brain, or whether she used an older specimen or even two specimens. My research turned up nothing more conclusive, although I doubt that Stein worked on an "embryo" from the first eight weeks of development. Nor do I think Stein worked on the "child 6 months old" that Mall wanted for her; there is no indication she ever received the requisite material, nor would she have had the time to finish it before January, when she submitted her paper to Barker (see also Meyer 2001:88).[1] Even if we discount the references to "embryos" and ignore Mall's wishful reference to the six-month child, and even if we conclude that Sabin might have misremembered events that happened forty-five years earlier when she described a "baby's brain of a little later stage," we are left with a specimen that Sabin described as a seven-month fetus and Barker described as a new-born babe.

Whether a seven-month fetus or a new-born babe, Stein's assignment would have required someone, likely Stein herself, to go to the cold storage room where Mall kept hundreds of late-term fetal and infant cadavers. Once a specimen was selected, someone would have had to remove the small brain, perhaps by following the directions spelled out in the 1901 edition of the *Reference Handbook of the Medical Sciences*. There, under the heading "Removing the brain from late fetuses, still-borns, or young children," the instructions begin, "This is most conveniently done if the cranium and maxillary region are first cut away from the neck and mandible by cutting with coarse-curved scissors from the corners of the mouth to the nape of the neck. The mass thus obtained is compact and may stand upright in liquid" (Wilder 1901:377). If the specimen were freshly dead, the brain would have been surprisingly soft and malleable. The instructions warn that with each subsequent step in the process, "more and more care will be required to avoid injuring the delicate brain, either by the instruments or by the cut edges of bone" (Wilder 1901:377). Stein was notoriously clumsy—maybe she dropped the delicate brain on the floor or squashed it while moving it to the fixative. By the time it was submerged in formalin, the brain stem had been twisted forward under the frontal lobe. After fixation, it was hardened in a block of paraffin before being cut into serial sections.[2]

In the end, I found myself identifying, quite improbably, with Stein's ludicrously misspelled assessment of her embryo work. Complete with typos, Stein wrote: "I havebeen *[sic]* able I have endeavored to expres/a very clear image which exists in my own mind of a region [of the brain] which the existing literature of the subject leaves in a hopeless mess . . . my aim in writing this article has been not so much to give/new/matter but to make crnfusion clear" (Stein n.d.; reprinted in Meyer 2001:94–95). Like Stein, I found myself trying in vain to bring clarity to a question that the existing literature had left in a mess. As metaphor, Stein's embryo encounter could explain the perpetual uncertainty that seems to be generated in efforts to pin down or fix what embryos are, what they mean, and the distinction between morbid and nonmorbid ways of looking at them. Embryological evidence is always generated and interpreted to fit historically particular problems: anatomical, political, metaphysical, clinical, and so on. The more I learned about the confusion surrounding the inchoate character of Stein's specimen, the more it seemed ironic that Gertrude Stein is the one more often described as puzzling and opaque, while embryological evidence is portrayed as concrete and irrefutable (L. M. Morgan 2008).

A PERFECTLY FRESH EMBRYO: CARNEGIE NO. 836

The historical particularities of specimen-ness become even more apparent if we follow the story of a single specimen. The specimen that became known as Carnegie no. 836 was found in the laboratory in 1914, in the uterus of a young woman who had just undergone a hysterectomy. She was probably still in the recovery room when her uterus arrived at the laboratory and an embryo was discovered inside, yet the embryologists immediately set out to detach the specimen from the circumstances that produced it. Specimen-hood is, of course, the social process that converts an object into an exemplar of a larger class of similar objects for the purpose of scientific study. Dead embryos and fetuses need to become specimens before they can be regarded as embryological work objects—the "right tools for the job" (Clarke and Fujimura 1992)—although of course scientific work is required to transform them from one kind of object to another (Casper 1998:117–24). My goal here is to explain the production of specimen-hood, because the transformation of embryos into specimens is arguably the single most important determinant of the ideology that allows us to think about embryos as we do, as things that are produced by nature and that stand largely outside of culture.

Carnegie 836 caused a stir the minute it was acquired in 1914. It was one of the smallest embryos the embryologists had thus far received fresh from the operating room, and it appeared to be in perfect condition. Just a few days into the new year of 1914, twenty-five-year old Mrs. R. had noticed a lump in her abdomen. Judging by her medical chart, it appears that Mrs. R. was childless after four years of marriage. She had experienced heavy bleeding—perhaps a miscarriage—two weeks earlier and was worried enough to make the 250-mile trip from her home in western Virginia to Baltimore, where she consulted Dr. Stickney. George Lewis Stickney (1887–1973) was a gynecological intern just two years older than she and inexperienced in serious cases. He prudently referred his patient to his professor, the esteemed Johns Hopkins clinical gynecologist Dr. William Wood Russell (1866–1923). Dr. Russell recommended the treatment that was (and still is) standard for fibroid tumors: hysterectomy.[3] Mrs. R. entered the Hospital for the Women of Maryland a month later, Monday the ninth of February. She was still awaiting surgery on Friday, when a tremendous blizzard blew snow and high winds into Baltimore. Two days later, Mrs. R. was wheeled to the operating theater where Dr. Russell removed her womb.

Surgeries such as hysterectomy gave embryologists the opportunity to acquire the beautiful, fresh embryos that would become their very best specimens. The embryologists marveled over the specimens "obtained by operation and most admirably preserved" (Keibel and Mall 1910:xvi). As Mall pointed out, "*nearly all of our perfect specimens were obtained from hospitals.* This is easily understood when one considers that only when the operator is near can perfectly fresh embryos be secured" (Mall and Meyer 1921:14; emphasis added). Obstetrical surgeons—the "operators"—were instructed to keep their eyes open for embryos whenever they performed surgery to open a womb or to remove an ectopic pregnancy (a dangerous condition in which a pregnancy develops in the fallopian tube rather than in the uterus). Skilled embryologists preferred to receive "perfectly fresh embryos," which allowed them to apply their expert skills to preserve, section, and stain the specimen. The Carnegie logbooks show that the very best embryos came directly from the surgically removed wombs of pregnant women (L. M. Morgan 2004). By long-standing agreement between the Hopkins-affiliated obstetrical surgeons and embryologists, then, Mrs. R.'s uterus was opened immediately after surgery and examined for the presence of an embryo. When the uterus was found to contain an early pregnancy, a messenger was dispatched at once to deliver the entire uterus to the Carnegie laboratory. He must have traveled gingerly over the snow-covered roads, Mrs. R.'s womb cooling in the package under his arm. He reached his destination, just over a mile away, at 1:15 P.M., as the embryologists finished their lunch.

At the embryology lab, Dr. Herbert McLean Evans (1882–1971) dropped everything to examine the new arrival. He could tell immediately that the embryo was at a very early stage of development and in exquisite condition. Uncharacteristically poetic, even reverential language was later used to describe it: "Shimmering through the amnion the 3 mm. embryo could be seen with its head visible above. It was apparently perfectly preserved and two gill arches were seen" ("Ovum 836"). Later that day, Evans wrote an effusive note to thank Russell for "the remarkable young ovum in situ which came over this morning . . . I carefully opened the . . . chorion and found a beautiful young embryo which we have fixed in corrosive acetic and which will doubtless be one of the very best specimens in the collection. I do not know how to inform you of our appreciation of your thoughtfulness" (Evans 1914a). There is no record of Evans expressing his gratitude to the woman from whose body the specimen was removed. February 16 was undoubtedly a tough day for Mrs. R., but in the Carnegie laboratory it was a day to celebrate.

From the moment 836 entered the lab, Mrs. R. dropped out of the story. No one ever wrote *her* biography, as far as I know, but I began to feel that the full story of 836 should take account of her situation. This reflects my feminist commitment that even accounts of dead embryos should situate them within women's bodies and social lives. I wondered if Mrs. R. had survived the operation, and how she weathered the nor'easter that lifted roofs off Baltimore houses two weeks into her convalescence. I wondered how she and her husband bore the misfortune that left her barren at age twenty-five. I wondered whether she felt a pang of remorse a few months after the operation that left her forever childless, when President Woodrow Wilson proclaimed that the second Sunday in May would henceforth be known as "Mother's Day." I wondered whether she was ever told that Dr. Russell had found inside her excised uterus a small, perfect embryo that went on to have a long and distinguished career as Carnegie no. 836.

I later learned that Mrs. R. had indeed survived and returned to the rolling hills of western Virginia, where she lived the rest of her life as a farm wife.[4] Driving through the lush valley where her farm had been, I tried to imagine her tending tomatoes, stoking the stove, thinking about her future. With no children to carry her memory, she left few traces. Searching the cemetery near her home one drizzly summer morning, I found the gravestones of her parents, brothers, and a sister, but I could not locate her grave. I circled the cemetery again in the rain, hoping to stumble across her gravestone and growing increasingly distressed to think that Carnegie no. 836 was all that remained of her.

Mrs. R.'s gendered experience makes one thing clear: transforming a woman's personal calamity into an embryo specimen was a tremendous cultural achievement. Every one of the ten thousand specimens in the Carnegie collection was separated from the story of the woman who produced it. The embryologists never stopped to consider the consequences of their actions, as they took steps to erase and dehumanize the women who provided their precious specimens. Evans wanted to get a copy of Mrs. R.'s medical chart, for example, but he probably never knew or cared why Mrs. R. felt compelled to say that she was married when, according to the Botetourt County marriage ledgers, she did not legally marry Mr. R until four years *after* the hysterectomy. Women's lives and stories were never the embryo collectors' concern, any more than the love letter inside the envelope might matter to a stamp collector. The historical legacy of this mindset is with us still, because our ability to regard an embryo as "separate" was (and is) constituted by the very practice of detaching it from a woman's body and story.[5] Only by taking every embryo away from the circumstances of a woman's life was it ever possible to start imagining "embryos" as a category of thing, separate and separable from the women who produced them.

The story of 836 is a reminder that embryo collecting was historically peculiar. If circumstances had been just slightly different, there might not have been an 836 at all. Had Mrs. R. been born twenty years earlier, she would not have been a candidate for hysterectomy, because the operation was not widely performed until the 1890s. If she had been born twenty years later, the availability of a pregnancy test might have kept Dr. Russell from performing a hysterectomy on a pregnant woman. (One of the reasons the

Carnegie Human Embryo Collection is so valuable today is because few fresh embryos come from hysterectomies anymore.) Mrs. R. might not have been eligible for surgery had she not lied about her marital status, because many maternity hospitals in the early twentieth century refused to treat unmarried women. By obscuring all such contingencies of 836's existence, however, the embryologists left the impression that 836 was a natural rather than a social creation.

Back in the laboratory, the embryologists walked through a series of regimented steps to objectify the embryo, to transform "interrupted pregnancy/raw uterine matter" into "specimen." Evans took detailed notes, giving us a close-up look at the process. The first step in standardizing the specimen was to catalog it and assign it a number. Then, within half an hour of its arrival in the lab, Evans carefully removed "a sac-like oval structure" from the uterus and "placed it in warm salt solution." Under the microscope, he made a small incision and introduced a fixative, warmed to the proper temperature. He arranged for what he called the "split ovum" (opened chorion) to be given a number and photographed.[6] Two hours after 836 arrived in the lab, Evans moved the embryo to the first of several alcohol solutions in which it would be placed over the next four days, to begin the process of fixing, also called hardening (Evans 1914b).

Fixing was a crucial task in the creation of an embryo specimen. Fixing is, as developmental biologists Gilbert and Faber point out, "a technical term in embryology, which is equivalent to 'killed in its development for visual analysis'" (Gilbert and Faber 1996:138). In popular usage, of course, to fix has other connotations, which Diane Nelson explores in her study of body politics in Guatemala. Nelson notes the ambivalence inherent in trying to "fix" the multiple and shifting identities of Guatemalan citizens. She suggests "that the instability of these identifications—rather than their 'primordial' nature—incites ambivalence and attempts to 'fix' them (in both the sense of to stabilize and to repair)" (Nelson 1999:6). Her insight prompted me to inquire, as she does, about when and why the impulse to fix becomes irresistible, about the sites at which fixing takes place, and about how fixing links embryo specimens (in this case) with the body politic. Fixing can be seen not just as an anatomist's technique but as a metaphoric form of discipline required to stabilize shape-shifting embryo specimens.

Fixing is today a routine laboratory procedure, yet it took a long time for anatomists to figure out the best techniques. When Mall began collecting embryos back in 1891, he complained that physicians too often "ruined" precious specimens by placing them in water or strong alcohol, or by packing them in cotton or stuffing them into bottles that were too small (F. P. Mall 1891:1144). One of his circulars implored doctors to preserve their specimens in "Müller's fluid," which consisted of bichromate of potash, sulphate of soda, and water (Gatenby and Cowdry 1928:43), or in a 70 percent alcohol solution.

Many embryos arrived at the laboratory fixed in alcohol, which meant that they had been submerged in increasing proportions of alcohol over a period of several hours or days. This method was convenient but not ideal. Every physician had alcohol readily at hand, but as a reagent it had a tendency to distort the embryos: "they become overhard and shrink, and become brittle, and their capacity for taking stains well becomes seriously diminished" (Gatenby and Cowdry 1928:4). After trying, evaluating, and comparing many solutions (see Patten and Philpott 1921), most anatomists adopted formalin (a mixture of formaldehyde and water) as a fixative when it became commercially available in the late 1890s. Formalin was preferred—"its use being so very simple"—because doctors could get it easily or make it when needed (Minot 1905:503). A mixture of formalin and picric acid known as "Bouin's fluid" was another favorite fixative used by embryologists (Lee 1913; Johnson, Johnson, and Williams 1990:455; Schultz 1919). Bouin's fluid is still commercially available and is optimal, as one Web site advertises, "for use in preserving soft and delicate tissue structures." [7]

With fixing, Evans solidified 836's status as a specimen, in a form that would eventually allow it to be examined, drawn, modeled, standardized, and thoroughly analyzed. By the end of the week, Evans noted that "the fixed and hardened specimen [had] undergone a readily appreciable shrinkage from the condition seen in warm salt solution." All embryos shrunk when fixed, so Evans was unconcerned. He optimistically added, "All of the tissue seems beautifully preserved." About six weeks after it entered the lab, at 4:00 P.M. on March 31, Evans prepared the penultimate ablution, placing 836 into a solution of 70 percent alcohol plus iodine. No. 836 was now ready for the most crucial and delicate phase of its transformation: serial sectioning. This important rite-of-passage was scheduled to begin the following morning before dawn.

The word *section* as used by embryologists is both a noun and a verb. As a noun, it means a distinct part or subdivision of something else, in this case a thin slice of tissue suitable for microscopic examination. As a verb, it means to cut or divide into sections, like a loaf of bread. Embryologists commonly used three types of sections: transverse (also called horizontal), saggital (median), and coronal (frontal). The saggital plane goes along a line

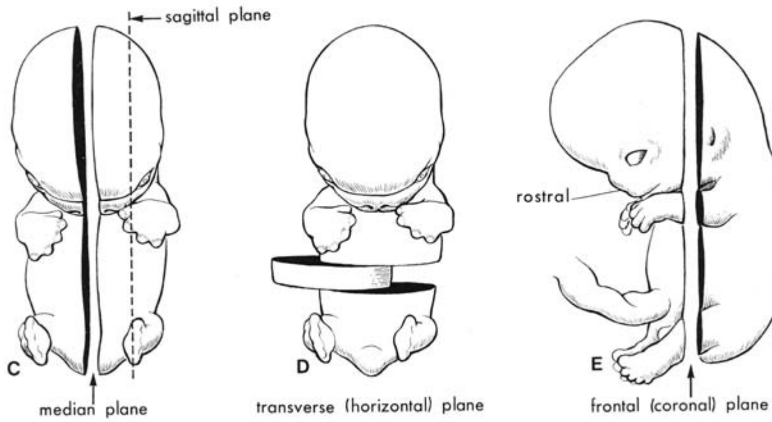


Figure 3. Planes of section. From Moore 1974:8.

from nose to genitals, from the front through to the back (the one in the exact middle is called the "median" plane; the sections parallel to the median plane are the saggitals). The transverse (or horizontal) plane goes vertically across the middle parallel to the ground, cutting the top half of the body off from the bottom half (also called cross sections). The frontal (or coronal) plane goes from left to right sides of the body, through a line connecting the shoulder and hip.[8]

Sectioning was rife with peril. The tiny embryo—now only four millimeters long (less than a quarter of an inch)—could easily be dirtied, squashed, or torn by the slightest nick in the blade. (In 1932, a similar embryo—no. 6469—was tragically "fragmented on cutting" and had to be discarded [O'Rahilly and Müller 1987:271].) And yet sectioning was the highest honor an embryo specimen could receive. Mall poignantly captured of the contradiction implied in sectioning when he wrote, "The advancement of embryology has shown that it is necessary to destroy, or rather to lay into sections, the embryos before they can be studied properly" (Mall 1891:1145).

Evans arrived at the lab shortly after 5:00 A.M. He bathed 836 in the solutions that would ready it for cutting. At precisely 9:58 A.M., he imbedded the hardened embryo in a block of melted paraffin; at 10:25 A.M. he plunged it into cold water to set for fifteen minutes. Meanwhile the technician, Charles Miller, used a microscope to scrutinize the microtome cutting blade for dents or gouges. Satisfied that the blade was pristine, he carefully positioned the paraffin block containing the embryo on the microtome and began to cut it into very thin slivers. The thickness of embryo sections is measured in microns; one micron is equal to one millionth of a meter. Forty-five minutes later, the twenty-eight-day, quarter-inch embryo known as Carnegie no. 836 lay divided into 248 sections, each fifteen microns thick and mounted on glass slides. By 2:30 P.M., the ritual was finished—836 had achieved the status of sectioned embryological specimen.

Sectioning revealed what Evans already knew: 836 was a standout, exceptional on two counts. It was obviously a very early "stage 13" embryo, and it was in perfect condition. Contemporary human embryologists are intimately acquainted with the twenty-three "Carnegie stages," a standardized set of milestones they use to describe morphological development (O'Rahilly 1987:1). The table looks like a straightforward linear trajectory of embryological development, a classic version of what to expect (from the embryo) when one is expecting. Yet it took an enormous amount of theoretical, methodological, technical, and ideological work to produce (O'Rahilly and Müller 1987). Mall first tried to determine the age of embryo specimens, reasoning that all embryos grew at the same rate. He measured his specimens carefully, reckoning a line from crown to rump, and arranged them on a continuum from youngest to oldest. Several of Mall's methods—including the careful preservation of specimens and reconstruction of models—were designed to determine the age of the embryos "with an error of but a few days" (F. P. Mall 1906:434). But the date of conception could rarely be ascertained with any certainty, which meant that Mall could never be sure of a specimen's age. Nor could the specimens be arranged in order of size because, as Evans noted, they would often shrink when fixed. Mall's staging scheme was revised by his successor, George L. Streeter, who substituted the term *horizon* instead of *stage*. But in 1987, Ronan O'Rahilly and Fabiola Müller settled again on the word *stage* because it was the standard for "all other vertebrate embryos" (1987:2). Subsequent embryologists have opted to stick with stages, which are organized around the emergence of specific morphological features rather than age (usually expressed as a range of days) or size (usually expressed as the measurement in millimeters of the longest distance from crown to rump).

The work of developing stages and norms for human embryological development has been described in detail by Nick Hopwood, a historian of embryology trained in developmental biology. Hopwood argues that late nineteenth- and early twentieth-century embryologists "produced" the concept of human prenatal development as a series of sequential steps (Hopwood 1999; 2005; 2007). By looking at the oft-neglected techniques the embryologists used to produce wax models, serial sections, and drawings, Hopwood demonstrates

FIG. 2. Embryo No. 144, × 7 diameters. Letters as in Fig. 1. *H*, heel; *h*, hip joint; *K*, knee joint; *x*, point in leg which equals the distance from *h* to *R*. By adding *xH* to *CR* the standing height of the embryo is obtained.

Figure 4. How to measure an embryo. From Mall 1907:131.

how crucial these forms of visualization were to the embryologists' effort to "give body" to the specimens (Hopwood 2000). "Embryologists' major products," he says, "have been developmental series: successions of progressively more advanced embryos, in the form variously of drawings, specimens in spirits, models, photographs, posters, sonograms, videos and flip-charts. All work in embryology has depended on, and most has in its turn generated, these material representations of development" (Hopwood 2000:31). Staging was an important process in establishing contemporary ideas about embryos, because it helped to provide the linear narrative that allows us to see a picture of an embryo and imagine its trajectory all the way from fertilized ovum to newborn babe (C. Cole 1993).

Embryo specimens were usually graded as good, fair, or poor, but occasionally an exceptional specimen would be ranked "excellent." To achieve this honor it had to be fresh and perfectly prepared, clearly exhibiting the morphological features of its stage. No. 836 was the first "excellent" stage 13 specimen to enter the Carnegie collection. One other "excellent" specimen of the same stage, Carnegie no. 1075, was logged the following year, but it was thought to be a bit closer to stage 14 by a few days—the "most advanced in group"—and therefore less exemplary of stage 13. The third stage 13 specimen to be ranked "excellent" would not appear in the Carnegie collection for fifteen more years. By 1987, the collection contained just fourteen "excellent" specimens of this stage, of which only five others were cut along the transverse plane of section (O'Rahilly and Müller 1987:271). But sections were not readily intelligible on their own. In the tumultuous summer of 1914, as war broke out across Europe, Evans and his assistant, Osborne O. Heard, stayed in Baltimore, where they began to sculpt a model.

On the afternoon that Mrs. R.'s uterus reached the laboratory, twenty-three-year old Osborne Heard had been working at the new department of embryology for less than six months. Born in an Idaho snowstorm, he loved winter and would not have allowed a trifling Baltimore blizzard to keep him from work (A many-sided man 1979). Heard, who had been apprenticed as an engineer's pattern maker since the age of fourteen, had been studying art and sculpture in night school when his teacher's neighbor, Herbert Evans, inquired about hiring an embryological model maker. Although Heard did not have any experience in anatomy or embryology, he took a leave from his apprenticeship to see whether he would adapt to the Carnegie environment. He obviously liked the new job, which paid twelve dollars and fifty cents per week. He ended up staying for forty-two years, during which he made over seven hundred embryological models and constantly developed technical innovations.

Heard's personality was well suited to the post. With his endless tinkering, a penchant for precision, and self-taught mechanical skills, Heard developed innovative techniques for sectioning, photomicrography, time-lapse motion-picture photography, mounting, and making projections and three-dimensional macroscopic models of embryos. When he started at Carnegie, embryological reconstruction was, in his own words, unique, challenging, and little known in the United States (Heard 1979:2). But pattern making had prepared him well: "Patternmaking *[sic]* basically requires precision and this I applied to reconstructions, something hitherto neglected" (Heard 1979:1). For both Heard and Evans, making models of 836 would have been an enormous test of their capabilities. Heard was young and unproven, and although Evans had been around for a while, Mall had entrusted them with the responsibility for reconstructing one of the most important specimens in the collection. A failure could have tarnished both men's reputations.

They began building their model in the summer of 1914, when Evans knew there would be little else to do. Mall had left for Europe, unaware that events there would soon lead to war.[9] Evans stayed in the laboratory, along with the few other noble souls who had postponed their vacations to receive specimens and oversee renovations to the building. Ever since the advent of Carnegie funding, specimens had been arriving almost daily. Mall wrote that it had taken him twenty-five years to collect the first hundred specimens, five years to collect the second hundred, and only three years to collect the third hundred (F. P. Mall 1916b:109–10). Someone had to stay in the laboratory to catalog the new arrivals. Everybody else—including Evans's wife—had left to vacation in the hills or at the seashore, and Baltimore was quiet. Evans had described the ambience in a series of evocative letters to Mall the previous year: "Your letter was a most welcome visitor to this deserted spot. I see the Lewises sometimes but chiefly I sit by the ceaseless buzz of the fan and project sections of the embryo until the day light fades and I grope my way out to some restaurant. My house is funereal" (Evans 1913a). A few weeks later he wrote, "I have been pausing before answering your last letter to have some news to tell you, but news does not happen in this slowly moving clime. The suns come and go and bake the sands along the Chesapeake's shore but little happens. The school is quite deserted." He continues, "We have 16 human embryological entries since your departure. I have noted their arrival, condition, etc. and shifted them to ground glass vessels so that they are cared for" (Evans 1913b).

With little else to do, Heard and Evans threw themselves into model making. Heard recalled the rhythm of those days, and Evans' attachment to 836, this way: "Dr. Evans was especially interested in #836 as he had carefully carried the specimen procured at the operating table through reagents up to the point where Mr. Miller sectioned it. First we made outline tracings and from these I made an external form model. Later I made a series of photomicrographs x100 on glass plates aided by the Zeiss [projecting] apparatus. Many nights we worked through until the early hours of the morning on reconstructions of this beautifully preserved specimen. With no street cars running we often had to walk home" (Heard 1979:5).

The justification for modeling—this "resurrection after the sacrifice" (Hopwood 2002:70)—had been set out in the late nineteenth century by Wilhelm His, the eminent German embryologist who was Mall's mentor and the inventor of the microtome. His initially molded his embryo models freeform out of lead plate or wax, but over time he became convinced that three-dimensional, wax plate modeling following sectioning was a more objective and accurate way to apprehend the complex structures of an embryo (Hopwood 2002:53). Two-dimensional sections were essential because they allowed minute examination of the embryo's internal structure. "Structure," Minot once said, "is the only distinctive mark of living bodies" (Minot 1906:19). But two-dimensional sections were notoriously difficult to interpret, even for seasoned embryologists, and His realized that three-dimensional modeling would be a pedagogical boon. His's refinement of the new modeling technique coincided with the years that Mall spent in His's lab (and is described in Hopwood's sumptuously illustrated book, *Embryos in Wax: Models from the Ziegler Studio,* 2002). Mall was so entranced that he took the technique whole cloth back to Baltimore, where he later taught it to the Carnegie staff. Hopwood's description of His's techniques (2002:70) matches precisely the steps performed upon 836: the opened chorion was photographed, drawn by an artist on paper, fixed and sectioned, and reconstructed in wax plate models. The embryo recruits emerged from fixing, sectioning, and staining as an orderly, regimented collection, numbered and ready for service.

Heard loved model making, even though it was tedious and time consuming. "I felt privileged," he said, "to make visible to others macroscopically the microscopic world of embryology through three-dimensional reconstruction" (1979:2). To make each model, Heard projected an image of each section onto a screen. He then traced the outlines of the desired feature onto white paper and transferred them, using carbon paper, onto wax plates. He cut away the excess wax and stacked the plates to form a finished wax model fifty or a hundred times the size of the original. Modelers tended to work with the materials they knew,[10] and as a sculpture student Heard had plenty of practice making different kinds of molds. In the early days of working on 836, Heard developed a new plaster casting technique that would allow the models to better withstand handling as well as the steamy summer weather (see Lewis 1915). This involved piling up the leftover portions of wax plate, then filling the cavities with plaster of Paris. When the plaster set, hot water was used to melt off the wax, leaving behind a durable plaster mold (Shikinami 1926:52). Heard produced at least six models of 836 in addition to the external form mentioned above: four of the heart, one of the vascular system, and one of the brain. These were kept in cabinets on the Carnegie shelves.

Had 836 not been made into a model, it might have remained just another specimen among ten thousand. But Heard and Evans's model allowed 836 to become the prototype representative of stage 13. Its anatomical features—

heart divided into primordial atrium and ventricle, appearance of limb buds, and closed neoropores (openings at either end of the neural tube)—came to be recognized as classic characteristics of this stage of development.[11] A number of embryologists used 836 to describe one organ system after another, including the aortic arches of the heart, urogenital system, somite formation, thyroid glands, gonads, cranial arteries, lungs and diaphragm, trachea and esophagus, "extrinsic ocular muscles," adrenal glands, brain, and eye. To meet all these demands, 836 had to be continually reimagined.

To make their work intelligible to other researchers, embryologists relied on medical illustrators. 836 became the specimen that all the embryo imagers wanted to draw, and in subsequent years this single tiny embryo specimen was posed, drawn, photographed, and modeled in dozens of different poses. Several breathtakingly beautiful illustrations of 836 were made by James F. Didusch (1890–1955), an accomplished medical illustrator who spent nearly his whole career at the CIWDE (Altemus 1992). Didusch first drew 836 in 1914, a year after he was hired, and it became one of his favorites. He returned to it again and again, making new drawings at least through 1951, just four years before he died. In the 1920s, 836 posed for a new kind of model when Japanese embryologist Jujiro Shikinami used it proudly and "with much satisfaction" to depict the development of the urogenital system (1926:51). In the 1940s, medical illustrator Dorcas Hager Padget (1906–73) turned his attention to 836, this time to show the development of the cranial arteries (Padget 1948).

No. 836 remained in the embryological limelight even after other models became available. DeVries and Saunders, for example, boasted that their 1962 study of heart development (cardiogenesis) would be an improvement over previous studies because previous researchers had relied on very few specimens (1962:89). Ironically, though, even though DeVries and Saunders had access to all of the fourteen stage-13 specimens (which they called "age group XIII") then in the Carnegie collection, their results were based on just two: 836 (which received top billing) and the "somewhat older" 8066 (De Vries and Saunders 1962:103). Despite having access to numerous specimens, De Vries and Saunders ignored the other models in favor of 836. Likewise, when George Streeter published his definitive description of "horizon XIII" (later "Carnegie stage 13") in 1945, he used 836 as the archetype, featuring illustrations of 836 almost exclusively, as did O'Rahilly and Müller in their landmark compendium *Developmental Stages in Human Embryos,* published in 1987.

Three-dimensional models were an important part of 836's popularity, as well as an indispensable complement to the serial sections. But it needs to

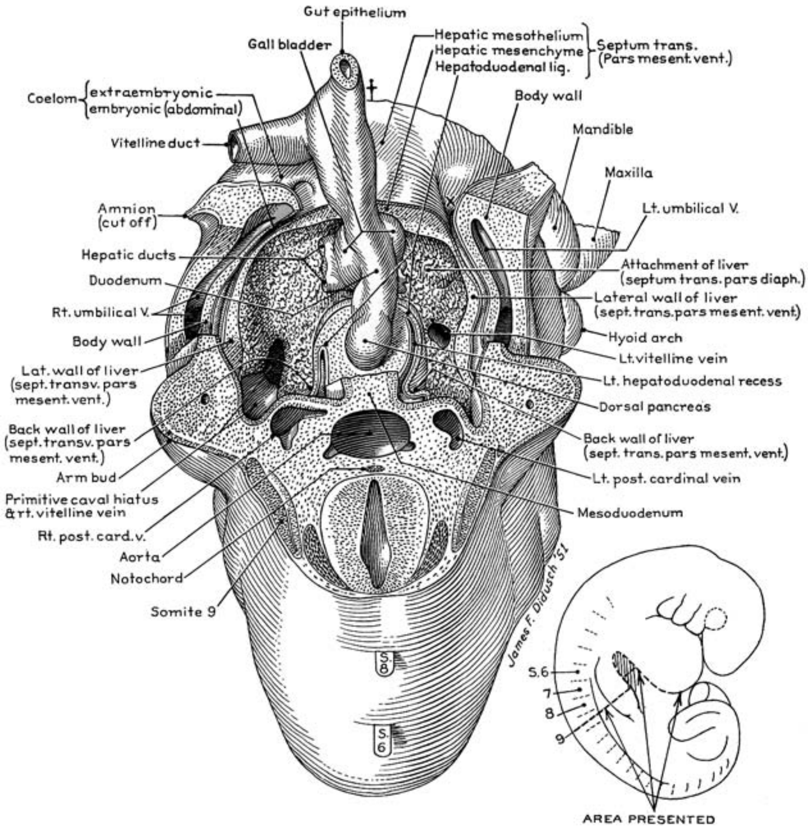


Figure 5. James F. Didusch's rendering of the transverse septum of Carnegie no. 836. From Wells 1954:117.

be pointed out that most models developed in the Carnegie studios were not beautiful. Gray and uneven, with unpolished edges, they looked crude, especially compared to the exquisitely crafted and finely finished wax teaching models produced at the Ziegler studios in Germany (see Hopwood 2002). Granted, the two institutions had different goals. Ziegler ran a commercial enterprise, selling a wide range of display models to universities and museums. The Carnegie Department of Embryology, meanwhile, was a modest, introverted research institute making models for its own internal purposes. Rather than contracting a commercial firm to produce models, Mall preferred to hire, train, and supervise modelers to his own exacting standards. The models did not need to be pretty, just accurate. Yet it was the beautiful models that tended to stay on the shelves. Osborne Heard later lamented that "the brain and nervous system models given Dr. Dehuban [*sic,* Dekaban] while at [the NIH] were destroyed after his departure [in the 1960s]. . . . Perhaps the destroyer had no concept of the painstaking work he threw in the trash can. So be it" (1979:5). The models thrown out at the NIH might well have included one of 836's brain, which was described in the literature but seems to have since disappeared. Heard became a bit defensive about his models in later years, as images of embryos became increasingly sophisticated and aesthetically appealing. As he explained, "Reconstructions, it should be emphasized, were made primarily for research purposes, not as museum pieces or teaching aids. Though several were surface finished, most were retained as they came out of the wax molds" (1979:6).

Throughout its early years in the lab, 836 had become embedded in more than just paraffin. A rare manifestation of professional tension erupted when Evans quarreled with Mall over custody of the specimen. In 1915, shortly after he finished the model of 836, Evans accepted an offer to chair the department of anatomy at the University of California, Berkeley. Evans had by then been under Mall's tutelage for nearly ten years. His decision to leave was shocking to those who expected him to be Mall's eventual successor. As a student, Evans had been enthralled with anatomical and embryological research. He declined a prestigious internship and clinical training to accept a position in anatomy. Mall had groomed Evans carefully, arranging for him to spend several summers in Germany, giving him responsibility for the lab when he was away, inviting him to contribute a chapter to his prestigious 1910–12 volume, the *Manual of Human Embryology.* Yet for Evans and his wife, the prospect of returning home to California was too tempting. When Evans left, he took with him two other gifted young Johns Hopkins graduates, Katherine J. Scott and George W. Corner, the latter of whom would return later to direct the department of embryology. Mall was stung that Evans would choose Berkeley over Hopkins, and especially that he would take with him two of the department's most promising researchers.

Evans would have liked to take 836 with him to California. He had already begun a comprehensive survey of the development of the somite phase (segmental blocks of mesoderm along the notochord or primitive backbone) in human embryos. He had completed the portion of his research that required him to observe all the European embryos (Bartelmez and Evans 1926:4). The sections and models of 836, which had consumed so much of Evans's time over the previous year, would have been the centerpiece of this research. Yet

Mall refused to permit Evans to take 836 to Berkeley. The story is recounted by eyewitness George Corner, who said, "When Evans finally left Baltimore, Mall was unwilling to let him take along, even for his temporary use, the rare and precious serially sectioned embryos necessary for the study—one or two of which, at least, Evans had himself collected and laboriously sectioned during Mall's summer absences. Evans was disappointed and hurt by what he considered his chief's ungenerosity" (Corner 1974a:159).

Mall and Evans were caught up in the unwritten rules governing academic patronage and intellectual property. Evans surely felt that his investment of labor and intellectual expertise should justify co-ownership of the specimen, or at least borrowing privileges. Meanwhile, Mall thought Evans was out of line. Perhaps he was thinking about the loss of his own investment of labor that Evans's departure would represent. Or perhaps he was punishing Evans for his arrogance. One of Evans's contemporaries described him as "an independent and brilliant medical student [who] undiplomatically fluster[ed] elderly clinicians" (Saunders 1972:187). In any case, Mall pulled rank, setting an example for other trainees to practice humility, acknowledge their debts, and relinquish the products of their labor. The specimen remained in Baltimore but the dispute wounded both men. Evans never again spoke to Mall, nor did he ever again work with 836.[12]

This would not be the only quarrel over 836. In the course of modeling 836, Heard had devised a major improvement (described above) to the customary method of constructing wax plate models. The technique was published in a widely cited 1915 article by another Carnegie embryologist, Warren H. Lewis, who made the mistake of not acknowledging Heard's contribution to the work. Heard complained that Lewis was "not one to acknowledge help," and that he should have been credited for the invention (Heard 1979:4). The hierarchy in the laboratory reflected the social hierarchy outside. Senior men treated women and technicians as menial laborers and their social inferiors, offering them lower pay and inadequate recognition of their talents. But Heard felt entitled to greater respect, and he had in fact proved himself an indispensable member of the staff. He must have made his displeasure known, since his superiors took pains to acknowledge him in their future publications. A 1926 article by George Bartelmez and Herbert Evans, for example, notes that their "work would not have been possible without the help of Mr. O. O. Heard, who prepared the elaborate series of models according to the method described by W. H. Lewis" (1926:4). A 1945 article by Streeter acknowledges Heard (in captions) no fewer than five times. It is not clear whether the spat over 836 resulted in Heard receiving a salary increase.

Ever since it arrived in the laboratory, the specimen known as Carnegie no. 836 was capable of motivating social action. This does not mean, however, that embryo specimens were ascribed the qualities of personhood. I had been alert to signs of personification as I read through the embryologist's publications and correspondence, but found no evidence of it before 1936, when an embryologist quipped, "The blastocyst is having its steriographic *[sic]* picture taken today. You will be glad to know that it made no objection and kept perfectly still" (Streeter 1936). This was the first time I saw an embryologist draw an analogy between the qualities of embryos and those of small children, although of course the phenomenon became pronounced later in the twentieth century. Anthropologist Lisa Mitchell drew attention to it in her ethnographic study of ultrasound use during pregnancy: "During routine ultrasounds, the fetus emerges as a social being, a social actor with a distinctive identity—'the baby'—enmeshed in a social network of kin and sonographers" (Mitchell 2001:136). Prior to the 1930s there was no indication that people regarded embryos as small *persons* by naming them or incorporating them into their social imaginaries, but nevertheless the embryologists' actions made those specimens capable of acting on the world.

Many small steps—what Latour calls "*the whole series* of transformations" (1999:150; emphasis in original)—transpired as embryo specimens came to acquire power. And indeed, embryo specimens arguably changed the course of history. A specimen figured in sending Gertrude Stein fleeing to Europe, in transforming Mrs. R. into a phantom, in pitting two eminent scientists against each other, and in removing women from stories that would be told about embryos. Even in the early years of the twentieth century, I argue, embryos were ascribed a specific kind of social subjectivity. This subjectivity was predicated in part on the laboratory techniques and practices that put a premium on certain qualities: stability, predictability, fixity, uniformity. These techniques reinforced an understanding of pregnancy as a process in which embryos develop independently, and they reduced women to the role of embryo incubators. That this radically atomistic view of gestational development is culturally and historically specific can be seen by contrasting it to societies in which both parents, for example, might be enjoined to act in ways that nurture a growing fetus throughout pregnancy (see Conklin and Morgan 1996). To appreciate the difference this could make to cultural understandings of embryological development, it is instructive to imagine "how 'embryo' might have come about" (to paraphrase Duden) if embryologists had been less curious about morphology and more curious about the impacts of economic injustice, discrimination, nutritional status, or occupational exposures on embryological development.

The entire Carnegie Human Embryo Collection went into semi-hibernation during the postwar years. Embryo collecting was out of fashion by the mid-1950s, and the focus on human embryological morphology was considered so staid and old-fashioned that there was some question about whether Carnegie should continue to support it (Singer 2004). The Carnegie Institution of Washington decided to revitalize the Department of Embryology by appointing a director with a new vision. James David Ebert (1921–2001) was a passionate teacher and innovative experimental embryologist who turned the department sharply toward the new field of molecular biology. Under his direction, the human embryology program was discontinued in favor of new pursuits. The era of embryo collecting was over.

By the early 1970s, with developmental embryologists distracted by new developments in genetics and molecular biology, 836 had almost been forgotten. Some people thought the entire Carnegie embryo collection was a relic of bygone days and not worth saving (see Noe 2004). That view was emphatically not shared by Ronan O'Rahilly, a Swiss-born Carnegie embryologist who continued to work closely with the Carnegie embryo specimens throughout the 1970s and 1980s. Together with his wife and collaborator, Fabiola Müller, O'Rahilly is the author of several important textbooks in embryology and teratology, as well as one of the world's authorities on the Carnegie collection. In 1971, he and Bent Boving, a Swedish embryologist and former Carnegie researcher, packed the collection and took it with them to Wayne State University. O'Rahilly moved it again two years later when he relocated to the University of California at Davis. There the collection was housed in an outbuilding under the auspices of the California Primate Research Center. O'Rahilly continued his work while he "carefully curated the collection and allowed some researchers access to the holdings" (Noe 2004:48). In spite of O'Rahilly's devotion, the collection inevitably suffered from the relative lack of resources.

Osborne Heard was shaken when he visited what he reverentially referred to as "The Collection" in 1978. "My reactions were definitely ambivalent in that I was not prepared for the reduction in the number of reconstructions and the background in which The Collection is now housed. . . . I kept back the tears when I saw what had survived and was so far from *home!*" (Heard 1978; emphasis in original). Recovering his equilibrium, Heard added mischievously that Evans (who had died in California a few years earlier, in 1971) must rest more easily knowing that 836 was nearby. In 1990, after

O'Rahilly retired and moved to Switzerland, the collection was moved to Washington, DC.

The major remaining Carnegie-era human developmental collections have now been centralized at the Human Developmental Anatomy Center of the National Museum of Health and Medicine in Washington. This is a working research collection of human and comparative (nonhuman) embryonic and fetal material, as well as other sectioned anatomical materials including brains. Some of the other early twentieth-century collections housed there include George S. Minot's comparative collection of mammalian embryos from Harvard, and Davenport Hooker and Tryphena Humphrey's neuroanatomical collection of human and comparative embryo and fetal specimens from the University of Pittsburgh. The Burdi-Patten Embryology Collection, with its copious fetal material, was recently moved to Washington from the University of Michigan.[13] Fetal skeletons and wet-tissue specimens, mostly dating from the nineteenth century, are on display at the National Museum of Health and Medicine and at the Mütter Museum in Philadelphia. The Mütter was originally a nineteenth-century pathological museum, now known for its exhibit about the original Siamese (conjoined) twins, Chang Bunker and Eng Bunker (1811–74), as well as its other "disturbingly informative" medical and anatomical curiosities such as rows of skulls and wax models of syphilitic sores (Worden 2002). Harvard's Warren Anatomical Museum's once extensive collection of wet tissue fetal specimens was sadly neglected in the late twentieth century and is now in storage while conservation efforts continue. The Museum of Science and Industry in Chicago still shows its prenatal development exhibit, the same one that was originally shown at the Chicago Century of Progress Exposition in 1934 (C. Cole 1993).

CURIOSITY REVISITED

As we have seen, Bobbie Ann Mason once traveled all the way to the National Museum of Health and Medicine to see the mummified remains of the famous Mayfield quintuplets, but just outside the door she lost her resolve and went home, ashamed of her morbid curiosity. Was her curiosity any less worthy of being satisfied than that of the curators or embryologists who gathered thousands of specimens? The obvious, if unsatisfying, answer to this question is that medical scientists—doctors, pathologists, technicians, and medical students—have always taken the prerogative to objectify the dead and to handle bodily tissue. Observation, especially of the kind that French philosopher Michel Foucault calls the "medical gaze," is the claim that allows medical scientists to justify their own curiosity as politically uncomplicated, professionally necessary, and ethically neutral. They saw curiosity as their solemn duty, justified by their mandate to heal, and they did not consider their collecting to be morbid. A simple thought experiment, however, should reveal how these assertions masked the extent of their power. What would we think of Mason's protagonist, Mrs. Wheeler, if she had canvassed the clinics of Baltimore, telling doctors she would send a messenger day or night to retrieve dead embryos and fetuses for her personal collection? We would of course think she had lost her mind (although we might forgive her for being driven a little mad by her ordeal). Yet when embryologists engage in gruesome laboratory practices—sawing babies' heads open and cutting human embryos into slices—we are more inclined to regard their actions as professionally justified. Why would Mrs. Wheeler be crazy while the embryo collectors were not? The answer, of course, is that they were operating within different frames of reference, although with respect to identical objects.

Daston and Park distinguish "wonders and wonder," which they say "are often objects of mild condescension," from the "edifying" objects of science. Scientific professionalism, they say, is characterized by "seriousness of purpose, thorough training, habits of caution and exactitude," all of which are "opposed to a wonder-seeking sensibility" (Daston and Park 1998:367). Perhaps Mason was aware that she would taint herself with this "mild condescension" when she could not summon the courage to ask to see the quintuplets. Lacking the scientist's professional justification, her curiosity seemed to her feeble, awkward, and ultimately stifling.

Curiosity is labeled "morbid" when it is out of place, specifically when a person of unauthorized status takes more than a passing interest in death or disease, or asks to take a peek behind closed doors. While embryologists learned to take for themselves the prerogative to collect and handle specimens, the rest of us learned to regard our curiosity as transgressive and perverse. Let us imagine, for a moment, that the division between morbid and nonmorbid curiosity were redrawn. Nonspecialists could be authorized to look at the Carnegie embryo specimens and at Mrs. Wheeler's quints and to learn how they came to exist. Meanwhile, embryologists could be authorized to go beyond the morphological details of the specimens and investigate the stories of the women whose interrupted pregnancies made the Carnegie Human Embryo Collection possible.

FIVE

Traffic in "Embryo Babies"

HUMAN EMBRYONIC AND FETAL SPECIMENS were once so abundant that the Carnegie collectors could gather hundreds in any given year. As evidence of the unlimited supply and educational value of such "material," fetal specimens filled the shelves of anatomy, zoology, physiology, and embryology departments around the country from the second decade of the twentieth century to at least 1950. Today, by contrast, human embryonic tissue is a scarce and tightly regulated commodity. These fluctuating fortunes of supply and demand might seem counterintuitive; fertility rates are lower now, although the clinics that provide abortion and fertility services presumably generate a fair supply of embryonic and fetal remains. The recent scarcity, of course, is the result of federal limitations that govern fetal tissue research in the United States. The changing legislative and regulatory landscape is a fascinating story, especially with reference to the disposition of anatomical and fetal material (Coutts 1993; Green 2001; Terry 1986), but it takes for granted the "natural" character of embryonic and fetal specimens.

It is interesting to consider the social climate that generated thousands of human embryo, fetal, and infant specimens, making them available to anatomical collectors. The existence of the Carnegie Human Embryo Collection is evidence of a social project that took advantage of conditions specific to Progressive Era Baltimore, including rapid industrialization, immigration, high fertility rates, restrictions on contraception and abortion, and patriarchal policies that governed marriage, paternity, and childrearing. Unveiling the hidden and thus invisible sources of embryo production helps to explain how the Carnegie anatomists were able to accumulate embryo and fetal specimens, package them as biological entities, and feed them back to the public as "naturally occurring" organisms. This chapter begins with a story about how the very earliest, two-cell human embryos were finally added to the Carnegie collection as the result of an intentional "egg hunt" that took scientists into the wombs of pregnant women. One of the egg hunters later described the specimens as "naturally occurring human ova," although I argue that his characterization effaces the techno-scientific apparatus and gender-stratified work that made the specimens available and in fact called them into existence. A fuller appreciation of this context requires that we look outside the laboratory, at the living conditions that put pregnant women at risk of illness, and that facilitated miscarriage, fetal death, and infant abandonment. Today it is easy to forget the health risks faced by women who were denied the vote, and for whom contraception and abortion were illegal and antibiotics completely unavailable. Yet this historical environment was perfectly suited to the needs of "egg hunters" and collectors of human embryos. Embryo specimens are very much the product of social action; they do not spring up naturally, like mushrooms after a rain.

EGG HUNTING

From 1938 through 1954, three medical researchers in Boston set out on a systematic quest to find the very earliest fertilized human ova.[1] They included gynecologist John Charles Rock (1890–1984), his assistant Miriam Menkin[2] (1901–92), and gynecological pathologist Arthur Tremain Hertig (1904–90). Their project was a far-flung collaboration that also involved the Carnegie Institution of Washington Department of Embryology, which was especially interested in tracking down the very earliest embryos—those "between the time of fertilization of the egg and the implantation of the embryo in the uterus about 14 days later" (Hanson 2004:69)—that had so far eluded their determined efforts.

Rock was a devout Catholic with five children who openly disagreed with the Catholic Church's opposition to birth control. As a professor at Harvard Medical School and director of an infertility clinic in Boston, Rock lectured frequently about the need to help women, whether that meant achieving pregnancy or preventing it (Gladwell 2000; Hertig 1989:434; Scully 1988: 368). Rock had been an actor in the Harvard Hasty Pudding theatrical club in college, which was no doubt a fitting role for his flamboyant personality. In the 1940s, he conducted the first in-vitro fertilization experiments in the United States, and in the 1960s he helped to develop the birth control pill.

Menkin was Rock's talented but unsung technician and editor. She "had once dreamed of being a doctor herself," according to a PBS documentary about the invention of in-vitro fertilization, "but she gave that up to work as a technician and help put her husband through medical school" (*Boston Globe* 1992; PBS 2006). Because she did not have professional credentials, Menkin was not publicly credited for her work during her lifetime. Her contributions, though, were considerable. It was she, in fact, who performed the first laboratory in-vitro fertilization in 1944, and in the fifteen-year search for early human embryos she "rendered invaluable help as the liaison officer between the Clinic and the patient" (Hertig and Rock 1973:137). In other words, she recruited the patients, explained the project to them, and earned their trust and cooperation. Yet her name did not appear as coauthor on Rock and Hertig's scientific papers, nor was she invited to speak at scientific conferences, such as the one where Rock and Hertig appeared on a double bill and were promptly dubbed "the ham and the egg" (Hertig 1989:434).

Hertig provided the link between Boston and Baltimore. In 1938 he was an affable professor of pathological anatomy at Harvard, but in 1933 he had spent a year working in the Carnegie Department of Embryology, watching the reproductive physiologist Carl Hartman perform hysterectomies on rhesus monkeys. Hartman kept a colony of about two hundred animals that had been bred specifically for the purpose of finding the earliest embryos (Hanson 2004:75). That project, in turn, was part of a larger study to understand pregnancy, menstruation, and embryological development in the rhesus macaque *(Macaca mulatta).* Historian Elizabeth Hanson describes how Hartman's efforts were instrumental in transforming the rhesus macaque into a medical laboratory animal, such that by the end of the 1930s twelve thousand macaques per year were being imported into the United States for medical research (Hanson 2004:77).

The embryologists were of course principally interested in one of the macaque's closest relatives—the human—but to get at unresolved problems in human embryological development they decided to develop a parallel collection of macaque embryos. Studying reproduction in macaque surrogates was in some ways better and easier than studying it in humans. As Hanson explains, macaques were readily available because they were being imported into the United States on a grand scale to satisfy the demand at circuses and zoos, and researchers could have greater control over reproduction by choosing the dates on which the macaques were bred (Hanson 2004:69). The fact that rhesus macaques were evolutionarily close to humans must have appealed to the comparative anatomist in them. And the macaque colonies were built to be conveniently close, on the roof on the embryological institute.

When Hartman initially had the idea of performing hysterectomies on the macaques to find early embryos, he hoped to be able to leave the uteri intact so he could "use these pregnant monkeys repeatedly because of their scarcity and value." This plan was thwarted, however, when postoperative infections set in and the monkeys became sterile (Hertig and Rock 1973:123). By the time Hertig arrived in Baltimore in 1933, Hartman was removing each pregnant monkey's uterus and fallopian tubes and developing special techniques to find the earliest embryos. Hertig paid close attention, hoping to apply the same techniques to humans.

Hertig always enjoyed a good joke, so it was in the spirit of fun that he used the flippant phrase "egg hunt" to describe the project he and Rock devised in 1938 at Boston's Free Hospital for Women (Hertig and Rock 1973:124; see also Noe 2004:21). The project was explicitly modeled on Hartman's rhesus breeding program, using the same methods to search for early embryos in women slated for elective hysterectomy. Menkin screened potential human subjects at Boston's Free Hospital for Women. Women were required to meet the following conditions: they "had to be married and living with their husbands, intelligent, and to have demonstrated prior fertility by delivering at least three full-term pregnancies, and they had to be willing to record menstrual cycles and coitus without contraception" (Hertig 1989). Women agreed that if they had unprotected intercourse, they would note the dates on a postcard and send it to Menkin. Surgery would be scheduled for a date that would maximize the chances of finding what Hertig and Rock called "fertilized ova" (they studiously avoided using the word *embryo,* especially to refer to a conceptus not implanted in the uterine wall).

The study was billed as an effort to investigate causes of infertility and to help infertile women and families. Women seemed to be eager to help; the field of medicine enjoyed good credibility (as manifested in the *Dr. Kildare* series that was popular on film, radio, and television), and community-mindedness was at an all-time high during and just after the war. In addition, women wanted to help their infertile sisters, during a time when "doctors and science writers exuded confidence in medicine's abilities to give all women babies" (Reagan 2003:361). As one newspaper gushed, "Secrets of human procreation, hidden within women's wombs for thousands of centuries, are slowly being unlocked by two Harvard Medical School doctors who hope through their painstaking research to bring a new era of fecundity to civilization" (Graham n.d.). Hertig stressed that the patients were "a very happy group" of women, honored to be ushered under the wing of Rock's personal care and pleased to help him with his investigations (Hertig 1989:434). That the postwar baby boom did bring "a new era of fecundity to civilization" probably owes little to Rock, Hertig, or Menkin, but it does suggest the enthusiasm with which their project might have been received by the young mothers who participated.

Hysterectomies were performed early in the morning. While Rock operated, Menkin stood outside the door waiting to take the uterus and fallopian tubes directly to the pathology laboratory. There, Hertig opened and examined the uterus. Whenever he found a specimen, he placed it in a vial, took the train to Baltimore, and hand-delivered the specimen to the Carnegie embryologists—who were, of course, eager to catalog, photograph, section and model it. These specimens entered the permanent Carnegie collection toward the end of the embryo-collecting era, with corresponding catalog numbers ranging from the high 7000s to the low 8000s. The absence of these earliest embryos from the collection was of course the main, perhaps the only, justification for the project.

Fifteen years after he performed the first operation, Rock had removed the wombs of 211 women and Hertig had found inside them 34 embryos. The oldest of these specimens was seventeen days and the youngest was a two-cell "fertilized ova" estimated to be thirty hours old. In looking at the provenance of embryos in the Carnegie collection, the impact of this project becomes strikingly clear. Rock, Hertig, and Menkin provided the *only* specimens in the Carnegie collection of stages 2, 3, 5, and many of the specimens from stages 6 and 7 (O'Rahilly and Müller 1987:265). With the addition of these much-coveted embryos, the egg hunt *and* the Carnegie Human Embryo Collection could be considered complete (see McLaughlin 1982; Hertig 1989; Hertig and Rock 1973).

Because they deliberately set out to terminate what they hoped would be existing pregnancies, the ethics of this project might raise some eyebrows. Rock and Hertig were aware that the study was potentially sensitive, and even though they did not consider it unethical, they tried not to advertise it (although they could not prevent the occasional reporter from getting wind of their activities). Most laypeople were unaware it was happening (McLaughlin 1982:69).[3] If Rock had been questioned, he would have said he could not be accused of performing abortions, because he had no way to determine whether a woman was pregnant. The only available pregnancy test would not show a positive result until two weeks or more beyond a missed menstrual period, and doctors generally considered women's reporting of their own pregnancy symptoms to be unreliable in the absence of substantiated evidence.[4] Besides, the purpose of abortion was to kill the embryo or fetus, but the researchers said they harbored no such intention. Interviewed thirty-five years later on the ethics of the research, Hertig said, "Induced abortions were illegal in Massachusetts and the Free Hospital for Women was not running an abortion clinic; however, we and others were vitally interested in early human development" (Hertig 1989:434). Rock and Hertig justified their embryo-acquisition practices by claiming that the "material" otherwise would have "gone to waste but would not have been put to the use for which the Lord intended it" (quoted in McLaughlin 1982:63).[5] They reasoned that any fertilized ova they removed were not likely to be viable anyway, because many of the women suffered from uterine fibroids that would threaten their ability to carry a pregnancy to term. In any case, the Rock-Hertig study did not differ much from the embryologists' long-standing reliance on hysterectomy to produce the best specimens; it was just more calculated and systematic. In October 1938, Hertig found an embryo specimen in the uterus of a thirty-seven-year old woman who had just undergone a hysterectomy at the Free Hospital. "She had been instructed to have coitus daily during her theoretically fertile period, which she did" (Hertig 1938). In spite of the obvious social orchestration that brought these embryos literally into existence, Hertig summarized his work by referring to the 34 embryos discovered in 211 surgically removed uteri as "this series of *naturally occurring* human ova" (1989:435; emphasis added).

On one level, of course, it makes sense to describe these embryos as natural products, that is, as nature's (futile) attempt to perpetuate the species. On another level, though, these fertilized ova were anything *but* "naturally occurring," considering that 211 women were recruited specifically for their demonstrated fertility and encouraged to have sex in hopes of producing the last elusive specimens to round out the Carnegie embryo pantheon. Hertig conveniently skirts the fact that the specimens were found only as a result of highly specialized surgical and pathological practices, which within a few decades would be considered illegal. He makes no mention of the egg-hunting hubris that created the "need" to find the early embryos and thus provided the justification for invading women's bodies in this way. He does not highlight the similarities in technique that implied women were a short step up from macaques. My point, of course, is that a great deal of ideological (as well as practical) work was required to frame the specimens as "naturally occurring." Yet by ignoring those contexts, Hertig left the impression of a stand-alone embryo.

Behind each mute specimen in the Carnegie collection is a story, yet many of the stories remain hidden behind Hertigesque obfuscation. The widely promulgated notion that embryos are "naturally occurring" hides the sources of embryo production and especially the social and economic circumstances that made embryos available to collectors. But embryo specimens are produced in specific contexts; Hertig's assertion that his specimens or indeed *any* of the Carnegie specimens were "naturally occurring" conveniently ignores the sometimes predatory social contexts that were responsible, in no small measure, for the availability of specimens. Just as culture is present in every egg hatched in an elementary school classroom, so too is culture present in the social relationships, economic inequities, social policies, and health conditions that determined the availability and appropriation of the ten thousand Carnegie embryo specimens.

This point is of more than historical significance. Contemporary stem cell debates frequently draw a line between research on living embryos and on dead ones. Living embryos are defined as those that have the potential to develop into children, while dead embryos (including already-existing stem cell lines derived from human embryos) do not have that potential. In a 2001 statement banning federally funded embryonic stem cell research except on already existing lines, President George W. Bush said the research was troubling because it destroys *living* embryos (Mahowald 2003:135). He was not similarly troubled by research on already existing stem cell lines; there was nothing he could do about embryos that were already dead.

This may seem obvious: what is the point of objecting to research on something that is already dead? Yet it is curious that no notice is given as to *how* those specimens came into existence, how they died, or whether society should in any way be held accountable. The debates revolve around the morality of killing, without considering the provenance of "already existing" stem cell lines or embryo specimens. How did those women get pregnant? How did the pregnancies end and how did the specimens come to exist within the laboratory? Is it ethical to do research on a specimen that came from a hysterectomy performed on a pregnant woman? To whom would it matter if a specimen's existence can be traced to a woman who killed herself with a lethal dose of caustic potash?

The Rock-Hertig-Menkin project allowed readers to assume that these specimens occurred naturally, as many readers did. For example, "Drs. Hertig and Rock collected 34 normal and abnormal human ova from uteri and fallopian tubes removed for gynecologic disease. These ova were studied in fastidious detail in a series of ageless papers published over a span of fifteen years" (Karnovsky et al. 1996). To give another example, when the Body Worlds exhibit of plastinated corpses began to tour the United States in 2004, it included a small exhibit of human embryo specimens (in formaldehyde) as well as a few plastinated fetuses. A sign posted outside this portion of the exhibit read, in part, "Please enter and experience the wonders of human development. . . . To the best of our knowledge, the human embryos and fetuses displayed here (from historical collections over 80 years old) failed to survive to birth because of natural causes or accidents" (see L. M. Morgan 2006a:23). The representation of "gynecologic disease," "natural causes," and "accidents" as the source of specimens is problematic for two reasons: first, it makes infectious diseases, accidental deaths, and surgical interventions sound like natural rather than unnatural causes differentially distributed through the population. Second, it leaves the erroneous and misleading impression that embryo specimens "appeared" passively and serendipitously (like cadavers in the basement of the anatomy building in 1893), whereas in many cases they were purposively called into existence.

The debate over whether it is ethical to kill embryos overlooks the human actions and forms of social organization that bring embryos into being (or not). But we should pay greater attention to the social production of embryonic *life.* If we don't, the *creation* of embryos and embryo specimens passes unremarked and virtually unregulated, while the *destruction* of embryos and the deliberate creation of specimens is cast as disturbing and morally problematic. It is a mistake to restrict debate to the destruction of embryos while ignoring the social contexts of embryo production. As feminist philosopher Laurie Shrage notes, "pro-life" sentiment in the United States calls for protecting embryos, "including laboratory-produced embryos that might be used for research" (2003:35), but does not call for more affordable childcare, a living wage, national health insurance, or better parental leave policies. Nor do opponents of stem cell research routinely support social services that would abolish poverty or create jobs. Current U.S. law does not limit the hyperstimulation of ovaries for the purposes of egg retrieval, nor does it limit the number of times that in-vitro fertilization can be performed, in spite of the fact that these procedures can have serious consequences for women's health.[6] As long as the goal is to produce *living* embryos, research and clinical intervention is permitted. But any procedure that threatens to kill an embryo—including one of the estimated four hundred thousand existing surplus embryos left over from in-vitro fertilization—is hotly debated. The question of how embryos come to exist is left unexamined.

My point is not to criticize Rock and Hertig for ingeniously exploiting a fleeting historical opportunity; rather, I wish to demonstrate how the framing of their project diverts attention from—indeed renders invisible—the social dimensions of producing specimens. By "social" I refer to the political, economic, and moral arrangements that sort people into stratified categories (along the basis of race, gender, class, immigration status, etc.), and that affect their ability to control factors affecting their health, including education, occupation, housing, nutrition, and exposure to exploitation and disease. Consideration of the social dimensions of embryo collection might entail a shift from viewing pregnancy (and embryos and fetuses) as the product of individual choice, to seeing it as the product of social circumstances (Rothman 1999; Solinger 1992). Consider, for example, the couple that decided "just this once" not to use a condom and inadvertently became pregnant. Under a "choice" framework they might be chastised for their carelessness and irresponsibility, while under a "social" framework we might question why male contraceptive methods are still limited to a thin sheath that was known to the ancient Egyptians. Under a choice framework, the couple that produces four embryos through in-vitro fertilization might be congratulated, while under a social framework we might lament that the woman has been stuck for years in a job she hates because other health insurance plans are unlikely to cover her infertility treatments.

Historian Leslie J. Reagan suggests that if we were to focus on the "material and political preconditions" (2003:370) that underlie pregnancy, pregnancy loss, and the creation of children (as well as specimens, I would add), we would see how individuals' actions are always shaped by a social milieu that constrains pregnancy and reproduction.[7] The same social environment, of course, affects which pregnancies "come away" and how, whether through deliberate action (such as hysterectomy or abortion) or unintentional action (including disease). Each specimen in the Carnegie collection was produced by a specific circumstance, although these specificities tend to be erased by the effort of creating a homogenized collection. In the early twentieth century, for example, the rubella virus was capable of causing miscarriage, yet by the early twenty-first century, rubella had been eliminated from the United States. Does this make rubella a natural or a social cause of miscarriage, or both? The specimens in the Carnegie collection obviously resulted from a variety of circumstances, including physiological events that prevented the maturation of embryos. Yet the social production of embryos should not be ignored. Carnegie specimens are also the product of social services that were unavailable to women who needed them, including adequate sex education, contraceptive methods, and abortion. Specimens were sometimes the result of moral values that ranked "legitimate" over "illegitimate" children, leading to the termination of pregnancies that might under other circumstances have been carried to term. All of these factors contributed to the availability of embryo specimens—which, in other words, were not "naturally occurring" at all.

"WHAT HAPPENED TO THE BABIES?"

The idea of a "naturally occurring" embryo is challenged by examining the hidden sources of its production, including the conditions of women's lives in early twentieth-century Baltimore. In addition to the increased availability of obstetrical surgery (especially hysterectomy) mentioned earlier, the Carnegie embryo collection owes its existence to the rapid industrialization that drew women to Baltimore, where they (and often their children) entered the labor force in unprecedented numbers. Their fertility rates were high, in part because of the stark socioeconomic inequalities they faced. Many immigrants brought their agricultural large-family norms with them to America, but even those who might have wished to control their fertility would have been stymied by the fact that abortion and contraceptive methods were illegal. Some women suffered from communicable diseases, malnutrition, and occupational hazards that caused miscarriage and infant death. To complicate matters, an intense social stigma against out-of-wedlock births led unmarried women to seek self-induced or clandestine abortion, or sometimes to abandon their newborn infants or even to take their own lives (Reagan 1997; Solinger 1992). Some governmental policies ostensibly unrelated to reproduction also affected the production of embryos. Civil authorities did not systematically register births or deaths, which allowed for considerable ambiguity about the legal status of stillborn infants, fetuses, and babies. Mall became aware of a curious consequence of government policy in 1917, when he noticed a sudden decline in the number of embryo specimens entering the laboratory. The reason, he belatedly realized, was that pregnancy rates had plummeted when the United States entered the Great War (World War I), as men rushed to enlist. Later, the post–World War II baby boom had its shadow equivalent in a rise in embryo specimens. As these examples make clear, the availability of embryo specimens obviously has a social component, although it is often overlooked.

In 1933–34, "a very fine exhibit of embryo babies in all stages of growth" was put on display at the Century of Progress Exposition in Chicago. The forty specimens in the collection, lined up from smallest to largest, constituted one of the first large-scale, public displays of gestational development to be mounted in the United States under the banner of medical science. It was wildly popular: "Crowds of people stood for hours before this row of bottled embryos—old men and young men, old women and young women, boys and girls of every age, climbing, stretching, jumping in their efforts to see over the heads of others," wrote one observer. A child was heard to inquire, "What happened to the babies? Why didn't they live?" An adult answered, "I can't tell you. Something went wrong. Possibly their mothers became ill, and the embryos could not survive. At all events, they were preserved that more might be learned about them and the manner in which all human babies grow" (Strain 1937:41). Riveted by the materiality of the "bottled embryos" before him, the adult observer found the child's questions unanswerable and—well, immaterial. In these two simple questions and the adult's response, we can see encapsulated a shift in emphasis, from the questions, "What happened? Why didn't they live?" to an answer that says, in essence: "It doesn't matter. Just look at them and learn."

The prenatal exhibit at the Century of Progress Exposition was designed to convey a series of metamessages, as Catherine Cole explains in her fascinating analysis (C. Cole 1993). It depicted human development as a seamless trajectory from conception to birth. Curiously, it did this by glossing over the reality that pregnancy is often interrupted, as these bottled fetuses so obviously demonstrated. In addition, as Cole says, "The installation's linear format constructed the fiction that all 40 specimens are one person" (C. Cole 1993:48). Another lesson of the exhibit was that medical science would reveal "the manner in which all human babies grow," thus treating the miracle of life as a *secular* origin story. A more implicit message demonstrated that the specimens' individual identities were irrelevant and could be sacrificed in favor of a story about our collective prenatal heritage.[8] (One wonders how many women seeing the exhibit asked themselves, "Could that be *my* baby in that jar?") The exhibit was definitely not designed to instruct viewers about the causes of pregnancy loss or the circumstances that led to the deaths of the specific fetuses. The bottles on display deflected attention from the women whose "babies" were featured, as well as from the circumstances that resulted in pregnancy loss. There were no captions noting (to give a hypothetical example) that, "this fetus was taken at autopsy from Emily Paulsen, who died of typhoid fever in 1914, in her fifth month of pregnancy." By omitting any explanation of how they had died, the exhibit represented dead embryos and fetuses as impersonal, anonymous entities, *materia medica,* devoid of social lives. In addition to erasing women literally and metaphorically from the embryos they produced, the exhibit also alienated embryologists and technicians from the fruits of their labor, from the work they did to collect, preserve, and hence to produce the specimens for display. It obscured evidence that might lead to an understanding of the means of production and modes of production in the making of embryo specimens.[9]

The exhibit drew the spectator into a stance of gape-eyed wonder, thus laying the foundations for the public fascination with fetal personhood that would come later. It also exemplified some of the criteria identified by Sarah Franklin, who wrote that the contemporary construction of fetal personhood was made possible because "biology . . . not only obscures social categories, but it becomes the basis for their cultural production" (Franklin 1991:200). The 1933–34 exhibit of prenatal development proffered a biological basis for what was more accurately the cultural production of embryos and of the embryological view of development.

Severing the identities of the women and scientists from specimens made it difficult for viewers to ascertain "what happened to the babies." Even if we had asked the exhibit curator, he or she might not have known, because throughout the first half of the twentieth century, doctors frequently put fetal specimens into jars without bothering to record the circumstances. For example in 1924, one doctor wrote to Carnegie offering to donate "three embryos," apologizing that he knew nothing about their histories: "I do not know whether such foundlings are of any particular value to you" (Donald Hooker 1924). The embryo collectors sometimes spoke as if a specimen came from a disembodied uterus or a surgeon instead of from a woman. Mall, describing a specimen acquired in 1910, wrote, "One specimen, a negro embryo (No. 460), 21 mm. long, is worthy of special mention at this time. It was obtained from a hysterectomy performed by Dr. Thomas S. Cullen" (Mall and Meyer 1921:21).

We might be able to find out "what happened to the babies" if we had access to the patients' medical records, but this could be difficult, too. The first time I visited the Carnegie collection, my guide indicated one bank of filing cabinets that I was not permitted to open. Those were the medical histories, she explained, filed by specimen number for quick matching. The records contain information considered relevant to the specimen, such as the woman's age, race, marital status, fertility history, date of last menstrual period, circumstances of pregnancy, name of her physician, results of relevant tests, speculation about the cause of miscarriage, and so on. If I had been a pediatric cardiologist studying a clinical condition, I might have been permitted to consult specific histories after the patient's names had been blanked out. But some specimens had been acquired recently enough so that the parties involved might still be alive, and the museum did not have the resources to assign someone to delete all the names. For that reason, I was barred by confidentiality provisions from making a blanket survey of the medical histories. While I understand the reasons for this practice, it nevertheless has to be considered a social mechanism that ensures the specimens will remain anonymous, depersonalized, and decontextualized.

There was a brief period when the American scientific literature divulged more about the "embryo babies" and the women who produced them. The earliest accounts of embryos and fetuses published in the 1890s and early twentieth century often spelled out whatever was known about a woman's relevant medical history, including the dates used to calculate an embryo's age and theories of how it "came away." These accounts offer a haphazard roster of women's reproductive experiences at a time when miscarriage was common, abortion was illegal, and access to contraception was restricted under the Comstock Laws passed in 1873, which effectively banned contraceptives by classifying them as "obscene" and prohibiting them from being sent through the mails.

Sometimes an embryo specimen was found at autopsy on an unmarried woman who had committed suicide. In his 1904 textbook, J. Playfair McMurrich, a colleague of Mall's at the University of Michigan, describes the youngest ovum then known to embryologists: "The youngest human ovum at present is that described by Peters. It was taken from the uterus of a woman who had committed suicide one calendar month after the last menstruation, and it measured about 1 mm. in diameter" (McMurrich 1904:82). The unnamed woman died after swallowing caustic potash (Bryce and Teacher 1908:53). Drinking caustic potash (potassium hydroxide), also known as lye, was a terrible way to die. Other specimens were found at autopsy on women who ingested mustard powder or arsenic-containing insecticides (Keibel and Mall 1910–12:27; Ramsey 1938:69). Sometimes women died after illegally induced abortions or after "receiving some burns during an epileptic seizure" (Keibel and Mall 1910–12:32). The embryologists were not particularly concerned about the circumstances of death, so focused were they on the attributes of the specimens. For example, Keibel writes, "Reichert found the ovum in the uterus of a suicide and estimated its age at twelve to thirteen or thirteen to fourteen days" (Keibel and Mall 1910–12:22). If Keibel was concerned that an unwanted pregnancy might have driven a woman to suicide, he does not say so.

Historian Nancy Medley argues that Mall relied on patients' medical histories to assess the reliability of women's stories, which in turn would help him to verify data about the specimens (Medley 2002). Mall was specifically interested in knowing the exact ages of the specimens as he figured out how to describe the sequential stages of development (Hopwood 2000), and he reasoned that knowing something about a woman's circumstances and station in life could be useful. Medley gives the example of Carnegie embryo no. 26, which came from a twenty-seven-year old domestic servant who had been under the constant surveillance of her employer, himself a doctor and colleague of Mall's. On New Year's Eve, the woman had been away all night. Later, she "fell into the hands of an abortionist." Mall trusted the story because it came from his colleague, the physician, who arrived at Mall's office to deliver the embryo, and who confirmed that December 31 had been the woman's only opportunity to get pregnant. This information allowed Mall to feel confident about the date of conception and thus the age of the specimen. Medley points out that it was the *doctor's* testimony—not the woman's testimony—that allowed Mall to pronounce this a "reliable case" (Medley 2002). Judging by these histories, at least some of the specimens were the tangible result of heartbreak, illness, desperation, or sometimes death on the part of women who were under strict surveillance by their employers, and who were powerless either to prevent their pregnancies or to carry them to term.

As horrifying as some of the histories are to read, from a historian's perspective it is unfortunate that they accompany only a few of the published reports. Eventually, as embryologists became more confident about their ability to "read" embryos without having to wade through the messy complexity of medical histories, they scratched women's biographies from the list of potentially useful information about a specimen. There is no indication that they (or their medical colleagues) became more sensitive to patient confidentiality until much later (although we might wonder how hard it could have been for an interested party to identify the twenty-seven-year old servant working in Dr. Miller's house). In any event, the embryologists' later accounts include only the barest outlines of clinical history, without the minutiae. One sees the embryologists' optical gaze narrowing over time. Increasingly, the embryologists looked through their microscopes at the embryos, rather than through wide-angle lenses at their society. In the process, they transformed embryos into entities that could be interpreted solely on the basis of morphological features, on the assumption that the body carries intact its own meanings. The circumstances of pregnancy became irrelevant.

The cultural ideology that portrays embryos and fetuses as natural, anonymous, free-floating creatures carries serious consequences. Separating the social from the biological genesis of human life allows us to pretend that pregnancies are conceived, carried, miscarried, aborted, and represented in a social vacuum. It allows us, for example, to fool ourselves into thinking that a specific pregnancy is a mistake rather than the outcome of a specific sexual relationship. It directs attention away from gender politics, law, and the existence (or not) of reproductive options.[10] It leaves men almost entirely out of the picture, except as the dispassionate scientists who instruct us in what to see. It encourages us to view embryos as natural, women and men as invisible, and society as blameless. This view can now be recognized as the outcome of a social project to gather embryos, select and repackage certain of their features, and feed them back to us as "naturally occurring."

"POSSIBLY THEIR MOTHERS BECAME ILL"

When the unidentified adult responded to the child's question, "What happened to the babies?" by saying, "Possibly their mothers became ill," he (or she) was making a point that sometimes gets lost today: maternal health is the best guarantor of fetal and infant health. The risk to women of disease and of pregnancy-related death in the early twentieth century was alarmingly real. Women made up an important part of the labor force in the port city of Baltimore, which grew rapidly in the last thirty years of the nineteenth century mostly as a result of migration. Half the migrants came from overseas. Germans, Irish, and Russians made up the majority, but hopeful migrant families from England, Wales, Scotland, Austria, Hungary, and Bohemia were all drawn to Baltimore. The other half of the migrants—a third of whom were black—were from in-state, coming from rural regions to compete for jobs in the rapidly industrializing economy. The factory-made clothing industry employed more than ten thousand people, and thousands more worked in canneries, canning oysters, fruits, and vegetables. Women were employed as domestic servants, seamstresses, shoemakers, and cigar rollers. Many of Baltimore's working women—some 30 percent—were single, having "left their families to find room and board in the city" (Haag 1991: 295). The introduction of machinery into the canning industry brought large numbers of women and children into the factories, where they shelled peas, pitted cherries, shucked corn and oysters, sliced beans, and otherwise prepared food for canning. Hirschfeld reported 21,600 women employed in Baltimore in 1900, an increase of 363 percent over 1870. "More than 80 per cent of these women were native white girls," he wrote, "most of whom were unmarried" (Hirschfeld 1941:62).

These conditions put women at particular risk of illness and death. When Mall arrived in Baltimore in 1893, the city was just entering a recession during which almost half of industrial workers lost their jobs. Crowded tenements, poor nutrition, and inadequate sanitation made the city ripe for disease. Antibiotics had not yet been invented. The still-employed female population was susceptible to occupational health risks in the form of nicotine poisoning and lung disease from breathing tobacco dust in the cigar-making factories, chronic lead and mercury poisoning in the canneries, and accidents. Infections such as scarlet fever, diphtheria, pneumonia, tuberculosis, and—in those days before routine pasteurization—milk-borne diseases were common and contributed to high rates of miscarriage. Miscarriage itself could cause anemia, long-term disability, or even death (Reagan 2003:359). Contraception and induced abortion were illegal, although both were widely practiced, sometimes safely but other times with disastrous results. Around 1903, an estimated one in two hundred women died while giving birth (Hahn 1995:214, n.).

Women were susceptible to nonfatal diseases as well, some of which contributed to the availability of embryo specimens. Syphilis was a major culprit, although it was lumped together with other sexually transmitted diseases and euphemistically called "the social evil." In 1914 the influential Johns Hopkins gynecologist John Whitridge Williams reported that syphilis was a primary cause of fetal death. He cited the results of a study that documented 705 fetal deaths among ten thousand women admitted to Johns Hopkins; he attributed more than a quarter of the deaths (26.4 percent) to syphilis (Hahn 1995:212). Dr. Ralph W. Lobenstine wrote in the same year that syphilis was "the greatest known destroyer (aside from criminal interference) of intrauterine life" (Lobenstine 1914:390). He also said that doctors administered mercury to pregnant women to treat syphilis, although arsenic was sometimes used for the same purpose.[11] Childbirth exposed women to puerpural fever, and medical interventions such as the use of forceps and chloroform during labor affected both mother and child (Lobenstine 1914:390). These conditions conspired to produce a surfeit of embryo and fetal specimens.

"Dying is what children do most and do best in the literary and cultural imagination of nineteenth-century America," writes Karen Sánchez-Eppler, and threats to child, infant, and fetal health persisted into the twentieth century across the lines of race and class (2005:101). Fully 35 percent of the Baltimore population who died in 1900 was under five years of age (Hirschfeld 1941:17). In the United States as a whole, an estimated one child out of five died before the age of five (Preston and Haines 1991:208). Even with Baltimore's decent standards of medical care, child mortality was high. The poor suffered disproportionately, but upper-class families also lost children to disease. Communicable diseases such as "cholera infantum" (a term used to refer to childhood diarrheas of various kinds), smallpox, scarlet fever, measles, diphtheria, tuberculosis, and respiratory diseases such as influenza and whooping cough were transmitted more easily in crowded urban areas than in the countryside. Furthermore, many parents did not seek medical attention for sick children, because they were so frequently ill (Preston and Haines 1991:13). Even affluent parents could expect some of their children to die.

The professional division of labor in medicine allowed anatomists to be concerned about obtaining an ample supply of corpses, while trusting that colleagues from other departments would be working to reduce rates of miscarriage and child mortality. Already in the late nineteenth century, the care of pregnant and parturient women (obstetrics) was separated from the care of children (pediatrics), which was in turn separated responsibility for public health and hygiene. This division of responsibilities allowed the anatomists to collect infant bodies with what otherwise might seem a callous disregard for the causes and emotional consequences of child mortality. The bodies of infants, the anatomists found, were relatively easy to obtain. Infant deaths were not heavily ritualized because their lives had been so fleeting. As a result, children who died went into the ground more quickly than adults. A study found that in Vermilion County, Illinois, from 1910 to 1920, "76 percent of infant burials occurred on the day of death or the day after, compared to only 15.7 percent of other funerals" (Farrell 1980:206–7). The expense of burial kept some infants from being buried at all, especially in the cities; some of those corpses were passed along to the Anatomical Board and distributed to the medical schools for dissection. This practice had been well established in Europe since the early eighteenth century, when bodies that could legally be given to the anatomists included stillborn, abandoned, or nursing infants ("fundlings that dye upon the breast"); child wards ("the bodies of fundlings who dye betwix the tyme that they are weaned and their being put to schools or trades"); prisoners; and the unclaimed dead (Hartwell 1881:9). Some unburied or unclaimed infant corpses ended up as specimens in Mall's dissecting theaters, or on display in medical museums or exhibitions.

Moving from childhood toward the earliest margin of life, the embryonic and fetal tissue that entered the Carnegie collection probably came most often from spontaneous abortion, also called miscarriage. Nevertheless an unknown number of specimens were the consequence of induced abortion. The migration of young, unmarried women to a rapidly industrializing city created an environment conducive to unwanted pregnancy and induced abortion. Abortion had been illegal in Maryland since 1867 (Mohr 1978:211–15), but Reagan found that it was nevertheless widely practiced, including by well-regarded medical doctors (Reagan 1997:69). Poverty, illegitimacy, and a high birth rate were some of the reasons that led one Baltimore doctor, George Loutrell Timanus, to provide abortions openly. From his graduation from medical school in 1914 until about 1950, "Dr. Timanus had a close relationship to Baltimore's white medical elite at Johns Hopkins University," Reagan writes, "where the faculty taught Timanus's techniques to their students and called him a friend" (1997:158). Abortion was regarded as a "matter of routine" in several U.S. cities (Reagan 1997:69). Women sought abortion for a variety of reasons, including the desire to delay marriage and the dishonor and shame of unmarried motherhood. Reagan points out that not all unmarried women who entered into sexual relationships did so with the expectation of marriage or because they were victimized by ruthless men (1997:32). While she is undoubtedly right that some women relished their independence and enjoyed their sexuality, the fact remains that sexual freedom without access to effective contraception meant that women were too often forced to risk unwanted pregnancy, the prospect of an illicit abortion, or the stigma of bearing an illegitimate child.

Without access to the patient records accompanying the Carnegie specimen collection, it is difficult to know how many of Mall's specimens might have come from induced abortion. One exception to this silence surrounding induced abortion appears in Mall's account of specimens 2 and 6, which were donated by Dr. C. O. Miller of Baltimore: "Both specimens were removed from the uterus by self-inflicted mechanical abortions, which the woman was in the habit of performing on herself and which finally caused her death. Dr. Miller informs me that when he was called to visit his patient she was bleeding profusely and he had considerable difficulty in removing this embryo and its membranes" (F. P. Mall 1908:141–42). Mall and Miller emerge as callous accomplices in this account, more concerned with obtaining the specimen than with the fading life of a woman who was "in the habit" of performing abortions on herself. Mall was disinclined to comment on the social circumstances that enabled a woman who miscarried to express relief: Specimen no. 357 came into Mall's collection courtesy of a Baltimore physician, who stated, "The specimen came from an unmarried woman twenty-two years old, who said that she was glad it had come away, for it saved her the trouble of having an abortion induced" (F. P. Mall 1908:337–38). There is a great deal of pathos written between the lines of Mall's descriptions of his specimens, but he rarely gave any indication of being socially concerned or personally moved by it.

Although hampered by incomplete patient histories and a lack of data, Mall did once speculate a bit about whether miscarriage and abortion rates might sort out by social class. In 1915, he received a letter asking for clarification of his estimate that there are five hundred to six hundred stillbirths for every thousand live births. The writer wondered whether that included "an estimate of criminal abortions or are they based only on spontaneous abortions, etc." (Fullerton 1915). Mall responded somewhat opaquely, as was his custom: "We have a great many records bearing upon the questions you ask, but up to the present no body *[sic]* has had time to tabulate them, nor will it be easy to get at them before we get into our new quarters as our thousands of data are pretty well tied up in books." In other words, answering this question was not high on his list of priorities. He continued, saying he thought only a few of his specimens "rest upon criminal abortions" because he solicits specimens only from "physicians of good standing, and I think that no professional abortionist is likely to send us material. However, I am of the opinion that induced abortions nearly always give us normal specimens, while spontaneous abortions nearly always give pathological specimens. During the last few years I have gradually begun to suspect that a larger percentage of the normal specimens come from the laboring class, while the opposite is true for the upper class; however, it will take a great deal more experience than mine to establish this point" (F. P. Mall 1915c).[12] He elaborated this view a few years later, adding that pathological embryos tended to be "associated with the social evil," by which he meant sexually transmitted disease.[13] It should be mentioned that Mall based his evaluation of class *solely* on his estimate of the type of clientele served by different doctors, rather than any empirical evidence about the socioeconomic backgrounds of the women from whom specimens were taken. To summarize, Mall speculated that women from the laboring classes were motivated by poverty to seek induced abortion toward the middle of pregnancy, producing normal fetuses. Meanwhile, he thought, women from the upper classes produced younger, spontaneous, pathological embryos. He did not explain why he thought the upper classes were more afflicted than the poor by the "social evil." Apart from these rather vague speculations, Mall tended to ignore reproductive law and policy concerning induced abortion, probably because such matters were irrelevant to his professional goals. For our purposes, though, it is important to note that embryologists did not consider embryo specimens to be relevant to the question of induced abortion. Not until much later would it become possible to link the status of embryos to the morality of abortion.

Embryologists did recognize the impact of poverty, poor nutrition, alcoholism, illegal induced abortion, overwork, and syphilis on women's wellbeing and on rates of fetal demise, but pregnant women simply were not their concern. They did not need to humanize miscarrying women or mothers-to-be. The closest they got was to help their colleagues in obstetrics to gain a more thoroughly biological understanding of the causes of miscarriage. To answer that question, they would need to study embryos and tissue. In the summer of 1913, Evans wrote to his boss:

> It has unquestionably done much good for me to be on the post this summer. Dr. G. C. Dohme, for instance, came in to talk over a case in which spontaneous abortions have repeatedly occurred (your no. 703). The patient, who desires children, is in excellent health and although Dr. Dohme suspected a spirochete infection there was no positive Wasserman [that is, a test developed in 1906 to diagnose syphilis]. I told him we would do our best to examine the foetus and especially the placenta carefully, for just such a case has unusual interest. Should a curettage ever be done on therapeutic grounds I urged him to send us the scrapings in order to see if any alteration of the endometrium is apparent. (Evans 1913a)

Mall hoped that the embryo collection, with its fastidious record keeping, might advance the epidemiological study of spontaneous abortion. He tried for several years "to have recorded all abortions, together with the age of the specimens," as a first step toward determining the frequency of miscarriage. Whereas obstetricians thought that 20 percent of pregnancies ended in abortion, Mall said in 1917 that his studies of rats and swine suggested the proportion might be higher than 40 percent (F. P. Mall 1917). He impressed upon his clinical colleagues that animal models were inadequate and that the development of more satisfying human models would require their collaboration. In other words, he implied, "send more embryos!"

As Maryland health officials began to take a concerted interest in collecting accurate birth and death statistics,[14] they struggled over the definition of "stillbirth." At what point in pregnancy would the expulsion of the fetus be considered a stillbirth? Where does one draw the line? The terms and definitions used to mark the beginnings of life were unstable, reflecting an inherent uncertainty and ambiguity surrounding the beginnings of life and personhood. Historian Richard A. Meckel writes, "through the first half of the nineteenth century conceptual and linguistic age distinctions were rather fluid and vague. The term infant, for example, was as frequently used to refer to a child under five as it was to a baby under one" (1990:33). As late as 1924, a frustrated statistician wrote, "The term *still*-birth is variously defined in different countries and in different localities in the same country, from early embryos to full-term children born alive, but not surviving the third day of extra-uterine life" (Howard 1924:492). Such definitional uncertainties sometimes created problems for the anatomists, who wanted to ensure that the laws governing the documentation and disposition of stillborn fetus/infants would not close off their access to embryo specimens. Mall and his colleagues thus had to figure out how to exempt the embryos they wanted from the more stringent laws that would apply to infants and fetuses defined as "stillborn."

The margins of life have always and in every culture been a focal point for fighting over who will be regarded as "person" and under what circumstances. Medical sociologist David Armstrong argues that the invention of infant mortality in early twentieth-century England reflected and produced the emergent separation of fetal from infant phases of life; the category of "stillbirth," he said, made meaningful a social distinction between fetuses and infants that did not previously exist (Armstrong 1986). Embryos (as well as fetuses and stillborn infants) must be regarded as the object *and the effect* of negotiations about where to draw the line.

Discrepant definitions of stillbirth provide a window for seeing collective social uncertainty about how to classify early lives (and deaths). Who would qualify to be registered as "stillborn"? For nearly a century, the city of Baltimore kept records on stillbirth without ever defining the term. Trying to sort out the history of the matter, biostatistician-gynecologist William Travis Howard, Jr. (1867–1953), wrote in 1924, "Still-births have been recorded in the statistical tables in every year since 1812, but not until 1900 were they classified according to sex and color. . . . Nowhere in the records is still-birth defined. It is unlikely that whatever definition custom had established was seriously modified, except under very unusual circumstances." In the absence of a definition, he wanted to assume that stillbirth registration would have been governed by social consensus rather than by chaos: "It is probable, therefore, that on the whole until very recent years, a still-birth represented a dead-born fetus of at least 5 full months utero-gestation" (Howard 1924:187). There is scant evidence of the "social consensus" to which Howard refers. It is more likely that the governing social norms were loose enough to accommodate a wide range of highly politicized circumstances. For example, one British author accused the French of fostering infanticide, saying that their law was "more obliging still to the criminal, for if the live born child dies within 24 hours after its birth it may be registered as 'a stillborn' infant!" (Rentoul 1915:421). Civil authorities worked with medical professionals during this period to try to fix the fluid boundaries that marked the beginnings and endings of life, as though legal codification could resolve the ambiguity.

In 1904, as part of the Maryland legislature's effort to count and otherwise regulate the populace, a law was passed stipulating that stillborn infants should be registered under both "birth" and "death," and that both birth and death certificates should be issued for each case (Howard 1924:80). For at least eight years, though, the law was not consistently enforced (Howard 1924:185). The ambiguity in the law caught up with Mall one day in 1909, when he sent a messenger to retrieve a set of remains. The next day, a letter arrived from the acting health commissioner chastising him for removing "the body of an infant" (which may well have been what we would call a fetus, judging by subsequent correspondence) from a house in violation of the law.[15] The letter politely invited Mall to obtain the proper permits. Mall responded by asking whether all embryos and fetuses, no matter how early, would require a permit. "Where," he wondered—asking a question that vexes Americans still today—"do we draw the line?" Uncertain what to say, the health commissioner appealed to the attorney general of the state of Maryland (who went by the unlikely name of Edgar Allen Poe) to clarify the matter. Poe's response was a perfect parody of legalese. He wrote: "'Replying to your favor of March 5th, relative to the proper interpretation of Section 187 of Article 14, I beg to say that in my opinion the said Section should be given as broad an interpretation as possible, and should be held to include any foetus that had at least assumed any definite shape'" (Bosley 1909, quoting Poe). It is unclear why the attorney general should have decided that "assuming a definite shape" was an improvement over his earlier definition, unless perhaps a conversation with an embryologist had convinced him that "material" from the embryological period should be spared. In any event, it is worth pointing out that Mall's questions forced the state to fix demarcations along a continuum of gestational development. Mall pushed the state to define its interest in the formed fetus; in this sense his action was one of the historical precedents that contributed to the process of constituting the fetus as an object of state concern.[16] Poe's clarification simplified Mall's work because he could thereafter claim that many of his embryological specimens were exempt from state regulation.[17]

A few years later, for unknown reasons, Poe changed his mind and broadened his definition of stillbirth to include all products of conception. Around 1913, the chief of vital statistics wrote to Maryland physicians to request compliance with the stillbirth registration law: "We are convinced that we are not receiving full reports of stillbirths" (Beitler n.d.). He attributed this difficulty to widespread misunderstanding on the part of physicians of the legal definition of stillbirth. Poe defined *stillbirth* as "all products of conception no matter how early" (Beitler n.d.; also quoted in F. P. Mall 1917:2). Poe's definition swept under the rubric of "stillborn" all pregnancy losses, including everything from the earliest embryos to full-term infants born dead. Under this law, physicians would have to acquire birth and death certificates before turning any specimens over to Mall.

Mall was understandably concerned about the effect this law would have on the promptness with which he could acquire fresh specimens. In a 1913 letter, he pointed out that many embryos (such as Carnegie no. 836) are found even when no pregnancy was suspected. It would be impossible for doctors to comply with the law, he wrote, in cases of unconfirmed pregnancy, as "most of this material is not recognized as embryological before it is sent to us. . . . I mean that if the whole uterus or tubal pregnancy or uterine scrapings is sent to us for inspection you cannot expect the doctor to make out a death certificate if he is still uncertain or even if he suspects that the specimen contains an embryo. Maybe this is dabbling with details you do not wish to settle at present, but these details cover most of the valuable specimens we get" (F. P. Mall 1913b). Mall sought assistance from Frederic V. Beitler, chief of the bureau of vital statistics for the State Board of Health, hoping to ensure that he would have ready access to fresh human material without further bureaucratic complications. Beitler wanted to make sure that birth and death would be registered before Mall got the specimens, to ensure accurate surveillance and tabulation. Mall argued that it made no sense to require doctors to fill out death certificates before forwarding their specimens to the lab; indeed it would be pointless if no pregnancy existed.

Poe's all-encompassing definition of stillbirth posed another problem. In order to acquire a death certificate for a stillborn infant, parents needed to have a burial permit, and to get a burial permit parents had to engage an undertaker (Howard 1924:80; see Remsberg 1992).[18] But if stillbirth was defined as "all products of conception no matter how early," this meant that even early miscarriages would require a burial permit. This in turn could pose a financial burden not only for impoverished parents but for undertakers. Morticians would likely have opposed the law because they could not charge enough to profit from doing infant embalmings and burials (see Strub and Frederick 1989:307, on the financial burdens to undertakers of "infant cases"). Parents who couldn't afford the permit would have been inclined to circumvent the law. The Health Department quickly realized it had given people an incentive to bury fetuses under rocks, which of course was not what it intended. Mall also objected, because he did not want his supply of specimens to be jeopardized. The commissioner of health proposed a solution: his office would dispose of these fetal bodies free of charge. "If the foetal body is properly wrapped up and placed in a small box and sent to this department along with the birth certificate and death certificate, . . . we will see to it that the body is properly disposed of" (quoted in F. P. Mall 1917:2). He did not specify what he meant by "properly disposed of." Nor did he offer to *bury* fetal bodies at state expense. He did not say exactly what he planned to do with the remains, but because he was a close professional friend of Mall's it is reasonable to assume that they would be sent to the anatomical laboratory (see L. M. Morgan 2002).[19]

The lack of dissent was notable. Mall's question—about where to draw the line—prompted the state to reexamine and redraw its definition of stillbirth. In other words, state policy was tailored to meet the embryologists' needs. No one in the civil registry ever questioned Mall's "need" for specimens. No one asked whether Mall should be doing this kind of work, or whether the state should condone it by facilitating the legal acquisition of fetal corpses. Not until many decades later did anyone think to ask whether women should have been consulted about the disposition of fetal remains. A striking degree of symbiosis emerged, locking in the definition of dead embryos and fetuses as "medical waste" under the embryologists' control. It seems likely that the classification of embryo and fetal remains as "medical waste" was the result of a pragmatic alliance between anatomists and health authorities (L. M. Morgan 2002). The anatomists would help their colleagues in the Health Department to collect information and vital statistics, in exchange for which the health authorities would provide unfettered access to an abundance of embryo and fetal specimens.

Mall's struggles over how to define *stillbirth* and over "where to draw the line" is but another demonstration of what sociologists, anthropologists, historians, and public health researchers have long known: there is considerable historical variability, global inconsistency, and registrars' flexibility in demarcating the beginnings of life and death. Negotiations over the earliest margins of life can be seen in several realms, including vital statistics registration and the disposition of fetal and infant remains. Some countries, for example, routinely register as "stillbirth" events that would in the United States be classified as "live births," thus underreporting their infant mortality rates (Wegman 1996). Some U.S. states issue only death certificates in the event of stillbirth, causing pain to parents who believe they are entitled to birth certificates but raising concerns about whether issuing birth certificates in such cases would effectively codify fetal personhood (Lewin 2007; see also Cartlidge and Steward 1995). The disposition of remains is likewise affected by where and how the lines are drawn. To define fetal remains as "medical waste" can offend parents who want to memorialize fetal remains; to define all fetal remains as worthy of memorialization, however, would precipitate a crisis over the disposition of aborted fetal tissue (L. M. Morgan 2002). As shown in these examples, political struggles to determine the legal and ethical boundaries of early life can be seen even in Mall's time, when they had a powerful impact on embryo collecting. Embryo specimens, to paraphrase David Armstrong, should be seen as both object and effect of negotiations about where to draw the line.

THE WAGES OF SIN

Thou must not kill; but needst not strive
Officiously to keep alive.

WINTHROP D. LANE

The answer to the question "What happened to the babies?" would not be complete without considering the status of illegitimacy and the fate of illegitimate infants, because illegitimate offspring were at great risk for ending up in specimen jars in early twentieth-century America. Illegitimate infants were abandoned, neglected, and sometimes given away to foundling homes in far greater proportion than their legitimate counterparts. When researchers for the Children's Bureau of the U.S. Department of Labor began to study infant mortality systematically in the second decade of the twentieth century, they quickly realized that in the United States—as in Europe—disproportionate numbers of illegitimate children died in the first year of life. Data collection was hampered by spotty birth registration records in nearly all states. Several states did not even require birth registration for illegitimate children, who very literally did not count (Scheper-Hughes 1992: 286). Even in places where the registration of illegitimate births was required, the law was often not enforced (Lundberg and Lenroot 1920:20–24). Case studies carried out in Boston, Baltimore, and Washington, DC, showed that the mortality rate for infants of illegitimate birth was three to four times that of infants of legitimate birth. The reported mortality rates for infants born out of wedlock in those cities was 281/1,000 for Boston (compared to 95/1,000 for legitimate infants), 315/1,000 for white infants in Baltimore (compared to 95.5/1,000 for legitimate children), and 302/1,000 for white infants in the District of Columbia (Lundberg and Lenroot 1920:35). In Baltimore, a third of illegitimate children died. Baltimore's rate was the highest of the three cities, even without counting the poorer black population. Ironically, such results gave some researchers an incentive to overlook the problem rather than to address it. A Children's Bureau study of infant mortality in Gary, Indiana, in 1918, chose not to consider births out of wedlock, "on the ground that the conditions surrounding such births are not the same as in normal families" (Hughes 1923:3).

Several factors accounted for the high death rate among illegitimate infants. First, there was not much incentive to raise them. Their fathers—who enjoyed the full support of the law, as social reformer Jane Addams pointed out—often disowned them and abandoned their mothers before they were born (Addams 1916). The state did not want the expense of raising illegitimate children, even though one advocate argued that the economic investment could be justified if such children could be trained as workers or soldiers, "especially for agriculture, the navy, army, and mercantile marine" (Rentoul 1915:421). Rentoul's comment passed as progressive sentiment for the time, even though he was saying that illegitimate children should be put to work to feed and defend the very same men who denied responsibility for bringing them into existence. To state the obvious, the law regarded men's social interests as paramount. As one child advocate noted, "the interest shown during provincial times was a selfish one, the [Maryland] officials being concerned with safeguarding the rights of the master of servants and in avoiding the amassing of public charges in the persons of illegitimate children, rather than in providing for the welfare and rights of such children" (O'Brien 1937:131). Rather than forcing fathers to support their children, the city left unmarried pregnant women to their own devices. To this extent, embryo specimens can be considered an instantiation of patriarchal social policies.

Deprived of marriage and any means to support themselves, some unwed mothers surrendered their newborns to foundling homes. A few so-called "infant asylums" were incorporated under Baltimore city statutes. As an alternative, unwed mothers could opt to give their newborns to entrepreneurial women who charged a nominal amount of money supposedly to care for the child until it could be adopted into a loving family. These so-called "baby farms" were common in American cities throughout the late nineteenth and early twentieth centuries. They were commercial enterprises, where an infant could be boarded and adopted in exchange for a fee.[20] The fact that many such children died before being adopted showed such women to be among the "motley cast of secondary exploiters [who] shared the ill-gotten profits of commercialized womanhood" (Haag 1991:301). In a feeble attempt to address this situation, the city Board of Health passed an ordinance in 1906 requiring all nonincorporated homes that accepted compensation for the care of infants and young children to obtain a health license. In practice, however, the facilities were rarely inspected (O'Brien 1937:109). A closer look at the impunity with which they operated provides some insight into the social production of anatomical specimens.

Infant asylums, baby farms, foundling homes, or hospitals were ostensibly set up to solve a host of problems. The potential benefits of a state-sponsored foundling hospital were spelled out this way: "And if the establishing of Foundling Hospitals can put a stop to, or even greatly lessen, criminal abortion, criminal stillbirth work, the hiring out of babies for a few shillings weekly, infant desertion, a high death-rate, the national shame of baby farming, infant murder, and the giving of a lift up, instead of a kick down, to women who have made a grave mistake in life, then surely it is the duty of the State, or of our Municipalities to establish such an Institution" (Rentoul 1915:422).

In Baltimore, as elsewhere, infant asylums were profitable as long as so-called normal families allowed themselves to believe that illegitimate infants would be adopted into good homes by loving parents. This idealistic, sentimental view of adoption had become widespread in late nineteenth-century America, and it had the paradoxical effect of promoting a boom in "baby farming." Social historian Viviana Zelizer explains how it worked: baby traffickers would charge unmarried women (or the women's errant beaux) a fee to relinquish newborns to their care. The mothers could return home without their shameful burdens, while the baby farmers were "doubling their profits by then selling them to their new customers" (Zelizer 1985:195).

With such extravagant and reassuring promises, it is no wonder that many unwed women in Baltimore took advantage of offers to give over their newborns to strangers who offered to put them up for adoption. They could not have known that the demand for babies had not risen high enough in Baltimore to provide a ready supply of adoptive parents (see O'Reilly 1910). Tragically, many of the infants who entered foundling homes did not survive.

A 1913 report blew the lid off this scandal. The report began not as an inquiry into child mortality, but into prostitution. In 1913, the Maryland governor set up the interfaith Vice Commission after Baltimoreans expressed concern that the city had become "wide open" to prostitution and vice (Finney c. 1940:245).[21] The commission released its five-volume report to the public just days before Christmas 1915, and a political bombshell it was (Lane 1916b:749). A full-page story in the *Baltimore Sun* summarized the findings:

> Investigators of the commission have shown that prostitution in one form or another exists in all parts of the city; that the professional prostitutes number only about one-tenth of the women practicing it; that when the investigation was at its height it was estimated that there were 3,800 women in Baltimore deriving, in whole or in part, their living by prostitution, and that of these there were but 325 women in the regular houses of prostitution, and that, in addition to those earning money in this way, there are a large number of immoral women who will not take pay—these being known as "charity" girls; that sexual perversion, rare a few years ago, is now commonly practiced by prostitutes, both professional and amateur, and by men and women outside the ranks; that offices in large office buildings are places of assignation; that waiters, porters and bell boys in hotels are procurers; that many manicure girls, especially those in barber shops and hotels, use that calling as a cover; that abortions can be procured without trouble; that, when it is too late for this, many physicians are ready and willing, provided the price paid is sufficient, to arrange for the care of a girl in confinement and afterward, and to separate her baby from her immediately after its birth, so that she will never see it again, and that these babies are, to all intents and purposes, murdered, and moreover, that some clergymen will assist in such separation for a price. (*Baltimore Sun* 1915)

The public outcry was commensurate with the sensational reporting. Baltimore citizens were shocked, outraged, and offended. They complained that their city had been defamed, that the charges were false, that Baltimore was no worse than other cities. Yet one volume of the commission's report was even more disturbing, especially to child welfare advocates.

The Traffic in Babies was based on a study undertaken by Vice Commission members in 1914. The report documented *mortality rates of 73 to 95 percent* at two unnamed infant boarding facilities that would, for a fee, "receive infants immediately after birth and keep them permanently" (Walker 1918:1). "Keep them permanently" was in this case a euphemism for killing them within a few short weeks or months through starvation or letting them die of disease. In institution no. 1, 844 babies (or 73 percent of those admitted) died in a five-year period between 1909 and 1913. In the other, the mortality rate was 95 percent. The author of the report was horrified: "What we have recorded is virtual murder, and slow and cowardly murder at that. It would be far more humane to kill these babies by striking them on the head with a hammer than to place them in institutions where four-fifths of them succumb within a few weeks to the effects of malnutrition or infectious diseases. . . . Nearly all of them die; and many of us know that they die; and moreover many think it better that they die" (Walker 1918:3–4).

When the infants died, some were buried at a nearby cemetery; others—at least five thousand, according to the Vice Commission—were buried two-to-three per coffin, the coffins piled in mass graves. About half the bodies from one home were donated to the Anatomical Board, which distributed them to local medical schools. Undoubtedly, some ended up at Johns Hopkins, where they might have been transformed into specimens that were described as "naturally occurring." We heard earlier from Dr. Hooker, who wrote to offer three ahistorical embryos to the Carnegie embryologists, saying he did not know whether "such foundlings" would be of interest. Miscarried embryos shared with illegitimate infants the dubious status of foundling. Both were defined as—or rather, converted by social custom into—entities that lacked the genealogical credentials that could guarantee them a proper place in society. Denied a place in the social order, illegitimate infants could be given over to die.

Interestingly, the Vice Commission report portrayed infant death not as a tragedy in itself, but as evidence of the general degradation of morals in Baltimore. Historian Pamela Haag points out that Baltimore Progressives began their investigation into prostitution at a time "when a growing and flamboyant population of middle-class, 'respectable' young women—often newly-emigrated from Maryland's rural regions—began to engage in wage labor for consolidated industries and postpone reproductive labor expected in marriage" (Haag 1991:293). A ready supply of embryo specimens was clearly one result of this economic shift.

The Vice Commission was concerned that prostitution contributed to the deterioration of moral standards and the corrosion of domesticated motherhood, both of which resulted in excess infant deaths. In other words, infants were expected to die, but consigning them to such a fate violated what was considered to be right and good—namely, the natural bond between mother and child. The commission wanted to help women become respectable mothers and to save children's lives. Foundling hospitals had been tried in Baltimore as in other cities, but "it gradually became obvious that the protective effect of such institutions was more than outweighed by the notoriously high infant mortality of all asylums in which infants are kept in close proximity in large numbers" (Ehrenfest 1920:523). The high mortality in foundling homes was largely attributed not to patriarchy or industrialization, but to the lack of breastfeeding and the poor quality of the public milk supply. Policy makers and infant welfare advocates therefore decided that foundling hospitals should be "displaced through the granting of aid to mothers to enable them to care for their own children" (Ehrenfest 1920:523). The legislators' answer, in the case of Baltimore, was the Six Months Law.

The Six Months Law, passed in 1916, required that mothers not be separated from their newborn infants for the first six months of life. Even unwed and working mothers were legally required to breastfeed and otherwise safeguard the health and well-being of their children. The Six Months Law reflected the widespread view of lawmakers that mothers belonged with their children: "Children will, of course, be her special and prime contribution and her life must be shaped around that as an end" (Donald Armstrong 1915:117). The Six Months Law codified the lawmakers' views of gender. It did not make men accountable for providing for the children they begot, nor did it provide women with the means for earning a living while they nursed their babies. At the time, though, social reformers were thrilled with a law they considered progressive. Reverend O'Brien opined that the Six Months Law "constituted one of the most advanced steps taken by the State in its legislation covering the entire field of child care" (1937:130). Elizabeth S. Walsh wrote, "the law has been educational in recognizing the rights of the child to a mother's care and love and, therefore, giving it a fighting chance for life, and as a moral tonic to the woman in deepening her sense of responsibility and duty towards the infant" (1917:124). She reported substantial declines in mortality among infants received at asylums in the first year after the law went into effect, from an average of 68 percent to 38 percent (Walsh 1917:123).

Many Progressives championed a law that reinforced the bond between mother and child. But as historian Alan Dawley pointed out, the law merely substituted one form of male domination for another: "Women's protective legislation . . . redefined the legal form of male dominance by substituting state regulations for family paternalism" (Dawley 1991:137). Suffragists, too, noted that the stigma against illegitimacy was but one manifestation of discrimination against all women. Jane Addams denounced the new regulations, saying, "Women slowly had discovered that the severe attitude towards the harlot had not only become embodied in the statutory law concerning her . . . but had become registered in the laws and social customs pertaining to good women as well." Addams noted the preponderance of laws weighted against girls and women during this time. "The Code Napoleon," she wrote, "which prohibited that search be made for the father of an illegitimate child, also denied the custody of her children to the married mother; those same states in which the laws considered a little girl of ten years the seducer of a man of well-known immorality, did not allow a married woman to hold her own property nor to retain her own wages" (Addams 1916:5).

In spite of Addams's eloquent appeal on behalf of women, Baltimore reformers used their concern for the welfare of children as an excuse to further penalize unwed mothers. Although their action may look shortsighted today, it was consistent with an increasing focus on infant and child welfare, especially the abolition of child labor which was then coming into vogue (see Preston and Haines 1991:25). "The sin of child labor," observed one analyst, was transformed "into the sin of the unprotected child" (Wiebe 1967:171). If not all children could be protected from the pervasive threat of infectious disease, reformers were convinced they could stop the "slow and cowardly murder" of infants in baby farms. *The Traffic in Babies* report argued that such deaths were far more egregious and shameful than infant deaths attributable to other causes. They hoped that the Six Months Law would convince women to see the error of their ways, accept their duties as mothers, and produce healthy, viable children. In the words of historian Pamela Haag, "As the Maryland vice crusade illustrates, a city's response to economic change and class reconfigurations always involves an attempt to reconcile pre-existing notions of social order—principally, ideas of appropriate gender roles and gendered notions of 'work'—with material exigencies that often render these ideals unrealistic and contestable" (Haag 1991:305). During the entire scandal, no mention was made of the possibility that infant remains might end up under the anatomists' control.

By the second decade of the twentieth century, the status of infants in the United States began to change. Children were beginning to be valued for sentimental and emotional reasons rather than for their economic value (Zelizer 1985). They were also getting more expensive. Child labor was prohibited by Baltimore law in 1894, "when the employment of children under twelve years of age was forbidden everywhere but in canneries," and in 1902 public education was made mandatory for children between the ages of eight and twelve (Hirschfeld 1941:76). The stigma against illegitimacy, which had previously consigned infants to baby farms and death, was giving way to the idea that illegitimate children should not be punished for the sins of their parents. Granted, there were multiple social problems that had to be addressed before babies could become more thoroughly sentimentalized: birth and death registration had to be enforced for all children, infant protection laws had to be passed, the milk supply needed to be cleaned up, and disparities between the rich and the poor had to be addressed.

The stigma against the twin sins of illegitimacy and unwed motherhood resulted in the deaths of fetuses, infants, and those women who took their own lives rather than be disgraced. Then, as now, society tried to control the flow of new members into the community; and then, as now, the status accorded to infants and fetuses reflected attitudes toward the women who bore them. What that meant in practice was that women (but not men) who bore children out of wedlock were considered "ruined" or "spoiled," and their "illegitimate" offspring were harassed and deprived of social standing. Faced with the prospect of bearing an illegitimate child, a woman might seek an abortion or surrender the newborn to a foundling home. The stigma of illegitimacy thus produced unclaimed pauper corpses, some of which undoubtedly ended up as specimens in anatomy and embryology laboratories.

"What happened to the babies? How did they die?" Even without access to patient records, answers to these questions can be approximated by looking beyond each of the silent, alabaster specimens to the conditions of life in early twentieth-century Baltimore. Baltimore was in many ways a perfect location for an embryo-collecting enterprise, precisely because so many factors conspired to facilitate fetal death. Intrinsic flaws in the poorly understood "germplasm" (today known as genes); exposure to contaminated air, water, or milk; and environmental poisons or toxins were just some of the possible causes. Other threats to fetal well-being originated outside, in what the embryologists termed the "maternal environment." Exogenous factors included the synergistic effects of poverty, poor nutrition, hazardous living conditions, and disease. There were so many things that could cause a woman to miscarry. Sometimes, a fetus died when a pregnant woman herself died as the result of illness, accident, or violence. In an unknown number of instances, fetuses were intentionally aborted, although abortion, too, needs to be regarded as part of the "maternal environment" at a time when unwanted pregnancy could not be reliably prevented and illegitimacy was heavily stigmatized. The punitive moral climate undoubtedly contributed to the availability of embryo specimens, as policies designed to keep women in their place took their toll. In a few cases, it is possible that "the babies" had died shortly after birth, as a consequence of disease or the notorious foundling homes.

THE JARS

> *It was one of those things they keep in a jar in the tent of a sideshow on the outskirts of a little, drowsy town. One of those pale things drifting in alcohol plasma, forever dreaming and circling, with its peeled, dead eyes staring out at you and never seeing you . . . One of those things in a big jar that makes your stomach jump . . .*
>
> RAY BRADBURY

If we want to understand "what happened to the babies" and the women who (mis)carried them, we also need to consider how they ended up on display.[22] The scientific exhibit of prenatal development at the Century of Progress Exposition lay at one end of a spectrum that included many other ways of displaying fetal corpses and tiny living babies. Understanding this context helps to explain why these specimens "worked" on viewers to legitimize the biomedical view of embryological development.

Prior to the 1930s, Americans who might have wanted to look at fetal specimens would have had few options. Medical students and health professionals could consult their hospital collections, usually in the anatomy or pathology departments. Men (but not women) with money were permitted admission to pathological museums, such as the Mütter Museum in Philadelphia (Sappol 2004; Worden 2002). The masses could visit see freakish specimens at the carnival shows that continually cycled through small town America. Carnival specimens were sometimes faked, but that did not keep people from lining up to see them.

In addition to the "very fine exhibit of embryo babies in all stages of growth" at the 1933–34 Chicago exposition, there was also a sideshow on the midway. Billed as entertainment rather than science, it appealed to the fairgoers' morbid curiosity with a banner boasting, "A Real Two-Headed Baby." The brains behind the two-headed baby was Lew Dufour, who knew from long experience in the business that pickled babies were a carnival crowd-pleaser, and Joe Rogers, an entrepreneur who knew how to blur the line between money and medicine. "A scientist may know a lot about embryology and biology," Dufour was quoted as saying, "but it don't mean anything at the ticket window because it's not presented right," and indeed the exhibit grossed no less than fifty thousand dollars for the organizers (Liebling 1939:23, 25).

A. J. Liebling, who wrote about the colorful partners for the *New Yorker* magazine, indulged his own morbid curiosity by investigating how the showmen acquired their specimens. Most big cities, Liebling explained, had clandestine clearinghouses that would provide dead fetuses for a fee. "It is now a small industry," he wrote, "though seldom mentioned by chambers of commerce." No kidding. In Chicago, Liebling revealed, the unnamed "tycoon" of fetal specimens had worked as "chief laboratory technician at a medical school. The specimens are smuggled out of hospitals by technicians or impecunious interns" (Liebling 1939:24). The two-headed baby, Liebling suggested, could have been purchased from unscrupulous medical men before it was peddled to viewers—more than three hundred thousand times—at fifteen cents a peek. Meanwhile the more scrupulous of the medical men were distancing themselves from these freak shows.

A third "baby" exhibit on the midway at the Century of Progress Exposition was a bit more reputable than the two-headed baby. It was called "Living Babies in Incubators," and it was organized by doctor-turned-showman Martin Couney, who made his living by exhibiting babies born too early (see Baker 1996). Couney's medical credentials may have impressed the organizers of the fair, but in medical circles his reputation was tainted by the fact that he earned his livelihood marketing medical curiosities. Doctors had been outspoken critics of incubator baby shows for decades. If Couney had read the medical literature, he might have claimed that his exhibit offered a public service by promoting the benefits of modern medical technology. "What connexion *[sic]* is there," a *Lancet* editorial opined back in 1898, "between this serious matter of saving human life and the bearded woman, the dog-faced man, the elephants, the performing horses and pigs, and the clowns and acrobats that constitute the chief attraction?" (*Lancet* 1898). According to the *Lancet,* Couney would have been guilty of several offenses: trivializing the "serious matter of saving human life," jeopardizing the health of vulnerable infants, and profiting in the process. A hospital ward, the *Lancet* said, was the appropriate location for nurturing prematurely born infants; what the *Lancet* did not say was that dead fetuses and infants belonged only in the morgue or anatomy laboratory. Medical doctors disapproved of profiteers who sold glimpses of life and death through carnival shows such as "The Real Two-Headed Baby" and "Living Babies in Incubators."

The tension between medical men and carnival hawkers is evidence of social-class tension, as the ascendant scientific bourgeoisie tussled with vulgar entrepreneurs over who would control the display of fetal and infant remains (see Sappol 2002:274–309). Beginning in the 1930s, medical and science museums started to mount their own displays, of which the Chicago Century of Progress exhibit was arguably the most widely viewed of the era. Because it was justified as "public education" rather than entertainment, it was awarded the privilege of residing under the tent of science rather than on the midway. Its location was evidence of its purported moral superiority, a move that would wrest from midway hawkers the right to display fetal remains, *respectfully*—not as freakish or monstrous anomalies, but as normal, everyday biological miracles. As historian Lynn K. Nyhart points out, the museums distinguished themselves from the commercial establishments by emphasizing education; they would educate the public "sensibilities toward a more middle-class valuation of truth—and an appreciation of science as a source of that truth" (Nyhart 2004:330). This exhibit claimed to display nothing less than our collective human origins. What remained unsaid was that these and similar specimens were *socially occurring human ova,* collected and culled from the surrounding city and countryside, and that they could be seen as evidence of what *society* had wrought.

SIX

Embryo Tales

If Mall were still alive, he would be startled to see embryos and fetuses popping up in so many unexpected places. Picking up his mail in June 2003, he could find an image of a fetus gracing the cover of *Newsweek* magazine, illustrating a story about stem cell treatments.[1] Turning on the television in 2007, he could see an advertisement for Ford's flexible fuel car ("for the next generation"), featuring the animated silicon models of dolphin, polar bear, and elephant fetuses. At his local video rental shop, he could check out *Look Who's Talking* to watch a fetus speaking from the womb (Kaplan 1994). He could log onto the video sharing Web site YouTube to watch animated ultrasound clips purporting to be the fetus of [insert a pregnant celebrity's name here], offering cynical commentary from the womb. How, he might wonder, did embryos and fetuses become so animated? What happened to turn embryos and fetuses from quiet laboratory objects to active—very active—sociopolitical agents?

For twenty years, feminist scholars have documented the emergence of what anthropologist Janelle S. Taylor calls the "public fetus." Whereas the previously private fetus had been confined to the realm of woman's domestic experience and a few domains of medicine (Duden 1993; Newman 1996), the public fetus appears routinely "outside of the clinical setting, for non-medical purposes" (Taylor 1992:69). It is characterized by its visibility, autonomy, and initiative, although it comes in a variety of guises ranging from gruesome anti-abortion propaganda to cute cartoon characters. During the 1980s, the public fetus began to appear as the newest patient in the clinic and litigant in the courtroom, as well as the figure that justified intrusive surveillance over pregnant women's behavior (Casper 1998; Daniels 1993; Ginsburg 1989; Hartouni 1997; Luker 1984; Mitchell 2001; Morgan and Michaels 1999; Oaks 2001; Petchesky 1984, 1987; Rapp 2000; Roth 2003; Rothman 1986).

In tracing the history of the public fetus, many feminist scholars focus on the post–World War II period (Mitchell 2001:170), especially the post-1980 period when a rising wave of religious conservatives clashed with women's rights activists. Feminist scholars have also documented the revolutionary impact of technologies such as amniocentesis that allow fetuses to be tested for a spectrum of genetic disorders, and increasingly sophisticated forms of ultrasound monitoring that allow parents-to-be to see images of the fetus in utero. Armed with pictures and information from inside the womb, it became possible in the 1980s to learn the sex of a not-yet-born child, and to assign it a name and social identity (Rothman 1986; Petcheskey 1987). There can be no doubt that these developments have brought fetal subjects literally into view. Yet by emphasizing the latter half of the twentieth century, feminist scholars have tended to overlook earlier ways that embryos and fetuses were incorporated into public discourse (for exceptions see Clarke 1998; Duden 1993; Luker 1984; Newman 1996; Reagan 1997; Stormer 2003b).

In fact, embryos and fetuses had their public debut as social agents much earlier than scholars have generally acknowledged. Embryos were invoked to speak in various public debates that took place in the second and third decades of the twentieth century, including the theory of evolution, the so-called "race problem," and the relationship of humans to other species. Each of these debates has its contemporary equivalent, yet human embryos are rarely invoked anymore as evidence. Today, when embryos and fetuses are discussed in a sociological context, they are more often hitched to debates over the morality of abortion, cloning, and stem cell research. In other words, the historical case studies presented in this chapter make the point that embryos and fetuses need not be *automatically, naturally, or even primarily* associated with abortion or reproduction. My thesis is that we fashion and animate embryos and fetuses in ways that correspond to the kind of social "work" we ask them to perform.

Only after the embryologists identified human embryos as tissue that held the key to explaining the origins of the human body did it become necessary to collect and study them. Only then could embryos be distinguished from other, less meaningful body parts. In other words, it was the embryologists' interest that shaped embryos and fetuses into "bodies that matter," to borrow a concept from philosopher Judith Butler (1993). Giving meaning to embryos was not an automatic function of scientific discovery, but a result of cultural authority that valued science as a way of knowing. Embryos were conjured into existence in response to *specific* social dramas and concerns. Accordingly, scientists do not so much discover them as materialize them to show how they might (or might not) be relevant to matters of social and political concern (Hartouni 1997). After embryos were given body and form in the late nineteenth century, as Hopwood (1999) so eloquently argues, in the twentieth century they were increasingly made to move and speak.

Embryo subjects do not carry their meanings intact. People select the specific embryo features that are relevant to stories they want to tell, and they interpret the significance of the embryos accordingly. Interpreting embryos is not easy. As a nonanatomist trying to make heads-or-tails (so to speak) of a sectioned specimen affixed to a glass slide, I know that interpretations do not spring unambiguously from the specimens. One must be taught to read them. Embryos thus take their meanings from the scripts we assign to them.

VOICING THE EMBRYO

Until the late 1910s, the Carnegie embryologists rarely, if ever, discussed embryos in public. Nor did they have much to say, publicly at least, about the circumstances of pregnancy, the traffic in babies, the ethics of embryo collecting, or the circumstances under which embryos came into their possession. Most of them refrained from participating in Baltimore's Progressive Era social-reform movements, and so had little to say about Baltimore's ongoing debates over abortion, contraception, illegitimacy, infant mortality, venereal disease, and women's suffrage (Fee 1987). They perceived themselves as participating in a rarified, scientific enterprise that bore no relationship to the mundane, vulgar world of public affairs. Clarke argues that most reproductive scientists of that time, including the embryologists, "shunned" the social reformers and others who were engaged in applied work. Reproductive scientists prefered to adopt the "calm, moderate tone of objective science" in talking about their occupations, Clarke says, as a deliberate way of legitimizing themselves and the work in which they were engaged (Clarke 1990:28–29). Before 1910, embryologists rarely applied their professional interest in embryo "material" to matters of the outside world.

In 1916, a young woman named Armenouhie Lamson changed all that.

Armenouhie T. Lamson (1883–1970) migrated to the United States from Turkey with her parents in 1908, when she was twenty-five years old, fleeing the dissolution of the Ottoman Empire. A talented medical artist and writer, Lamson enrolled at the Johns Hopkins Medical School in 1910 to study medical literature and art. In 1916, she wrote a short little book called *My Birth: The Autobiography of an Unborn Infant.* The story is written as a *collective autobiography,* telling the story of human gestational development in the first person, from the embryo's point of view. Lamson's remarks about life as an embryo and fetus provide rare insight into prevailing social etiquette. She reminds the reader that it would have been improper in the second decade of the twentieth century to mention the baby-to-be before it was born, despite the fact that it was about to change household life forever. In the following passage, she speaks to the reader about how the reader cannot speak about her: "Yet to-day I am only a sweet but an unspeakable secret. To-morrow my existence and my arrival will be heralded among many people. To-day good form and good manners have barred me from the conversation of all well-bred people. To-morrow I shall be the only proper and interesting topic of their verbal intercourse. To-day only my mother takes me seriously and considers me in her actions. To-morrow I shall rule every member of her household" (Lamson 1916:134).

There was precedent for writing from the womb in the first person: *The Life and Opinions of Tristram Shandy, Gentleman,* written by English novelist Laurence Sterne, was a nine-volume novel that had appeared in 1759.[2] The story begins with Shandy narrating the circumstances of his own conception, digressing on a variety of topics before finally getting to Shandy's birth in volume 3. *Tristram Shandy* continued to be popular throughout Europe, and it is possible that even 150 years after it was published Lamson might have used it to inspire her own tale. In any case, she copied Shandy's strategy of writing from the fetal point of view. Like other people who claim to speak on behalf of the fetus, Lamson put words in its mouth, taking advantage of her beyond-the-womb-soapbox to register social protests. Foremost among her complaints was the issue of women's suffrage. Writing six years before American women were granted the vote, Lamson (obviously a suffragette as well as a good ventriloquist) allowed her fetal protagonist—who was, incidentally, male—to protest the lack of suffrage. "As soon as I am born I shall be considered an independent personality, and because of my sex, automatically all the rights of citizenship will be invested on me. I shall not have to beg or fight for them in later years" (Lamson 1916:134). Immigration was likewise on Lamson's mind. Her fetal protagonist was an opinionated little protocitizen during an era of heightened American consternation over foreign immigration and high immigrant fertility. As an immigrant with an unpronounceable name, Lamson herself was undoubtedly sensitive to prejudice against foreigners. This might explain why she cast her fetus as a patriot who longs for an American name.

> It seems that I have to bear that name ["fetus"] until the time comes when I am born and my parents give me a permanent name. I hope that name, which I shall have to bear all through life, will be the true product of the country I am to call my "country." It is a pity that a great country, like the one to be mine, is filled with names founded on stolen or borrowed roots from dead countries and gone people. It seems to me it is time that there should be invented names which stand for American liberty and democracy for American boys and American girls to live up to. Such a one I would wish to bear. (Lamson 1916:110)

Lamson raised another, ostensibly less political issue: the fact that embryos, at a certain point in development, possess a tail. In her three-week-embryo persona, Lamson wrote, "Fortunately my body—with a head and tail end—had taken such a curved attitude that the latter, painfully suggestive of my remote ancestors, was carefully hidden away from sight. It is perhaps for this reason that all undeveloped beings like me modestly retain such a position until they have received all the pleasing features of man" (1916:60). The revelation that human embryos possess tails would turn out to be one of the most riveting discoveries of early twentieth-century embryology research. The public was shocked and disturbed to learn that human embryos possess tails. If embryos represent "ourselves unborn," then what does it mean that "we" have tails?

THE PITTER-PATTER OF TINY—TAILS?

Am I satyr or man?
Pray tell me who can,
And settle my place in the scale;
A man in ape's shape,
An anthropoid ape,
Or a monkey deprived of a tail?

Punch (1861)

The human embryonic tail, embryologists realized early on, appears in human embryos at approximately forty-one days (when embryos measure more-or-less twelve millimeters crown-to-rump, or just under half an inch). It disappears at the end of the embryonic period at about fifty-seven days, when the embryo measures around about 30 millimeters crown-to-rump (Schultz 1925a:249).[3] Although the tail is visible for only about two weeks, the news that embryos have tails came as a shock to the American public of the late nineteenth and early twentieth centuries. Some people interpreted the announcement as blasphemous; how could a human created in God's image possess a devilish tail? Others interpreted the tail as embodied proof of recapitulation, that is, of Haeckel's idea that each organism passes through each phylogenetic stage in the course of its embryological development. To citizens who regarded themselves as civilized inhabitants of a world occupied by beasts and savages, the human embryonic tail was embarrassing or worse.[4] If it were going to be understood within a proper, civilized framework, the embryonic tail would have to be put in its place, so to speak.

Anatomists, anthropologists, and the general public joined in a lively public conversation about humans with tails. As Jan Bondeson points out in his book *A Cabinet of Medical Curiosities,* reports of uncivilized races with tails had been around since antiquity, perpetuated by westerners no less eminent than Marco Polo and Carl Linnaeus (1997:170–85). The idea that faraway peoples might possess tails was nothing new, but in the late 1880s embryologists added fuel to the fire by revealing that human embryos possess tails. This was a time when Europeans and Americans were grappling with the radical challenge to their worldview represented by Darwin's theory of evolution. In this context, the news that human embryos had tails was especially shocking to those who did not wish to believe that humans bore any resemblance—or evolutionary relationship—to monkeys.

The anatomists and embryologists at Johns Hopkins were perfectly poised to join the debate. Ross G. Harrison (1870–1959), a Johns Hopkins–trained embryologist and contemporary of Mall's, wrote an important scientific paper on the subject in 1901. He was a skeptic, not the least bit fooled by armchair ethnologists who told "tales of tailed tribes" from all around the world (Tremearne 1912:106). As an anatomist and man of reason, Harrison wanted to find evidence inside the anatomical features of the human body. His paper began by reviewing the literature on human "caudal appendages," arguing that the evidence did not support accounts about "various lands supposed at one time or other to have been the haunts of human races with tails" (1901:96). Travelers' fanciful stories, Harrison believed, should be replaced by scientific truths. He would therefore conduct a rigorous study of an existing human tail from an anatomical perspective. He cites the embryological evidence briefly, to acknowledge that "the fact that the human embryo at a certain period of development is provided with a tail-like appendage has lent color to the discussion of the question" (Harrison 1901:96). The rest of his paper describes an operation to remove a seven-centimeter (2.76 inch) tail from a six-month old child in Baltimore. Taking meticulous measurements at every step, Harrison dissected the offending appendage and took copious measurements. The data allowed him to address an ongoing debate among embryologists and anatomists about whether human embryonic tails shrank in the course of development or whether they were swallowed up "as a result of the growth of the extremities and the gluteal region" (Harrison 1901:101). This somewhat arcane anatomical debate—and the project to medicalize and hence to civilize the anomalous human tail—continued well into the twentieth century (see Kunitomo 1918; Dubrow, Wackym, and Lesavoy 1988).

Scientists would obviously want to maintain their professional decorum when speaking on the subject of the embryonic tail, but members of the public had no such apprehensions. The embryonic tail was the subject of endless amusing commentary and satire. Publishers soon learned that tails could sell magazines, and well into the twentieth century one finds numerous articles bearing titles like, "Why some babies are born with tails, others are covered with hair, and all young infants can hang by their hands like monkeys in the trees" (Gregory 1931). Fifty years after the poem that appeared in *Punch* (quoted in the epigraph above), the satirist Ambrose Bierce made fun of the word *tail* in *The Devil's Dictionary:*

> The part of an animal's spine that has transcended its natural limitations to set up an independent existence in a world of its own. Excepting in his foetal state, Man is without a tail, a privation of which he attests an hereditary and uneasy consciousness by the coat-skirt of the male and the train of the female, and by a marked tendency to ornament that part of his attire where the tail should be, and indubitably once was. This tendency is most observable in the female of the species, in whom the ancestral sense is strong and persistent. (Bierce 1958 [1911]:131)

In 1925, the Scopes trial in Dayton, Tennessee, provided a golden opportunity for embryologists to bring their knowledge of embryonic tails to the public. At issue in the highly publicized trial was the teaching of evolution in Tennessee public schools. Adolph Hans Schultz (1891–1976) was a physical anthropologist and primatologist employed in the Carnegie Department of Embryology. He would have been a logical choice to provide expert testimony in the Scopes trial, but he declined the invitation: "D. F. Malone had wired me from Dayton, inviting me to come as expert witness but I declined to participate in that circus" (Schultz 1925b). Still, Schultz felt moved to educate the public on the matter of evolution. He was a Darwinian evolutionist who used the embryonic tail as proof that humans and monkeys are descended from a common ancestor. With the trial ongoing, Schultz wrote a short article for *Scientific Monthly* called "Man's embryonic tail" (Schultz 1925c). "The embryologist has irrefutable and abundant proof to demonstrate that man, long before birth and when measuring but a third of an inch, bears a true external tail one sixth the length of his body" (Schultz 1925b:142). Not only did human embryos possess tails, Schultz pointed out, but human adults once wagged them. Schultz goaded his readers, pointing out that human adults sport "purposeless" muscles that "invariably correspond to muscles found in the tails of monkeys" (Schultz 1925c:142). He tried to convince his readers to appreciate the human embryo's animal similarities.

In addition to his popular article, Schultz wrote a scientific journal article titled "Embryological evidence of the evolution of man" (1925a). He was a talented artist, and this article included several illustrations that set human fetuses, newborns, and adults alongside those of macaques, orangutans, chimpanzees, and gorillas. "See," he seemed to be saying, "humans exist along a continuum that includes other primates." Schultz also included a drawing he made from an 1889 *Scientific American* account of a twelve-year-old boy from French Indo-China with a nine-inch-long external tail. The drawing shows a rear view of the child, naked except for the ankle bracelets that, along with his tail, marked him as doubly primitive (L. M. Morgan 2003). Schultz used this comparative evidence—much of it from the embryo and fetal specimens in the Carnegie collection—to argue that all primates share a common ancestor. Like Lamson, Schultz pointed out that the embryonic tails show human embryos to be primordial, more animal than human, closer to nature than to culture. Embryos are less like us, he implied, than we would like to believe, and we are more like monkeys.

The tail no longer figures prominently in embryo politics. Today the only people who seem to be interested in it are a few doctors and a subset of creationists (see Belzber, Myles, and Trevenen 1991). The latter carry on the tradition established during the Scopes trial, by trying to explain away the evolutionary significance of the embryonic tail as part of their effort to discredit the theory of evolution.[5] Otherwise, the significance of the human embryonic tail in public discourse has diminished over time. Why? Members of a society learn to ascribe importance to human embryos based not on the so-called natural features of the embryo, but on the social significance that can be attributed to those features at a given historical moment. In the case of the tail, a truly tiny fragment of bodily tissue was singled out and freighted with importance in ongoing public conversations. People told themselves and convinced each other, "This is our body. It represents who we are, where we came from, how we got here, and how 'we' are related to 'them.'" Embryonic tails enlivened their conversation, providing a focal point for debates over civilization, science, barbarism, secularism, atheism, and faith. This was a lot of weight for a tiny embryo to carry. It made the embryonic tail a big-small matter, the perfect foil for a range of social concerns. It represented divisions among various camps in social, political, and philosophical conversations about who "we" are and want to be. The significance was not in the tail per se nor even in the embryo qua embryo, but in how people coaxed those bits of flesh to mirror their social worlds.

Although the tail had largely vanished from public debates over embryos by the late twentieth century, it was replaced by another anatomical feature: tiny feet. Abortion foes chose as a symbol of their movement the "precious feet" image. Two tiny feet, portrayed on a lapel pin or bumper sticker, are used to illustrate what they depict as the fully formed humanity of early human life. Feminist rhetorician Celeste Condit explains the historical and political logic of the miniature feet, noting that pro-life activists in the 1980s deliberately chose to highlight an anatomical feature of the embryo that would make it appear gestationally advanced, visually appealing, and emotionally sympathetic. They chose miniature, humanlike hands and, especially, feet. This visual synecdoche functioned as a rhetorical weapon to make it appear as though a tiny embryo was indistinguishable from a newborn. The same effect could not be achieved by showing the whole body of the ten-week fetus, Condit said, because "a young fetus looks like a wretched creature [with its] ungainly face and head, off-balance and poorly formed" (Condit 1990:89).

There are two important points to be made about the "precious feet." First, tiny feet divert attention from the many ways that ten-week fetuses do *not* look like babies; tiny feet are an obvious propagandistic effort to reinforce an implied continuity between very young fetuses and newborn babies (Condit 1990:83; see also L. M. Morgan 2006a:25–26). Second, tiny feet are as much a cultural creation as a natural feature. In 1959, Carnegie-affiliated embryologists wrote a scientific article called "The prenatal development of the skeleton and joints of the human foot" (Gardner, O'Rahilly, and Gray 1959).

Anatomical features mean nothing on their own; we ascribe meaning to those features based on cultural cues that tell us, for example, that the backbone symbolizes courage and fortitude. The embryonic tail became important during a historical conversation about where to draw the line between human and nonhuman primates. Tiny feet were invoked to symbolize "baby steps" and the presumptive immorality of abortion. In each case, embryos took their meanings from the stories we asked them to tell and the scripts we gave them to perform. Embryos did not create these social controversies, rather, the controversies created the embryos.

RACIAL EMBRYOLOGY

"Racial embryology," the name given to the effort to find racial differences in embryo specimens, provides another example of how embryos were recruited in the service of political ideology. The idea that races were biologically distinct, anatomically encoded, and hierarchically ranked was widespread throughout the late nineteenth and early twentieth centuries. Anatomists and physical anthropologists were considering the possibility that different races of humans might derive from different evolutionary lineages. Evidence about the presumed biological basis of race could have implications for social policies, too, such as interracial marriage, social hygiene, immigration, sterilization, and education. If marked racial differences could be found in human embryos, the evidence could help to address some of these evolutionary and social questions.

The Carnegie Institution of Washington was particularly interested in ideas of human betterment through the life sciences, and in 1904 Carnegie provided money to establish a genetics center at Cold Spring Harbor. The center took an infamous turn in 1910, when Charles B. Davenport took over as director and established the Eugenics Record Office (Davenport, Witkoswki, and Inglis 2008). Davenport was an avid eugenicist, who believed that hereditary laws should be used to control human breeding and thereby improve the genetic fitness of the population. Eugenic ideologies quickly found expression in social policies that authorized the forced sterilization of people deemed to be "defective" or genetically unfit (including epileptics and "feeble-minded" individuals).

Eugenic policies also linked race and immigration. Anti-immigration laws passed in 1882 barred Chinese entrance into the United States, and several states prohibited marriage across racial lines. Newspapers were filled with discussion of the perils of "race suicide," exhorting white families to produce "better babies" and "fitter families" (Lovett 2007). The eugenics movement affected thinking about fetal death and infant mortality (Meckel 1990:118), with some eugenicists arguing that a certain amount of infant mortality was inevitable due to "bad breeding" (Donald Armstrong 1915:118).

In this climate, it was inevitable that the Carnegie embryologists would be drawn into the conversations about the biological bases of race. Baltimore was the perfect place to examine specimens for evidence of racial differences because it sits at the crossroads of north and south, with ready access to "European" and "Negro" remains. Examination of the anatomical evidence available in Baltimore led some doctors to believe that certain races were constitutionally weaker than others. Writing in 1924 about public health in Baltimore, Howard argued that "Negro" fetuses and infants were less likely than whites to survive the risks of gestation and birth, even with access to good obstetrical care. In his words: "It is significant that from not only causes acting in utero and at birth (still-births), but from those operative most conspicuously during the first month of extra-uterine life, the negro is a much poorer risk than the white. That this is due largely to causes inherent in race stock is supported by the fact that in a very much larger proportion of instances than the white the negro infant has the advantage of care before, during, and immediately after birth, by the two university obstetric clinics" (Howard 1924:554).

Howard assumed that the availability of medical care would result in healthier babies, and that, "with two university obstetric clinics" nearby, Negro infants in Baltimore should have an advantage over whites. But of course medical care is only one determinant of a baby's healthy future, and Howard did not consider income, education, nutrition, housing, or many other factors. He assumed, as did many eugenicists of the day, that a certain percentage of infant mortality could never be remedied by social policies. Donald B. Armstrong (1886–1968), for example, argued that the state should not provide medical care or other services to people who would be unfit to survive. He also opposed funding charities that were "wrongfully aiding the propagation" of unfit children (Armstrong 1915:118). For citizens deemed "fit," however, or to paraphrase Howard, "a better risk than the negro," the state should encourage reproduction and should do everything possible to maximize survival.

Mall was skeptical about the view that racial differences would be manifested in developing embryos, but he was willing to consider the possibility if he could get a large and racially varied sample. He hoped to expand the racial embryology project by reaching out to missionary doctors overseas, especially those in "the Orient." With a large enough collection, he could begin to tease out racial differences in embryological development, of what Howard (in the above quotation) called the "causes inherent in race stock." A closer look at Mall's racial embryology project provides another illustration of the extent to which interpretations of embryos and fetuses—even today—are a reflection of culturally embedded assumptions and hierarchies. Advocates of racial embryology projected their prejudices onto the developing bodies of unborn human organisms, just as people do today.

Mall was not a racist, at least not compared to other men of his time. He believed in racial equality, or what passed for it in his social circle.[6] But American racial ideologies were far from egalitarian in the early twentieth century, and Mall, like many other progressive intellectuals, was certain that the races were hierarchically ordered and distinguished by profound behavioral and biological differences. This view affected his theorizing about the timing of conception in relation to the timing of the menstrual period. He wrote, "Among civilized races copulation does not take place during the menstrual period, and it is believed that it is most likely to be followed by pregnancy if it occurs immediately after the period" (Keibel and Mall 1910–12:198). That statement was followed, a few sentences later, by the assertion that "negroes" were likely to have sex during menstruation: ". . . the habit of American negroes, who, I am informed by Professor Williams [author of the influential textbook *Williams' Obstetrics*], prefer to copulate during the menstrual period. At this time the odors of the negress are said to excite the passion of the negro and are very attractive to him" (1910–12:198). In other words, the "civilized races" did not, in his view, include "American negroes." Such racialist thinking, which was shared among medical professionals, no doubt contributed to Mall's desire that it would be a good idea to study the racial dimensions of embryology.

Mall envisioned a comprehensive collection of embryos from all possible races. Of course, Mall managed to hide the social and ideological conditions of embryo production by suggesting that the collection might reveal biologically distinct races. Mall's efforts to amass a racially diverse collection were hampered, however, by the fact that most of his donors were white, Baltimore-based doctors. Mall never did publish data detailing the racial composition of his collection, although he did provide a space to note "race" on the specimen intake forms. An approximation of the racial composition of Mall's specimens can be found in a 1920 article, in which Adolph Schultz said that of 704 "normal" Carnegie specimens in good condition, 70 percent were white, 18 percent were Negro, and the rest were "other" (4 percent) or unidentified as to race.

Mall's racial embryology project was inspired, in part, by physical anthropologists who collected and exchanged bodies, skeletons, and body parts to document anthropometric variations among various racial "types." Aleš Hrdlička (1869–1943), known as the founder of American physical anthropology, was one of these. Hrdlička was a Czech-born homeopathic physician who became a curator from 1903 to 1941 at the United States National Museum (which later became the Smithsonian Institution National Museum of Natural History). Hrdlička founded the *American Journal of Physical Anthropology* and was a central figure in the field. When Hrdlička needed specimens for an exhibit, he often turned to Mall. In November 1904, for example, Mall reportedly donated thirty-five fetal and newborn specimens—all of them "colored"—to Hrdlička at the United States National Museum, with subsequent "gifts" in 1906 and 1908 (Gindhart 1989:891). Hrdlička was a controversial figure, though, and Mall did not always agree with his conclusions about the role of science in documenting racial hierarchies.

A short departure from our subject serves here to illustrate Mall's commitment (at least in principle) to place data before prejudice. Between 1904 and 1906, in response to Hrdlička's suggestion, Mall permitted a former student, Robert Bennett Bean (1874–1944), to weigh and measure 150 brains from Mall's anatomical laboratory. Bean, trained as an anatomist and anthropologist, used the data to support Hrdlička's assertion that "racial differences exist in the Negro brain" (Bean 1906:354). Negro brains were smaller than Caucasian brains, Bean said, "the difference being primarily in the frontal lobe" (1906:411). Based on his assumptions about the functions of anterior and posterior parts of the brain ("association centers"), Bean concluded, "the Negro has lower mental faculties (smell, sight, handicraftsmanship, body-sense, melody) well developed, the Caucasian the higher (self-control, will power, ethical and aesthetic senses and reason)" (Bean 1906:412).

Mall facilitated Bean's research by providing the specimens, but he was not convinced by Bean's results. In 1909, Mall measured the same 106 brains again and came up with a different conclusion. He went public with his findings, publishing an article that refuted Bean and, by extension, criticizing Hrdlička. Mall said that Bean had used an inaccurate measuring device "borrowed from the Smithsonian Institution" (1909:9), that is, from Hrdlička. Furthermore, he said, Bean had allowed the "personal equation" (that is, "the measurement of differences between individual observers" [Menand 2001:269]), to influence his observations. To prevent this happening to him, Mall had conducted his research blind, "without . . . knowing the race or sex of any of the individuals from which the brains were taken" (1909:9). Bean had been wrong, Mall said; there was no discernable difference in the size of the frontal lobe. "With the methods at our disposal it is impossible to detect a relative difference in the weight or size of the frontal lobe due to either race or sex, and that probably none exists" (1909:15–16).

Mall may not look to us like a contemporary-style racial democrat, but he did pride himself on being an admirer of Franz Boas, the anthropologist who was then involved in a very public struggle against immigration restrictions and biological determinism. Mall and Boas had met at Clark University, where they worked in the same building, and Mall retained a lifelong interest in Boas's writings. Shortly after Mall's death, his widow wrote, "He was an almost fanatical believer in democracy and did not believe in limitation of the franchise by education, money, race or sex" (M. Mall 1918).

Given Mall's differences with Hrdlička, we might ask why he continued to collaborate with him. To answer this question, it is important to remember that these professional fields were much smaller in 1910 than they are today, and the fields of anatomy and physical anthropology were still closely intertwined, in both intellectual and practical terms. Mall was entirely dependent on the norms of professional courtesy and reciprocity for his own specimens, so of course he had an incentive to share specimens with his colleagues whenever circumstances and the law would allow. In 1913 Hrdlička again appealed to Mall for bodies. "Our object is to secure exact models of the newborn Negro and American child at birth, to form a part of the important series which will represent the two races by certain developmental stages from the birth to the most advanced senility" (Hrdlička 1913). Mall wrote back, not to insist that Negroes were Americans, too, but to explain that the law did not permit him to send cadavers across state lines (F. P. Mall 1913c). He did promise to notify Hrdlička the minute such a specimen arrived, so that he could send a sculptor over to make plaster casts.

Mall's daily correspondence often contained requests from colleagues for bodies and body parts, and while the law did not permit cadavers to be sent across state lines, it did permit the transportation of bones and skeletons. In 1915 he received a request from New York to provide "some typical negro femura, tibiae and mandibles" for a "primitive man" exhibit at the American Museum of Natural History. The anatomists at Columbia University were unable to fulfill the request, they said, because, "Our own material is pretty mixed and contains very few negroes. What there is of the latter is of the yellow 59th Street variety. I imagine that you draw your material from a purer layer of the Black Belt" (Huntington 1915). George Sumner Huntington was an old friend, and Mall wrote back to ask what the kind of bones the museum wanted. Four months later he sent a brief note to New York: "I am sending you by express the skeleton of a typical Baltimore negro for you to turn over to the museum" (F. P. Mall 1916a).

Mall suspected that the racial variation between further-flung populations might be even greater than between American blacks and whites, and he thought those differences might be evident early in embryological development. By 1915 Mall had in his possession some embryological specimens from the Philippine Islands, possibly collected by Lewellys Barker, Simon Flexner, and other members of the Johns Hopkins medical team that visited the Philippines in 1899, shortly after the Spanish-American War. Barker's description of the trip mentions that the team brought back "a large amount of pathological material to be studied later in Baltimore," although he does not mention embryos specifically (Barker 1942:71). In addition to the Filipino samples, By 1915 Mall had "a few pathological specimens from China." He was sufficiently intrigued by these exotic specimens to want more of them. "A preliminary survey of these specimens shows that they are unlike those obtained in the United States which indicates that there are special conditions in the Orient which we do not encounter here" (F. P. Mall 1915b). But the effort to expand the collection was slow and frustrating, especially when donors did not include information about the racial provenance of the specimens. Mall's exasperation is thinly concealed in his letter to Dr. Hammach in Manila. After thanking him for the specimens, Mall asks, "from an anthropological standpoint we like to have our specimens identified. . . . I am anxious to know whether any of these specimens are white" (F. P. Mall 1914b).

Mall wanted to ascertain whether developmental characteristics would vary according to race, geography, nationality, and other unspecified "conditions," but it is not clear what he thought those conditions might be. Nor did he specify which anatomical features would reveal racial differences, although he was fairly sure he would know them when he saw them. (Mall gave no indication that tails ranked high on his imaginary list.) He was not committed to the idea of racial purity, and he knew that miscegenation would have diluted many preexisting racial distinctions in North America. In 1905 he requested an "Indian brain" from a pathologist in Canada, who replied, "By the way I am a little doubtful as to the purity of the Indian strain throughout the Dominion. About here all the Indians have suspiciously French names, and when one remembers the moral character of the old 'Courreurs de Bois' [bush-rangers] one is inclined to suspect the origin of these names."[7]

Despite the questions about racial purity, Mall felt compelled to investigate whether racial differences could be discerned early in embryo development. With that in mind, he wrote another of his famous circulars. This one, titled "On the study of racial embryology," was sent to doctors on Canadian Indian reservations to invite them to send specimens to Baltimore.

> It is now desired to collect specimens from different portions of the world in order to ascertain whether the percentage of the types of variation as well as of pathological condition are constant in widely separated regions. We are still wholly ignorant regarding these points, but in order to test them I venture to ask whether it would not be possible to obtain specimens from your country in order to aid us in this work.
>
> If differences exist they would most likely be found in specimens collected from widely separated countries occupied by different races living under very different conditions. We can now compare European specimens with American whites; American whites with American negroes; and those from country districts with those from cities.
>
> We should like to include in this study embryos from American Indians, for we believe that the hygienic, sociological, and racial conditions between them and European embryos are greater than between American white and American negro embryos which come from people living under similar influences. Could you not inform me whether it would be possible to secure Indian specimens from British North America? (F. P. Mall 1916c)

But doctors based in foreign lands had limited opportunities to procure or even to encounter embryo specimens, as Mall soon learned. One doctor wrote from British Columbia to say that in ten years experience he had "seen but one case of abortion and only two of miscarriage and these at six months. These Indians are not very prompt in sending for medical attendance in case of sickness as the old women manage all such cases" (Henderson 1916). A similar letter arrived from Nova Scotia: "I have attended the Indians here for many years but have never met with a case of abortion" (Buckley 1916). And a physician writing from Ontario said, "The Indians seldom call a medical man for confinement or abortions and it will likely be some time before I will be able to procure specimens" (Gillie 1906).

In addition to the Indian reservations and hospitals serving Eskimos, Mall capitalized on American colonial and neocolonial exploits by asking American doctors overseas to gather embryos for him. He requested embryos from colleagues in Chile, China, the Philippines, and Korea. Mall's global quest was by far the most ambitious then underway, yet he faced at least one competitor who was also on the lookout for foreign embryos. George Corner wrote from the Labrador coast in 1913, "I have tried to cajole Dr. Wakefield, my chief, into sending you a Labrador fetus which he has, but it is promised to some English laboratory" (Corner 1913).

Mall would have liked to do comparative research on foreign embryos himself, but he was never able to get a sufficient number of them to feel confident drawing any conclusions. Eventually, he set the project aside without ever publishing a complete record of the foreign embryos he received. Due to lack of data, Mall never took a strong public stance on the topic of racial embryology. The topic was vigorously pursued after his death, though, by his associate Adolph Schultz, who explained to a colleague on the San Juan Reservation that he was:

> engaged in an anthropological study of racial characteristics as found in human embryos, which has been based for the most part upon the Embryological Collection of the Carnegie Institution of Washington. This comprises over 2000 specimens, most of these being white; but there are also a considerable number of negroes and a sprinkling of representatives of other races, such as Japanese, Malayan, etc.
>
> I have found marked racial differences even in the early stages of development. At the same time the individual variability is very great, and therefore we need a much more extensive material for study before definitive and trustworthy statements on the subject of racial peculiarities can be made. Of Indian embryos we have but a few. Nevertheless an examination of the latter, which show marked differences in the proportions of the face and other parts of the body as compared with white and negro in corresponding stages of development, convinces me that a further study of Indian embryos promises the most interesting results. (Schultz 1918)

In spite of his decision not to testify at the Scopes trial, Schultz was a flamboyant, colorful character. He loved to travel the world on collecting expeditions. His special interest was primatology, but he took advantage of any opportunity to enhance his collections of rare animal skins, bones, and embryos. At a time when physical anthropologists felt justified in acquiring bones and body parts without obtaining consent or considering the environmental or ethical consequences of their actions, Schultz wrote back to George L. Streeter, his boss at the CIWDE, to say that a New Zealand man offered to dig up Maori graves and send him the bones, and that in Panama a man invited him to come "and shoot all the monkeys off his place."[8] By 1928 Schultz boasted that he had "two hundred boxes containing my fetal skull collection" (although he does not specify whether these were the skulls of nonhuman or human primates). In addition, Schultz had in his collection many skulls of porpoises and manatees (Schultz 1928).

Schultz eventually did publish a series of papers on racial embryology (Schultz 1923, 1925a, 1926). Although Schultz was hindered by a scarcity of foreign specimens, he had ready access to American specimens of different races and nationalities and to scientific articles—however flawed—describing the "primitive races." Like many other physical anthropologists of the day, Schultz found his society's prejudices both reflected in and confirmed by the bodily evidence. For example, when he noticed that the clavicle bones are V-shaped in human fetuses, he was eager to compare their position in adults of different races: "In adult whites the collar bones, when in a normal position of rest, are almost or quite horizontally posed, but in adults of primitive races they have descended less from their fetal position. In view of the fact that in all monkeys and apes the clavicles stand very steep and do not descend during growth, it seems justifiable to conclude that the relatively low position of the shoulders in the white race is phylogenetically a progressive condition" (Schultz 1925a:252–53).

Schultz illustrates his claim about "adults of primitive races" with the drawing of a single New Caledonian man. For the most part, though, he was more interested in continuities between the so-called civilized and primitive races. This distinction allowed him to place Polish-, Russian-, Bohemian-, German-, Jewish-, and Italian-heritage embryos under the category of "white" or "European" (terms he used interchangeably). This group he counterpoised to "Negro" embryos. Schultz might have explained his choice of categories by appealing to the evolutionary similarities that he imagined existed within—as opposed to between—the two groups.

Most contemporary embryologists and physical anthropologists would agree that Schultz-style scientific racism—such as his comparison of the size of the nose in Negro and white fetuses (1920)—has been consigned to the dustbin of racist history. In the end, his voluminous piles of data revealed nothing about the hardiness or anatomical vulnerability of race. There is much to criticize in Schultz's arguments, but for our purpose the most important point is that his assumptions both reflected the social concerns of his

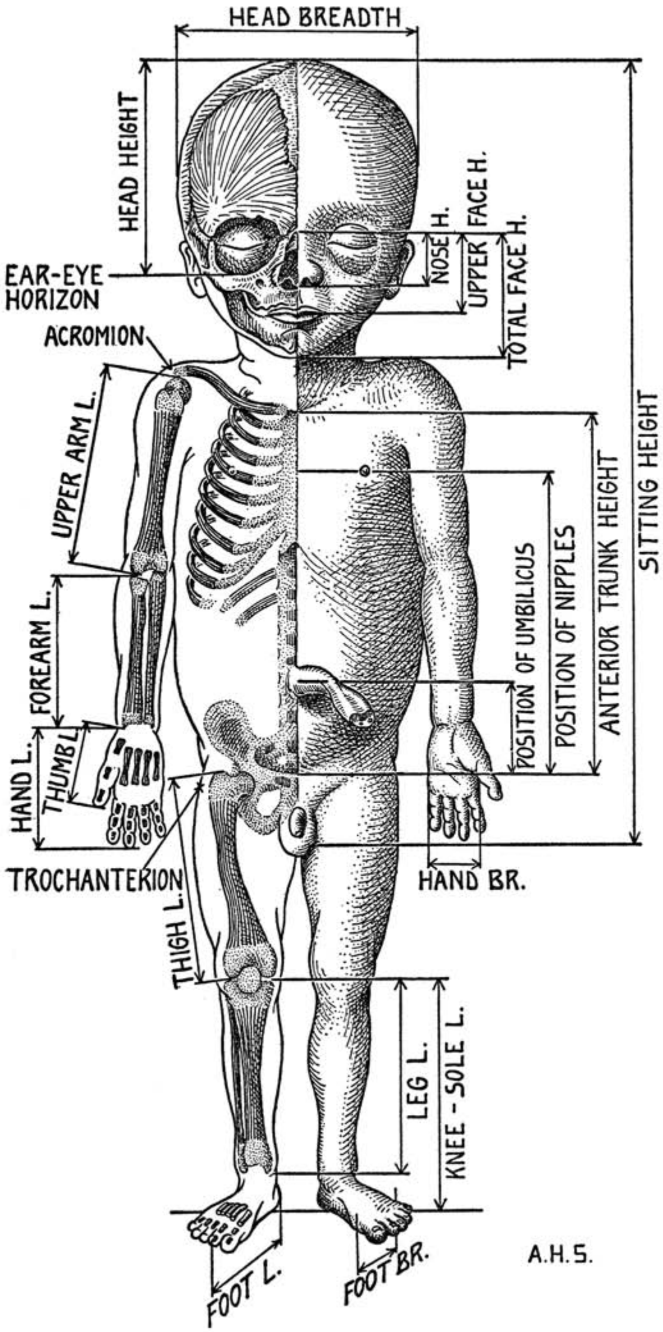


Figure 6. Measurements taken on human fetuses. From Schultz 1926:469.

times and influenced the kinds of embryos that he saw and depicted when he looked at the evidence. His tendency to discover precisely what he looked for in human embryos is still very much with us.[9]

THE PEKING EMBRYOS

Embryos, as we have seen, are molded around social concerns. Another illustration of this point comes from China, where an outpost of the Carnegie embryo-collecting project was established in 1919. The Peking Union Medical College (PUMC), financed and built by the Rockefeller Foundation, was inaugurated in 1921. It was patterned explicitly after the Johns Hopkins Medical School (Bullock 1980) and employed many Johns Hopkins–trained physicians. The anatomy department was headed by a Canadian anatomist named Edmund Vincent Cowdry (1888–1975), who had worked as an anatomy assistant under Mall from 1913 to 1916 during the heady first years of funding from the Carnegie Institution of Washington. Cowdry worked in Mall's lab while embryo collecting was taking off. When he got to China in 1919, he copied Mall's methods. He asked doctors to save human embryos and fetuses for him, in hopes of developing a collection that would serve at least three important goals: first, it would be used in medical education, especially for students entering obstetrics; second, it would provide important comparative data for the racial embryology project; and third, it would shed light on the theory of polygenism—that is, the notion that separate races of humans might have originated independently of one another in different locations (Stocking 1968:42–68).

Embryo collecting was tough business for a white man in China. Chinese cultural taboos against removing body parts made dissection and embryo collecting difficult at best. Cowdry had trouble obtaining even a few cadavers to use in anatomy classes. "At the end of a year and a half Cowdry had been able to procure only four bodies. When the first cadaver was carried through the rear entry, the technicians and *dieners* fled and no inducement could persuade them to return" (Bowers 1972:94). It was especially difficult for American doctors to appreciate the meanings the Chinese might attach to dead bodies and body parts, given that they harbored such ethnocentric attitudes themselves. Paul Huston Stevenson (1890–1971) was a missionary doctor who had been working since 1917 at Luchowfu Christian Hospital, Hofei, Anwhei, where he was desperately unhappy. He despised clinical work with its forced proximity to Chinese life. In 1920, Stevenson convinced Cowdry to offer him a position in the anatomy department at the PUMC, where he would measure the external form of the specimens much as Schultz was doing back in Baltimore (Anderson 1983). Stevenson attributed the high rate of miscarriage among poor Chinese women to what he saw as their repulsive cultural practices. What follows is a comment he made to the delegates at the PUMC inaugural medical conference: "Among some of the lower classes of the Chinese such factors as the health of the women, early and frequently incompatible marriages, marital unhappiness, frequent hysterical fits of unrestrained anger on the part of the women in the home, probably excessive intercourse, the practice of prolonging lactation to avoid pregnancy, and other causes, suggest themselves as possible factors in this subtle problem of the failure of many early ova to develop and their subsequent expulsion" (Stevenson 1922:337).

Stevenson was not the only ethnocentric doctor in the American ranks. Suspicion and mistrust characterized relations between some of the missionary American doctors and the people they treated, as seen in a letter I found in Mall's file:

> Your letter of June 16, 1913 with enclosures is at hand and we have read both letter and enclosures with great interest. We wish and hope to be of assistance to you in the splendid work of completing the collection of human embryos at the University.
>
> Owing to the ignorance and prejudice prevalent in China it has not been possible, so far as I know, to conduct, openly, any research work involving the use of dead bodies or materials derived from the human body, such as tumors, bones, foetuses, blood and so on to the end. It has been dangerous at times, even to make use of a manikin for teaching anatomy. But with the further entrance of the practice of western medicine into China, there has come a softening of prejudices and a slight decrease in the amount of ignorance so that now, in the ports and places more frequented by westerners, medical schools have been established and it has been possible to use manikins and even the human skeleton in teaching anatomy. Also some of the hospitals in the ports have been able to secure quite large collections of surgical specimens and I believe that there is, in Shanghai (a foreign governed concession), a collection containing some embryological specimens.
>
> Thus you can understand the difficulties under which we labor even in the most enlightened parts. Personally, we are inland, in a most conservative part of China and we have to be doubly careful. It will not be possible to openly collect any specimens but we may be able to make some collections unknown to any but ourselves. We shall be only too glad to do so if the opportunity offers. (Morgan and Morgan 1913)

The doctors, steeped in their own cultural assumptions and prejudices, did not question the necessity or ethics of embryo collecting. Yet they termed the Chinese "ignorant" and "prejudiced," and professed not to understand why the Chinese refused to regard the body as a set of parts to be dismantled, dissected, and dispersed. So strong was the doctors' righteousness, they told Mall they would even be willing to gather Chinese embryo specimens surreptitiously, in effect admitting that although they did not have the power to persuade people to relinquish embryos, they did have the power to steal them.

Despite the difficulties of procurement, between 1919 and 1925 Cowdry and his successors managed to collect four hundred specimens, which they kept in glass jars imported for the purpose from Germany. Cowdry's meticulous records of each specimen included the donor's name, specimen's race, national origin of mother and father, province of residence, menstrual history, and detailed notes about each case. Some of the specimens arrived rather tattered. The notes accompanying no. 15 reflect what I would like to believe is the pathologist's black humor: "Decapitated, dismembered, eviscerated, brain removed. Condition otherwise excellent" (Fortuyn 1927:26).

In 1927 the PUMC anatomists published a catalog of the specimens in their collection. *A Catalogue of the First 400 Specimens of the Human Embryological Collection in the Department of Anatomy of the Peking Union Medical College* offers an exhaustive account of the detail with which the anatomists examined their specimens. The catalog shows that the authors were preoccupied with racial comparisons, and that many of their observations and measurements were organized around anatomical evidence of racial variation. None other than Aleš Hrdlička took a keen interest in their work, because he was interested in the Asian origins of New World populations. As the anatomists examined Chinese embryos, they looked for evidence of "primitive characters" that might prove the Chinese embryos to be less evolved than the Europeans (1927:27). They also made special note of the three "mixed race" specimens in their collection, at a time when eugenists were arguing that miscegenation or "race crossing" might lead to racial degradation.

The PUMC anatomists were interested in several other features, any of which might demonstrate the earlier evolutionary genesis of Oriental populations. They evaluated the rate of growth and disappearance of fine body hair (called lanugo) on their fetal specimens, because hairiness was considered an evolutionary marker. Historian Frank Dikötter points out that "the persistence of embryonic conditions in the lanugo . . . was believed to be an atavistic manifestation of the original hairiness of mankind" (1998:86–87). For similar reasons, the anatomists paid particular attention to the anatomical feature known as the "Mongolian spot," a congenital birthmark that appears as a darkened area of skin on the lower back of their older specimens. This "pigmented area in infants of Oriental races," they explain, was hypothesized "to be a remnant of an ancestral cutaneous pigmentation," although they speculated it might also be "due to a bruise" (1927:37). They would ideally have liked to compare skin color, but unfortunately they found it difficult to ascertain skin color in preserved specimens. "The difficulties encountered in its study," they wrote, "are almost insurmountable. Due to conditions of blood, temperature and preservation, [skin color] may be cherry-red, pink, blue, black, paper-white, green, etc." (Fortuyn 1927: 74). With skin color ranging from cherry-red to green, they turned to hair color as a proxy for racial homogeneity. They clipped hair samples from the specimens, washed them, and evaluated the color, concluding that unexpectedly light hair in fetuses known to be of Chinese parentage was "perhaps an expression of the lack of genotypical homogeneity in the series" (1927:34). Moving on to other anatomical features, they evaluated whether testicles were descended in Chinese male fetuses, but they were disappointed that they could not find any literature on the age at which testicles descended in European fetuses (1927:82).

References to "mothers" were rare in the anatomists' notes on the specimens, in keeping with the custom established back in Baltimore. When the notes in the catalog do mention mothers, it is usually to emphasize some social pathology. The tendency to "other" Chinese women can be seen in the anatomists' attention to deviancy: "Mother died of gunshot-wound seven days after last menstruation"; "mother has a history of previous gonorrhea and was habitual opium-smoker"; "maternal secondary syphilis, opium addict"; "the mother was in a poor condition of nutrition." If birthing practices might have contributed to fetal death, the anatomists said nothing, with one exception: "Died during birth from manipulations of midwives" (1927: 50). I had to wonder, though, in reading several instances of crushed skulls, whether the too frequent use of forceps by western missionary doctors might have caused some of the fetal deaths. The notes on specimen no. 297, for example, read: "Occipital region of the skull and left frontal region crushed inward and eyeball collapsed during birth" (1927:51). The notes make no mention of the reasons why doctors might have been motivated to perform a hysterectomy on a woman who was twenty-five weeks pregnant (in the case of specimen no. 347). These examples show that the PUMC anatomists were not merely providing neutral descriptions of their specimens. They were interpreting the specimens through the prism of racial classification and scientific racism, and they took the opportunity to conflate social and anatomical pathologies among the Chinese.

It takes a close reading of the catalog to realize that *only seven* specimens were bona fide embryos from the first eight weeks of development. Eight of the specimens were infants and the rest were fetuses, mostly from the later weeks of gestation. Why did the anatomists call what was in reality mostly fetuses a "human embryological collection"? The answer is that the young embryos were rare and hence prestigious, while older fetal specimens were abundant and mundane. The reputation of the PUMC anatomists would have been enhanced by acquiring Chinese specimens from the embryological period, and they hoped to amass a large collection. As Stevenson said, "Not until they number thousands instead of hundreds can such questions as norms, curves of growth, frequency and causes of abortion, and many other subjects be studied" (1921:505); he added, "If the collection is to contribute to the solution of the complex racial problems referred to above, it must contain the largest possible number of specimens from all the four corners of Eastern Asia" (1921:506). It was this kind of wishful thinking that led them to exaggerate the number of embryo specimens in their collection.

Competition for embryo specimens took on something of the character of a race. Stevenson boasted to delegates at the PUMC inaugural congress that his department had acquired 155 embryological specimens in under two years, while it had taken Mall ten years to collect his first 100 specimens, "five years to collect the second hundred, three years for the third, and two years for the fourth" (Stevenson 1921:504). Mall had died and could not defend himself. But Cowdry, who was by then back in the United States, wrote to admonish Stevenson for exaggerating. He pointed out that Mall had collected *embryo* specimens, while the PUMC collection was comprised largely of *fetuses.* "There is only one point about which I am a little doubtful," Cowdry wrote. "On page 2 you draw a comparison with the collection of *embryos* made by Doctor Mall. It seems to me, on thinking it over, that this is not quite valid because after all the collection which we have made in China is almost entirely of foetuses. If Doctor Mall had been collecting foetuses he could easily have obtained ten times the number in the same time. As far as embryos are concerned our rapidity of collection does not compare favorably with his" (Cowdry 1922; emphasis in original). Stevenson was undoubtedly trying to put a positive spin on the PUMC's undistinguished fetal collection, but his grandstanding attempt to co-opt the grandeur associated with "embryos" merits a brief digression for the benefit of twenty-first-century readers.

The allure of the embryo was on full display in 2005, when President

George W. Bush appeared at a press conference to oppose human embryonic stem cell research. A number of so-called "Snowflake" children were dressed up for the cameras, all of whom had been "rescued" as embryos from fertility-clinic freezers and "adopted" through the Nightlife Christian Adoption Agency. Some of the children had slogans on their T-shirts, reading, "This embryo was not discarded" (Belluck 2005). The motivations behind the PUMC catalog and the Snowflake children were of course quite different, but in both cases the framers tried to leverage a political advantage by stretching the definition of "embryo" in presenting their subjects (fetal specimens and adopted children, respectively).

I have tried to imagine what the Chinese must have thought about the PUMC embryo collecting project in the early twentieth century. Dikötter writes about some of the xenophobic misperceptions that Europeans and Chinese had about each other's anatomy. "The negatively accented vision of the [western] foreigner," for example, "would be dominated by the stigma of hair," as well as their bad body odor (Dikötter 1992:46–47). That mutual antagonism was often couched in anatomical idioms is clear, although I could not find any literature on how the Chinese regarded the westerners' desire to collect dead fetuses. What would they possibly be looking for? Maybe the Chinese thought that westerners regarded embryos as talismans, or used them for devilish rituals. Perhaps the westerners extracted fat from the juicy bodies and turned them into soap. Perhaps they ate them. The suggestion is not so far-fetched. In 2001, a story circulated on English-language Internet about a soup, popular in Shenzen, allegedly made from aborted human fetuses, pork, and ginger. If "we" can imagine "them" capable of such atrocities, surely "they" can consider "us" equally barbarous. Assuming the hypothetical outsider's perspective makes embryo collecting look truly bizarre. It also highlights my argument that embryo specimens are not natural entities but cultural products. The Chinese collecting enterprise has to be seen at least in part as a colonial project, rooted in American scientists' assumptions about racial regimes, scientific privilege, and the "nature" of embryonic and fetal remains.

Ultimately, the PUMC fetus collection had little scientific value. The anatomy professors used it occasionally for teaching purposes, but as a research project it failed. The racial differences the anatomists expected to find were simply not present in the data, even after the most painstaking analysis. The racial comparisons in which the anatomists had been interested fell out of favor back home as "embryology declared its independence from evolutionary studies and set out to become a science based in both anatomy and experimental physiology" (Gilbert and Faber 1996:126). From the anatomists' perspective, the PUMC collection was practically worthless. It was too small to serve for comparative purposes and it contained too few actual embryos to merit sectioning. In contrast to the physiological research being conducted on fresh embryos in the United States and elsewhere, the PUMC collection could offer nothing at all to the field of experimental physiology.

It was only through serendipity that I learned about the PUMC collection. One day, after spending the morning in the archives at Harvard's Countway Medical Library, I ventured downstairs to look at the embryology section of the stacks. A patron in the next aisle slid a book too far into the shelf, pushing a small yellow pamphlet onto the floor at my feet, and *voila!* Apart from that one catalog, however, the PUMC collection seemed to have vanished from the embryological literature. My curiosity piqued, I wanted to know what had happened to the specimen collection after 1927. Eventually my inquiries were answered by Dr. Zhang Bingchang, professor emeritus and former chairman of the anatomy department at the Peking Union Medical College.[10] I quote his response in its entirety:

> The embryo specimens were preserved in glass jars with formalin. These jars were either stored in display cabinets or stacked on the floor of the department attic. As the embryo collection did not arouse the interest of PUMC anatomists, it never became the subject of further publications after 1927 and the glass jars have been lying idle in the attic covered by thick layers of dust. Nobody went up into the attic unless there was a need to search for special specimens such as quadruple amelia, meroanencephaly, polydactyly, etc. for demonstration during embryology classes.
>
> After China's liberation in 1949, PUMC underwent several closures, and every reopening resulted in an expansion of the Anatomy Department. Eventually, the embryo collection was moved from the attic to the department basement, as more space was needed for new labs and specimen display. Most of the glass jars in the embryo collection were used for other purposes and this resulted in the disposal of the embryo specimens. As far as I know, approximately 100 glass jars remain untouched, but the specimens are either dried up or decayed and cannot be used anymore. The person in charge of the lab told me that the reason why these 100 specimens are still kept in their original jars is that the jars are being kept for future use, not for preserving the embryo specimens. It seems to me that the remaining specimens will be discarded in the future. (Zhang 2000)

As Dr. Zhang pointed out, PUMC anatomists ceased to be interested in the embryo collection after the 1920s, when anatomists stopped suggesting that embryological evidence could resolve racial questions. Zhang's observation that the glass jars are now considered more valuable than the embryos was revealing, reminding us that the expense of the glassware was once justified by the value of the specimens. Now the politics of value have been reversed, the specimens reduced to being the unwanted contents of precious jars.

As a final note to the PUMC investigation I asked a former student, Juno Obedin-Maliver, to visit the PUMC fetal collection during her visit to China in the summer of 2004. Fortunately for me, she was happy to oblige. Accompanied by a translator, she met with the vice-director of the Department of Anatomy, Histology, and Embryology, who was kind enough to show her what remained of the collection. He did not know much about its history, Juno reported, nor did he grant it any importance. He insisted that seeing the collection was pointless; he repeated the word *meaningless* several times. She took a few pictures of the dust-covered, ill-preserved specimens. "The overall presentation was to my eyes disconcerting," she wrote. Perhaps sensing her dis-ease, the vice-director suggested that other schools had much nicer collections. A new and improved presentation of fetal development, he promised, would be coming soon to the PUMC.

EMBRYOS SPEAKING FROM THE WOMB

Just as I was finishing this chapter, an unsolicited package arrived in the mail. It was from Dr. Louise Ireland-Frey, a medical doctor and certified clinical hypnotherapist, now in her eighties, who received a master's degree in zoology from Mount Holyoke College in 1936. Cleaning out her files, she had found a spiral-bound manuscript. She put it in an envelope addressed to, "Embryology Staff, Zoology Department, Mount Holyoke College." The zoology department was eliminated in the 1960s so the package was forwarded to the developmental biologist on this faculty, who sent it to me. The manuscript was called "Embryos Speaking from the Womb." It is, in Ireland-Frey's words, "a very old true story" of the "prenatal adventures" of human embryos. The manuscript documents the stories that Ireland-Frey compiled in the 1950s from three individuals (one of whom was Ireland-Frey herself), who were "regressed" under hypnosis to the point that they recovered their own prenatal memories. Her hope, she wrote, was that future embryological research "will come to include the psychospiritual aspects of human prenatal development of mind and soul as well as the well-known physical development of the body" (Ireland-Frey n.d.:xvi).

The theory sounded far-fetched to me, but just a few minutes of Internet research showed that Ireland-Frey had plenty of company. While at Mount Holyoke she had studied theosophy, a religious perspective that attributes consciousness to all animate and inanimate things. Historian Sara Dubow says that theosophists "rejected the eugenic understandings of heredity, arguing instead that genetic inheritance could be weakened or strengthened by a mother's thoughts and feelings during the period of 'prenatal life.' Mothers 'must commence their training of their children before they are born,'" insisted Annie Besant, a theosophist leader, "because 'at the moment of birth there is no doubt that a child's whole moral disposition is contained within'" (cited in Dubow 2003:26–27). Ireland-Frey's exposure to theosophist teachings no doubt inspired her, for she became a pioneer in the field of pre- and perinatal psychology.

Pre- and perinatal psychology is a movement that emphasizes the spiritual and emotional consequences of life before and during birth. Prenatal psychologists personify embryos and fetuses, attributing consciousness to them and accepting them as spiritual beings. Ireland-Frey and her colleagues claimed to speak for embryos, to reveal the secrets of their "cellular consciousness" and to *channel* their thoughts into a wider social forum. The forward of Ireland-Frey's manuscript was written by Michael Gabriel, coauthor of *Remembering Your Life Before Birth* (1995). Gabriel argues that the "unborn infant" is not only conscious but deeply affected by its mother's feelings, and that people can uncover their own repressed prenatal memories if only they are willing to try. Unborn babies are sensitive spiritual beings, he says, whose prenatal experiences can affect their worldview and personality throughout life. Members of the Association for Pre- and Perinatal Psychology and Health lobby for gentle birthing techniques, convinced that traumatic childbirth can mark a person for life. The focus of the association is on "consciousness, not matter, [as] the fundamental basis of life," in the words of one reviewer of Gabriel's book (Adzema 1996). Readers will detect a similarity between the old notion of prenatal influence and the new prenatal psychology.

Many mainstream psychologists and psychiatrists are critical of this movement, arguing that prenatal psychology is not supported by the empirical evidence uncovered since the early twentieth century. In other words, pre- and perinatal psychology is inconsistent with the embryological view of development. Skeptics disagree that embryos are capable of spirituality and emotion, and they argue that the standards of replicability, explanations of physiological mechanisms, and evidence of treatment efficacy are lower than what is required using the scientific method.

Let us consider, for a moment, the alternative point of view. Let us imagine the prenatal psychologists as a rare breed of courageous renegades who have banded together to reject the mainstream cultural origin story. They are convinced that the embryological view of development is incomplete, that it misses an important spiritual dimension of the story. By asking whether it is possible for human embryos to have feelings and emotions, they represent the mind end of the dualistic mind-body spectrum. Here I am less interested in knowing who is "right" than in the social significance of having the question posed. The emergence of prenatal psychology can be seen as an ideological and political posture, a challenge to the hegemony of the embryological worldview. The question remains, who claims to know what embryos and fetuses are saying, and what kind of social work is required to police this boundary?

Today, images of embryos and fetuses speak—loudly—on a range of contentious topics including gender, abortion, and reproductive technologies. Similar concerns were on the minds of early twentieth century reformers, including suffragettes, medical doctors who advocated greater leniency to perform therapeutic abortions, and birth control advocates including the famous Margaret Sanger (Chesler 1992; Fee 1987; Gordon 1976). Curiously, though, embryos were rarely invoked as evidence in those debates. Embryos *were* invoked, however, to speak about an entirely different range of concerns, including race, evolution, nationalism, and whether humans were special in relation to nonhuman animals. Similar concerns are on the minds of early twenty-first-century reformers and activists, yet today's animal rights debates, for example, rarely revolve around embryological evidence. And in 1974, the authors of a popular book about pregnancy and childbirth expressed their preoccupation with overpopulation, nuclear proliferation, and the effects of radiation on fetal development (Rugh and Shettles 1974). The historical contrast shows the extent to which embryos take their shape and meanings from the scripts they are asked to read, rather than from the material evidence or sectioned specimens.

We have seen that embryos' utterances reflect—can *only* reflect—the concerns of those who teach them to speak. Of course embryos do not speak for themselves. Yes, an unacknowledged pregnancy will eventually assert its material presence, but only in a social context can an embryo (or newborn, or any other social being) acquire meaning. Embryos were once thought to reside in nature, but even "natural" anatomical features (such as tails and feet) are selected to correspondence to specific social controversies (Clarke 1998; Haraway 1997; Hartouni 1997). The embryologists believed that embryos were "of nature," so they would probably have rejected the suggestion that they were inventing embryos or telling them what to say. They preferred to think of themselves not as ventriloquists or scriptwriters, but as interpreters who would give voice only to the embryos' material truths. We now understand that embryos signify only what we ask them to signify.

There was a time when the embryo-fetus was not politicized or considered a protoperson. Hardly anyone asserted its right to life, or health, or to inherit property. The practice of collecting human embryos—cutting them into serial sections, and interpreting the results through the lens of biological science—was part of the effort to discipline, regulate, and control the embryonic form (Clarke 1998). But just as embryologists materialized the embryonic body and claimed it for science, so they authorized themselves to control and shape the interpretations that would be made of it. The embryologists denied their own authorship of the embryo, claiming that the embryonic body was speaking for itself. Their interpretations of the embryo's corporeal features were ostensibly based on a rational, unemotional examination of the biological evidence. From today's vantage point we can see the lasting social consequences of the knowledge they produced. They helped to construe the human embryo as an autonomous actor, detachable from women's bodies and motivated solely by biological forces. They helped to position the embryo as an arbiter in disputes about the moral implications of possessing a particular bodily feature such as the tail. By allowing the embryos to take sides in the culture wars over evolution and women's suffrage, they introduced the embryos into political debates. Meanwhile, the embryos paid little attention to pregnant women or to the social circumstances that influenced whether and how nascent persons come into being. In all these ways, the embryologists breathed life into their precious specimens, animating them to tell their embryonic tales.

SEVEN

From Dead Embryos to Icons of Life

I am not above picking up the supermarket tabloids for a particularly juicy story. One day, next to a headline that read, "Migraine headaches caused by evil demons inside your head," I saw a story called "SICK! Artist makes earrings from human fetuses" (Bowie 1994). I shook my head. Disgusting. But the headline also struck me as another ingenious version in a long line of stories sowing disinformation about offensive acts involving fetal tissue. Curious to know whether the story contained even a small kernel of truth, I bought a copy and took it home, where I looked up the supposed artist's name on Google. Of course I found nothing. Only the shameless *Weekly World News* could have fabricated something so twisted.

I should have known better than to be so sanctimonious. In 1990, an artist (of a different name) had displayed a work called *Human Earrings* in London. The exhibit consisted of a model of a head wearing earrings made of actual freeze-dried human fetuses, each with "a ring fitting tapped into its skull and attached at the other end to the model's earlobe" (Childs 1991:20–21). It was distasteful in the extreme, but I also found it provocative in a Robert Mapplethorpe–type way, as a challenge to the standards that govern embryo exhibitions. The prenatal development display at the Museum of Science and Industry could pass as educational, but embryo specimens worn as earrings earned the artist a fine for violating the public decency. I was both repulsed and intrigued.

Just a few days later, reading an account of the Carnegie embryo collection written in the 1940s, I was struck by a description of the earliest specimen in the collection—thought to be about seven-and-a-half days old—as "a veritable jewel in the treasury of science" (Corner 1944:15). A jewel? The author went on to say that each of the nine thousand specimens was "an honored and cherished gift upon the altar of truth" (1944:29). I started paying attention to treasure-hunting metaphors used by the embryo collectors, which captured the prospecting aura that sometimes infused the language of collecting. In 1874, Ernst Haeckel said that "human embryos hold within themselves a greater treasure of the most important truths and form a deeper source of knowledge than most sciences and all so-called 'revelations' put together" (quoted in Hopwood 2000:35; see also pp. 38, 39, n. 22). As embryologists acquired more and better specimens, the earliest embryos were always the most precious. In the early 1930s, Boston pathologist and embryo prospector Arthur T. Hertig said, "Human ova in the first 15 to 20 days were so scarce that isolated examples found in the surgical laboratory were prized, worth their weight in gold, and named after the person who found them" (Scully 1988:368). The pedant in me wondered briefly if Hertig might have chosen a different metaphor—because of course the earlier the embryo, the less it weighs—but he was making the point that early embryos were exceedingly valuable.

The metaphor of embryos as jewels is still used. Feminist philosopher Bonnie Steinbock, writing about embryo research in the contemporary era, said, "We show respect for human embryos by not using them in unimportant or frivolous ways, say, to teach high school biology or to make cosmetics or jewelry" (Steinbock 2000:127). Reading this, I imagined a tiny human embryo shimmering in gold leaf. Of course Steinbock was talking about living embryos rather than dead specimens, but the point remains that it is considered taboo to use actual embryos—living or dead—as jewelry.[1] An embryo specimen can only be a metaphoric jewel, and a jewel can only be a figurative (rather than a literal) specimen, as in the "womb with a view" earrings on the opposite page.

Unbeknownst to many readers, images of embryos and fetuses portrayed in magazines and books are often actually dead specimens, posed to look as though they are alive and meant to be interpreted as symbols of life. In the following pages, I describe three separate instances of the sleight of hand that occurs when dead specimens are dressed up (or disguised) so as to appear lifelike. The first takes place in the late 1950s to early 1960s, when the Carnegie's Department of Embryology shifted its focus from human embryological morphology and stopped collecting specimens. As embryos

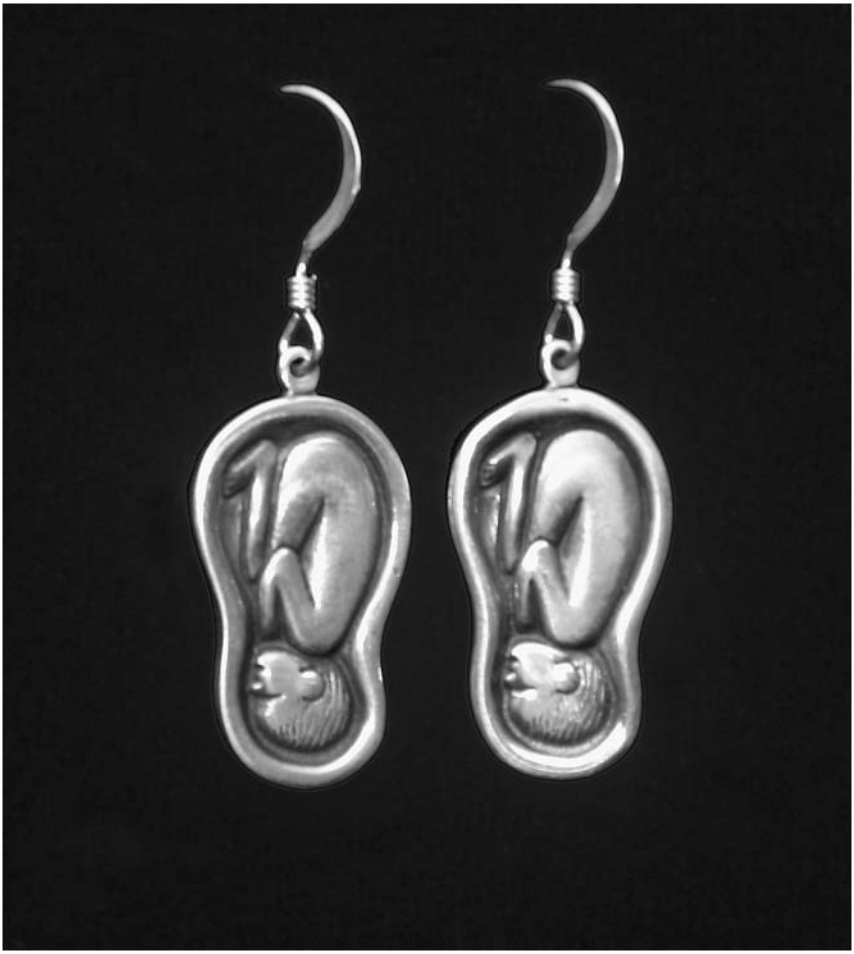


Figure 7. "Womb with a view" earrings. Silver, 2 cm. long. Designed by Russell Wray, www.raventreegallery.com.

and fetuses began to move outside of the laboratory and into popular culture awareness, Carnegie photographs were approved for use in a popular 1962 book, *The First Nine Months of Life,* a slim, educational account of prenatal development designed to appeal to young parents-to-be. The second example concerns the literal animation (or metaphorical resurrection) of Carnegie embryo no. 836—recently digitized as the prototype for a new, computerized embryo-imaging educational program. The third example is the beautiful, best-selling coffee-table book *From Conception to Birth* (2002). Full of computer-enhanced visualizations of human embryological development, the book is dedicated "to the individuals who have had the foresight to assemble and preserve the Carnegie Human Embryo Collections." Astonishingly, all three of these examples utilized dead fetal specimens from (or inspired by) the Carnegie collection, although the collection itself has virtually disappeared from historical consciousness.

THE 1960S: FROM FETAL SPECIMENS TO BABIES BEFORE BIRTH

Embryo collecting fell out of fashion in the 1960s, for a host of reasons. The embryo collectors were put out of business as a result of changes in the discipline of embryology and medical education, the dissemination of new images and photographs, and the intensification of the abortion debate. The discipline of embryology was subsumed under the broader, more comprehensive field of developmental biology (S. F. Gilbert 1991). Developmental biologists were more interested in molecular biology, genetics, and the differentiation that turns genotype into phenotype than they were in descriptive morphology, and most of them had long since ceased to be interested in building big specimen collections. In undergraduate colleges such as Mount Holyoke, the departments of zoology, physiology, and botany merged into a single department of biological sciences, where new ecosystems approaches replaced the anthropocentric curricula of an earlier era. Meanwhile, the teaching of human embryology, anatomy, and physiology moved out of undergraduate institutions and into medical schools. Sometime in the 1960s, undergraduates stopped being instructed to contemplate pickled human specimens or to draw the fetus with colored pencils.

The solidification of the embryological view of development in the 1960s coincided with the women's rights movement and the movement to liberalize abortion laws in the United States. One result was greater attention to embryos and fetuses. German historian Barbara Duden, for example, cites Swedish photographer Lennart Nilsson's famous photographs of embryos and fetuses, one of which appeared on the cover of *Life* magazine in 1965, as a turning point for the emergence of fetal imagery into the public arena. These pictures, she says, "have since become part of the mental universe of our time" (1993:14; see also Franklin 1991:195). In 1962, *Look* magazine reinforced some of the themes commonly associated with embryo photos—magnified drama and dramatic magnification—when it published "Dramatic photographs of babies before birth" (Flanagan 1962a). There is undoubtedly some truth to the claim that fetal imagery began to proliferate more rapidly in the 1960s, although Hopwood notes that "series of human embryos were already on display to wide audiences" much earlier (Hopwood 2000:78). The difference was that the new imagery claimed the fetuses were *alive*.

The proliferation of fetal images coincided—perhaps "collided" would be a better word—with the escalating debate over abortion. The issue came to the fore with the heart-wrenching, highly publicized case of Sherry Finkbine, who was hostess of the popular children's television show *Romper Room* and a thirty-year-old mother of four. When Finkbine was pregnant with her fifth child in 1962, she was given the drug thalidomide to help her to sleep. Soon afterward she, along with the rest of the world, realized in horror that thalidomide, if taken during pregnancy, could cause children to be born seriously disabled, sometimes without limbs. When word got out that Finkbine's physician had recommended a therapeutic abortion, local hospital authorities got nervous and reversed their decision. Amid ferocious controversy and nonstop news coverage, Finkbine flew to Sweden, where she could secure a legal abortion. Afterward, doctors told her that the fetus had been severely deformed and would not have survived. Abortion was not legalized in the United States until eleven years later (Luker 1984; Petchesky 1984; Tribe 1990).

Here I will not dwell on the Supreme Court's 1973 *Roe v. Wade* decision except to note that the legalization of abortion made more specimens available, at least potentially, to Carnegie collectors. In July 1968, Maryland became one of the first states to liberalize its abortion law. In September 1969, a Carnegie embryologist and placentologist named Elizabeth Maplesden Ramsey (1906–93) was following the situation closely. She wrote to a colleague that she was "particularly interested in the specimens derived from the 'new era' in abortion activity," although she was still evaluating the law's impact on the quality of specimen material that she could expect to receive. She suspected that the methods used to induce abortion might cause specimens to become macerated (that is, to fall apart after being retained dead inside the uterus). "Nothing," she said, "equals the 'operative termination' cases [that is, hysterectomy or hysterotomy] from our point of view" (Ramsey 1969). Carnegie embryologists still preferred specimens fresh from the operating room.

It is a historical irony that the spike in availability of specimens occurred just as specimen collecting was in steep decline. At its heyday in 1919, 760 specimens had been admitted into the Carnegie Human Embryo Collection in the space of a single year. Five years later, the Carnegie embryology laboratory received over five hundred specimens per year on average. Specimens arrived so fast that Mall instructed larger "embryos" (that is, fetuses) to be stored collectively in one jar: "If the embryo is large enough, a metal tag, bearing its number, is attached to one of the extremities. This makes it possible to store several of the larger specimens in one jar" (Mall and Meyer 1921:25). At Mount Holyoke College, too, fetal specimens belonging to the physiology department were stored together in a large ceramic vat and taken out as needed (C.G. Smith 1997). As the collection grew, the CIWDE ran out of room to store them and larger specimens were periodically incinerated (Heard 1979). Even the director lost track of how many specimens were on the premises. George Washington Corner (1889–1981), who directed Carnegie embryology from 1940 to 1955, had to admit in 1946 that he did not know exactly how many embryological specimens were in the collection. Specimen numbers had occasionally been assigned to "placentas, ovaries, oviducts, etc.," he said, and sometimes a single number referred to "fetuses received in a lot." Corner nonetheless estimated that "the collection includes specimens or records of not less than 10,000 individual human embryos and fetuses" (Corner 1946:125). Of the 10,000-plus specimens that the Carnegie held by World War II, 441 embryos of "superior" quality and nearly 2,000 others had been made into complete serial section sets (Corner 1946:125).

After the war, the Carnegie Institution of Washington Department of Embryology (CIWDE) began to move in other directions, to situate itself on the cutting edge of developmental biology. George W. Corner resigned in 1955, and went on to write a history of medical research at the Rockefeller Institute. As his replacement, the CIW sought someone who would take a different approach. They selected James David Ebert, who was eager to build on the recent discovery of the structure of DNA (in 1953) and to sponsor new investigations in molecular biology, biochemistry, genetics, and protein synthesis. As described by Adrianne Noe, Ebert "established his directorship in accordance with the CIW's desires that he bring to their Department the newest exploration technologies, molecular studies, and *a science that was not dependent upon the collection based on serial sections* that had been a key to the progress of the six earlier decades" (Noe 2004:47; emphasis added). Ebert instructed the staff to stop soliciting embryo specimens and to begin cleaning house. He opted not to continue the collaboration with Rock and Hertig to search for early human embryos. He had the collection culled to remove specimens that were faded, decomposed, or otherwise not conducive to research. The changes were documented by Elizabeth Ramsey, who had been hired in 1950 and whose claim to fame was her discovery in the 1930s of a fourteen-day specimen. (Contrary to Scully's claim that very early embryos were "named after the person who found them," Ramsey modestly christened her specimen "the Yale embryo.") Ramsey's responsibilities included processing incoming specimens, and she observed the decline in numbers of specimens arriving in the laboratory, although she noted that a few loyal donors continued to send material. In 1958, only ninety-one specimens were received, of which "69 were discarded as of no research value" (Carnegie Institution of Washington Department of Embryology 1958). By 1962 Ramsey processed only thirty specimens, of which twenty-two were discarded. The embryo-collecting project was effectively over.

In 1957, according to Noe, a decision was made to move the human embryo collection out of the CIWDE facilities. Not only was it no longer considered necessary to the CIWDE's work, but it took up valuable space. From that point forward, the person to take the greatest interest in preserving and utilizing the Carnegie collection for research was Ronan O'Rahilly, a Swiss-born embryologist at Wayne State University who had worked with the collection since about 1956. In 1969, so he could concentrate on the Carnegie collection, O'Rahilly stepped down as chairman of anatomy to move to Baltimore. In 1971, he returned to Detroit with the sponsorship and support of his friend the anatomist Ernest Dean Gardner (1915–78), who happened also to be dean of the medical school at Wayne State. In 1973, he moved the Carnegie collection to the University of California, Davis, where Gardner had just accepted a position. They took with them a comparative collection that had been left to them after their colleague Hans Bluntschli (1877–1962) died. Bluntschli had been a Swiss comparative anatomist who gathered embryos from nonhuman primates and other mammals during his collecting expeditions in South America and Madagascar in the early twentieth century. His serial sections of nonhuman primate embryos provided a justification for locating both the Carnegie and the Bluntschli collections in the facilities of the University of California, Davis, California Primate Research Center, where it was reopened—with vastly fewer resources—in 1975.

When Gardner died in 1978, the project lost an important champion. O'Rahilly "carefully curated the collection" for the next fifteen years (Noe 2004:48), but needed to fight for adequate resources to house it and to conduct his research. In 1982 he was in serious danger of losing space for the collection and its voluminous entourage: "all 10,299 associated records (one for each individual that had ever been in the collection), whole embryos, models, instruments, publications, and thousands of reprints" (Noe 2004:49), not to mention materials for his own research. "'Carnegie Village' is a lost cause," he confided in a letter to Ramsey. He was referring to his dream of having the collection in five contiguous buildings, but it was not to be: "We are not limited to defending space requirements for our own work and for the collection. Our physical separation (several miles) from the collection is a disaster both for us and for the collection" (O'Rahilly 1982). O'Rahilly never secured the space he wanted, but he continued to solicit specimens from a few chosen colleagues. Meanwhile, he and his wife, Fabiola Müller, wrote numerous scientific articles and books about embryological development, teratology, and the development of the nervous system, culminating in the 1987 monograph *Developmental Stages in Human Embryos,* which is still considered the most authoritative source on the Carnegie collection. When O'Rahilly and Müller retired and moved to Switzerland in 1990, a number of institutions bid to acquire the collection. The Carnegie Institution of Washington decided to turn it over to the Human Developmental Anatomy Center, which had been set up at the National Museum of Health and Medicine specifically for the purpose of housing collections of specimens related to developmental anatomy. The Carnegie collection arrived in Washington in 1991 and has been there ever since.

Mall and his successors spent more than fifty years collecting human embryos, and the results of their effort continue to be the standard against which all embryological development is measured. In O'Rahilly's words, "The rest of the world continues to look at the Carnegie Collection as the 'Bureau of Standards' in human embryology" (O'Rahilly 1987). Yet quite apart from its value in documenting the empirical trajectory of embryological development, the specimen-collecting phase of human embryology (roughly 1910–50) was a significant if now largely forgotten part of the historical process through which fetuses acquired their contemporary meanings in the United States.

The significance of the collection reverberates in subtle ways, not usually recognized except by historians (Clarke 1987; Hopwood 1999; Noe 2004). By rerouting human embryonic and fetal remains away from women and families and toward the domain of medical science, the embryo collectors separated the production of the embryos (in women's bodies and lives) and consumption of the embryos (in scientist's laboratories, museum displays, and pregnancy manuals). They "disciplined reproduction" by bringing human embryological development into the purview of medical and biological science and by discrediting alternative explanations for how we came to be (Clarke 1998). They convinced subsequent generations that tissue resulting from abortion, pregnancy loss, and autopsy belonged properly to medicine. Although the ethical use of embryo specimens is obviously the subject of great debate today (Mulkay 1997), human embryo and fetal specimens continue to be defined as medical waste and directed (with informed consent) from women's bodies through the corridors of medicine to the embryologist's laboratories. There, the embryologists use their tools—microtome, microscope, and modeling—to slice and scan embryos into new shapes and forms, until it is impossible to distinguish what embryologists know from the techniques they use (Jones 2000:244). The great achievement of Mall and his colleagues was that they shook the embryo free of its social trappings and reconfigured it as a naturalized biological specimen, where it could eventually be re-presented as an icon of life.

As fetal specimen collections disappeared from view, other sorts of fetal images began to spread across the visual landscape of popular culture. Most, but not all, of the newer images showed embryos and fetuses as symbols of *life.* The graphic portray of dead fetuses and embryos is, for all intents and purposes, now taboo in American society with only a few exceptions. One is the private world of hospitals, clinics, and funeral homes, where medical personnel, pathologists, and morticians continue to handle the remains of miscarried embryos, fetuses, and stillbirths. Another is anti-abortion propaganda, where images of bloodied and dismembered fetal body parts are designed to shock spectators and convince them that abortion is horrible. A third exception is a steady trickle of lurid news stories about dead fetuses that dot the crime pages, especially when fetal remains are found in inappropriate places such as toilets, trash bins, and sewage treatment plants. Apart from those specialized venues, it is rare to see unborn humans matter-of-factly depicted as dead. Pro-choice advocates never display fetal remains, and women's personal experiences with abortion and miscarriage are socially taboo, circulating—if at all—only in private conversations or specialized support groups (see Baumgardner 2005; Layne 2003). Dead embryos and fetuses are forbidden.

DEATH IN *THE FIRST NINE MONTHS OF LIFE*

In 1962 dead specimens were transformed into icons of life in a brief and unlikely collaboration between the neuroanatomist Davenport Hooker (1887–1965) and a writer and childbirth-education advocate named Geraldine Lux Flanagan. The story begins in Hooker's University of Pittsburgh laboratory in 1932, where he began to conduct research on living aborted fetuses. For the next quarter century, Hooker and his colleague Tryphena Humphrey studied the "prenatal function of the central nervous system" in an attempt to resolve a rather technical neurological debate: was prenatal neurological development guided by a central principle, or did reflexes develop independently of one another in each organism (Davenport Hooker 1958:10)? Untold thousands of animals had already been sacrificed to study this question, including rabbits, terrapin, rats, toadfish, pigeons, frogs and toads, sheep, loggerhead turtles, fetal cats, and guinea pig embryos. Hooker proposed to study the question in humans.

Hooker knew that embryologists were able to perform research and create unique specimens when *ex utero,* nonviable, living embryos and fetuses appeared in the laboratory. On such occasions, the embryologists would gather around to watch someone, such as Herbert Evans, show off his skill in injecting the tiny heart with India ink, which was pumped "as though it were blood to show the multitudinous vascular channels" (quoted in Corner 1974:159). This technique was used on living, nonviable fetuses that arrived in the lab directly from the operating room. The embryologists preferred live fetuses for studies of blood and lymph system development, because they found it hard to get their dyes ("India ink" or "Prussian blue" or carmine, which was made from cochineal insects gathered in Latin America) completely through the smaller vessels of dead specimens. After being cleared and sectioned, these specimens reportedly made "beautiful" models (Gatenby and Cowdry 1928:279). In 1911 Mall wrote, "In recent years a large number of foetuses as well as embryos have been injected in order to study the blood vessels with much greater care. A number of the specimens came into our hands still alive, which made it possible to obtain complete vascular injection in embryos less than 20 mm. [0.79 inches] long" (F. P. Mall 1911a:346–47).

Fifty years later, embryologists were still using the same technique. A 1962 letter from Carnegie embryologist Bent G. Boving to a Los Angeles pathologist suggests that fetuses should, when possible, be injected with fixative fluid while still alive. "In the unusual case that such embryos and fetuses are still living when delivered and in the pathologists' hands, fixation by perfusion via the umbilical vessels can provide a particularly fine specimen." Boving might have been referring to a project such as Hooker's when he continued, "In fact, certain preparations of the central nervous system almost require such a preparation, and some of our colleagues are currently trying to get whatever they can of such material" (Boving 1961). Embryologists had long used living fetuses for research and to prepare superior specimens, when Hooker got the idea to test the development of neurological reflexes by using horsehairs to prod living fetuses.

Between 1932 and 1958, Hooker performed neurological tests on 149 nonviable living—that is, dying—fetuses. The research methodology was as follows. Local doctors would notify Hooker when they were expecting a premature delivery (that is, spontaneous abortion) or planning a therapeutic (induced) abortion, so he could be on hand. Most of Hooker's specimens came from what he described as "operations to conserve the life of pregnant women" (Davenport Hooker 1957:17), otherwise known as therapeutic abortions. Hooker preferred that the operations be performed by *hysterotomy,* in which a woman's abdomen and womb are surgically opened to extract the fetus. This ensured that what he (and his anatomical colleagues) described as "the material" would be delivered alive.[2] He would quickly move the fetus to the observation laboratory, where it was immersed in a saline solution warmed to ninety degrees Fahrenheit (Davenport Hooker 1944:21). In vain, Hooker experimented with various techniques to slow down asphyxia and death. But nothing worked. "All activity ceases," Hooker wrote, within seven to ten minutes for the younger embryos, and within twenty minutes for the older fetuses (Davenport Hooker 1958:14). This brief lifespan left Hooker a short window, so he worked fast. The work itself consisted of stroking and prodding the fetus with a series of calibrated horsehairs (tipped with "a small bead of Duco cement . . . to prevent abrasion of the fetal skin") while recording the neurological responses using motion picture film (Davenport Hooker 1944:20). Hooker used film to record the movements so that he could watch and study them repeatedly. Because he had started the research during the Depression, no money was available to buy a movie camera, so he used his own money to buy a surplus camera leftover from the war. Humphrey notes, "With this camera, the first motion pictures of human fetal movements ever were taken in January of 1933" (T. Humphrey 1966:7). In 1952, Hooker assembled his footage into a silent educational film called *Early Fetal Human Activity,* which shows "characteristic reactive behavior (muscle activity)" from six fetuses ranging from eight and a half to fourteen weeks (Clark 1952:503).[3]

I learned about Hooker's research when I came across reprints of his scientific papers in the CIWDE files. Because he had not worked with the Carnegie collection of embryos, though, I initially set the reprints aside. Yet a question kept nagging at me: how and why had scientists justified doing research on *living* aborted fetuses? Of course they used a scientific justification for the work; Hooker wrote that his research would reveal "the exact nature and sequences" of activities of developing organisms. It would provide details of "their similarities and differences through the vertebrate scale" and "their implications as indexes of the structural development of the nervous system" (Davenport Hooker 1958:3). His research was supported by the scientific community, including other embryologists. Hooker kept up a lively correspondence with George L. Streeter, who considered Hooker's studies of fetal reflexes an important corollary to work being done at Carnegie, because the Carnegie embryologists could never answer scientists' questions about neurological functioning. In other words, the anatomy could never fully explain the physiology. As Hooker put it, the serial sections being made at Carnegie could never "be the final arbiter of certain of the finer points in fixing the exact time at which functional levels of morphological maturation are attained" (1958:2). In the end, Hooker agreed with other neuroanatomists who concluded that "behavior develops first as a total pattern" from which specific reflexes are later derived (1958:34). Hooker justified his research as necessary to settle a scientific dispute, and no one seemed to object. It is important to remember that all doctors and medical researchers, not just embryologists, were pretty much free to do as they pleased with nonviable humans and human body parts, as long as they remained professional and discrete.

Hooker and colleagues knew that their techniques could be ethically controversial, so they headed off potential criticisms in part by avoiding publicity. Journalists rarely mentioned fetal remains prior to the 1960s, although a 1938 *Time* magazine article was one notable exception. The article, titled "Embryonic grasp," was a brief account of Hooker's presentation to the American Philosophical Society, and it referred matter-of-factly to the "living abortuses" used in Hooker's work. It described how a twenty-five-week-old fetus "snatched a glass rod weighing three grams from the scientist's hand, waved it feebly but triumphantly for an instant before the spark of life went out" (*Time* 1938; see also *Time* 1945). The journalist cited the "admiring voice" of the scientist as Hooker described his findings before a "spellbound" audience. The point of the article was to report the early fetal onset of the grasping reflex, but I was struck by its unemotional tone. Didn't the audience question the ethics of fetal experimentation? Didn't the journalist question whether 149 women would have had to be subjected to major abdominal surgery if the researchers had not wanted the fetuses delivered alive? If the author or editors had expected readers to disapprove of Hooker's research, they would have framed the story differently.

Reading this article in *Time* was an ethnographic epiphany for me, when I realized (once again) that the fetuses produced in the first half of the twentieth century were socially, morally, and qualitatively different from the fetuses I see invoked, in all their various guises, around me today. It seems almost inconceivable to me that a journalist could speak so impassively about Hooker's research, but specimen-hood was obviously an acceptable role for a fetus in 1938, as was the use of dying fetuses to understand something as trivial (to me) as the embryonic grasp. It is not that Hooker, his colleagues, or his audience *de*-humanized the fetus or hardened themselves against its charms. They had no charming fetuses in their repertoire; they had never humanized fetuses to begin with. These concerns did not belong to them. I could not blame them for my own reaction. Hooker's fetuses were produced *as specimens;* not until much later would it become possible to imagine them as anything else, let alone to merge them into a cultural metanarrative that held them up as miniature humans deserving of respect. Later, fetal specimens were reframed to tell many different kinds of stories, most of which no longer include audiences enthralled by a fetus on the brink of death.

Hooker avoided criticism also by maintaining a high standard of professionalism and integrity. He was trained in experimental embryology under Ross Harrison at Yale, and he was well connected professionally. He had already chaired the department of anatomy at Pittsburgh for thirteen years when the project began, and he was known to be a conscientious researcher (T. Humphrey 1966:3). Every one of Hooker's publications focused strictly on the scientific merits of the project, framing the results in the driest imaginable medicalese. He was always careful to mention that the fetuses in his study came from operations "undertaken only after the most careful consideration and after extensive consultation" (Davenport Hooker 1939:7). Hooker stressed that no member of his research team was ever involved in a decision about whether to perform a therapeutic abortion (Davenport Hooker 1944:20). He was persuasive, well connected, or both, because his research received funding from a number of prestigious organizations, including the Carnegie Corporation of New York, the American Philosophical Society, and the U.S. Department of Health, Education, and Welfare. Only later, after Hooker's death in 1965 did Tryphena Humphrey note that the "laity" would likely have disapproved of his work, citing it as "'experimenting' on human beings" (T. Humphrey 1966:7). Great care would have to be taken to portray the research in a discrete and affirmative way.

This is precisely what Geraldine Lux Flanagan did in a successful book, *The First Nine Months of Life,* which was published in June 1962 and immediately translated into fifteen languages. Flanagan had majored in biology at Radcliffe and worked as a medical researcher before becoming a science writer at *Life* magazine. She was married to Dennis Flanagan, who for thirty-seven years was the editor of *Scientific American.* When Flanagan wrote *The First*

Nine Months of Life, it was the first book of its kind, a pioneer in what has since become an overpopulated genre of pregnancy guidebooks. Flanagan was a progressive thinker for whom "prenatal development and childbirth were closely linked" (Flanagan 2006); she went on to become a founding member of the International Childbirth Education Association. In 1957, Flanagan and six other women founded the Princeton Childbirth Education League, which led what was then a revolutionary campaign to permit fathers and companions to accompany laboring women through labor and delivery, as well as to allow open visiting hours for the parents of hospitalized children. "Our success," Flanagan writes, "was an amazing experience" (2006).

There were many reasons why *The First Nine Months of Life* was so popular. It was clear, snappy, and informative, aimed at "ordinary young parents" who "want to know about the growth of their baby" (Flanagan 2006). Unlike some of its predecessors, it was not preachy or condescending. Another reason for its popularity was the quality of its illustrations. The black-and-white photographs in the first edition may look old-fashioned by today's standards, but in 1962 they were stunningly vivid and unprecedented. *Look* magazine promoted the book in a four-page excerpt along with thirty-four photographs (Flanagan 1962a). Flanagan realized from the outset that pictures would be essential to the book's success. Existing books were poorly illustrated, she said, "mostly by pictures that make the embryo look monstrous." Her book would be "good looking," because she intended to "build the story around the pictures" (Flanagan 2006). Obviously, she would need beautiful, high-quality photographs, preferably of living embryos and fetuses. Flanagan flatly rejected using photographs of dead specimens—"the familiar 'bottled baby' pictures"—and vowed to "show the embryo in a life-like and attractive way" (Flanagan 2006). George W. Corner, then director of the CIWDE, was happy to oblige. Flanagan was the first popular writer to get permission to publish several of Carnegie's embryo photographs, and Flanagan was proud to note that none of them had previously been published outside of technical journals (Flanagan 2006). Yet the Carnegie photographs were dead specimens. For photographs of living fetuses, Flanagan contacted Davenport Hooker.

Several of the photographs in *The First Nine Months of Life* came from Hooker's films. "I met [Hooker] just once," Flanagan explained, "in 1961 when he invited me to his retirement office at Yale. I traveled up from Princeton for a day with him. He screened a number of his films for me and commented on them. He then allowed me to take several cassettes of his films back to Princeton with me. There I borrowed a hand-cranked film editing set-up

Figure 8. Hooker specimens as pictured in *The First Nine Months of Life.* From Davenport Hooker's films of prenatal development, as published in Flanagan 1962b:54.

and, bent over a table, I examined the films frame-by-frame, for days and weeks, to select the frames to be printed for *The First Nine Months of Life.* In the process, those little fetuses came very alive for me" (Flanagan 2006). In describing Hooker's research in her book, Flanagan wrote, "How do we know that the baby moves before his stirrings are felt by the mother?" We know, she said, because Hooker and his colleagues have "compiled thousands of feet of motion-picture film" recording "the activities of babies born very early" (Flanagan 1962b:75). She did not mention therapeutic abortion, or the fact that the pictured embryos and fetuses were filmed in their final fleeting minutes of life. I do not fault Flanagan; it would have been a challenge for any writer to convey the brutal facts of Hooker's research and remain faithful to the goal of writing an attractive, lifelike account of prenatal development. Flanagan was not deliberately hiding anything from her readers; she was just telling a different—significantly different—kind of story. She was describing the first nine months *of life.* Flanagan's book shows how one writer could manage, with great skill and subtlety, to divert attention from fetal remains.

Writers have played a key role in interpreting embryological research for lay audiences, and Flanagan was certainly not the first to tell the embryological origin story. We already mentioned Armenhouie T. Lamson's 1916 book, *The Autobiography of an Unborn Infant.* In addition, Margaret Shea Gilbert published *Biography of the Unborn* in 1938 and George W. Corner published *Ourselves Unborn* in 1944—to name only the most prominent of books that utilized photographs and drawings of Carnegie specimens. Yet Flanagan's book was special. Published at the height of the post–World War II baby boom, it was eagerly read by young parents. Its publication coincided with and fostered the birth of the public fetus. Flanagan's desire to show living fetuses was not hers alone; it was consistent with a rising cultural trend to depict embryos and fetuses as alive.

Sociologist Monica Casper tells a remarkable story of her interview with Margaret Liley, author of *Modern Motherhood* (1966), in New Zealand in 1994. Helen Margaret Irwin Liley had been married to fetal-surgery pioneer and outspoken abortion opponent Sir Albert William Liley, who died in 1983. Margaret, as she was known, showed Casper some chalk drawings, traced from "hundreds of fetal X rays." Casper writes, "While tracing the drawings with her fingers as a sort of radiant fascination danced across her face, she remarked that both she and Liley loved the images because they showed the fetus as 'active and moving.' She contrasted their chalk images with the famous photographic representations in *A Child Is Born* (Nilsson 1990), telling me that 'because those images are based on dead fetuses, they were static and lifeless. These are pictures of *living* fetuses'" (Casper 1998:64; emphasis in original). Liley, like Flanagan, was enchanted with the availability of images that portrayed fetuses as alive, even though those images were made during procedures that could harm or kill the fetus.

The First Nine Months of Life remained continuously in print for an astounding forty-three years. In 1970, Flanagan's book (and Hooker's research in particular) was cited by Dr. Bart T. Heffernan, an abortion opponent who lifted a couple of paragraphs from it for an amicus brief he wrote to the U.S. Supreme Court, arguing that a liberal Illinois abortion law should be overturned. Heffernan was a leader of the American pro-life movement, and the paragraphs he borrowed from Flanagan just happened to include a discussion of Hooker's research on fetal movements. (Hooker had died in 1965, without ever publishing his views on abortion.) In the 1970s, Hooker's research began to be appropriated in support of pro-life causes. In 1977, pro-life activist Sir Albert William Liley cited "the famous work of Dr. Davenport Hooker" to make the point that "babies" (i.e., young fetuses of eight to ten weeks gestation) are "responsive to touch." Without referring to the abortions that produced some of Hooker's research subjects, Liley describes Hooker's work as producing "monumental film footage of mechanical behavior responses of very early miscarried babies."[4]

The "naturalness" of these living fetuses has to be seen as an effect created by the technologies, images, and language that are chosen to depict them. Anthropologist Lisa Mitchell makes this point in her analysis of obstetrical ultrasound: "Ultrasound appears to many of us to supply a culture-free and correct understanding of nature and, hence, of the 'true' nature of fetuses." But, she continues, "the naturalness of fetal persons is constituted through the very technology said to locate it objectively" (2001:11).

The Internet is, increasingly, one of the technologies that can be said to constitute embryos as fascinating cultural objects. Once instance occurred in mid-2005, when the American pop music star Britney Spears announced she was pregnant. A couple of months later, a Google search for "Britney Spears's fetus" turned up half a million hits, many of which led to blogs alleging to be written in the voice of Britney Spears's fetus. Dozens of similar examples could be cited. In December 2005, the media reported that actor Tom Cruise had purchased an expensive ultrasound machine to make home pictures of his unborn offspring. In March 2006, the governor of Michigan signed a bill that required health professionals to offer women seeking abortion the chance to see ultrasound images of the embryo or fetus. Anthropologist Marilyn Strathern has written of the impact that technologies can have on attributing social identities to pieces of human flesh. With reference to embryonic stem cell research, she wrote, "Paradoxically, the biotechnology that in the eyes of some destroys individual beings also becomes one of the vehicles through which the very 'individuality' of embryonic features become apparent" (Strathern 2005:20). At every stage in the process of representing embryos and fetuses, the technologies used to bring them into being are double-edged, conjuring them into existence (often by work performed on dead specimens) at the same time as purporting to reveal them as natural (often living) entities. Beginning in the 1960s, embryos and fetuses were increasingly asked to represent life.

It became rare, after the 1960s, to admit that fetal images came from dead or dying specimens. Yet the Carnegie Human Embryo Collection is a link between the past—when embryo specimens were prized scientific objects—and the present, when encounters with dead fetuses are regarded as distasteful and macabre. This decoupling of the specimens from representations of them was a significant turning point in American culture. It had implications for what could (and could not) be said publicly about the Carnegie collection, for subsequent depictions of the embryologists' research methods, and for what women could say openly about their experience with abortion. Fetal death in general started to be publicly ignored, as though it never happened. This has to be seen as a significant epochal shift. Afterward, it became harder to talk openly about pregnancy loss or the embryo-collecting project, or to admit that specimens afforded scientists a better understanding of embryological development. Fetal death was banished from public conversation through the cumulative acts of individuals who chose not to mention the fact that dead specimens were essential to the production of embryological knowledge.

Feminist scholars have scrutinized the pictures that appeared in *Life* and *Look* magazines with an eye toward analyzing how the fetus emerged into public culture (Duden 1993; Matthews and Wexler 2000; Michaels 1999; Petchesky 1987). Their analyses are fascinating on their own merits, but two points are particularly relevant for our purposes. First, they argue that the photographs highlight fetuses to the exclusion of women. "From their beginning," Petcheskey said, "such photographs have represented the fetus as primary and autonomous, the woman as absent or peripheral" (1987:268). The disappearance of women is especially noteworthy, as Michaels notes, because it coincided with genuine social opportunities achieved by the women's movement. "Just as feminism was beginning to establish the reality of women," says Michaels, "the mother was nowhere in sight" (1999:117). They are correct that women have vanished, yet the Carnegie embryo-collecting project makes clear that this history goes back much farther than the 1960s, because the early embryo collectors were equally prone to depict embryos as autonomous and women as peripheral.

A second point made by feminists is that most of the fetal photographs used to bespeak "life" are in fact dead specimens. With reference to Nilsson's photos in *Life* magazine, Sandra Matthews and Laura Wexler say, "the cover photograph seems to have been appropriately labeled by *Life* as 'the first portrait ever made of a living embryo inside its mother's womb' because by 'using a specially built super wide angle lens and a tiny flash beam at the end of a surgical scope, Nilsson was able to shoot this picture of a 15-week-old embryo, [yet] *all* the rest of the pictures were of embryos that 'had been surgically removed for a variety of reasons' from their mothers' wombs. In other words, they were *dead* embryos" (Matthews and Wexler 2000:195; emphasis in original; see also Duden 1993:14). Matthews and Wexler go on to explore why the pictures in Flanagan's book did not achieve the iconic status that Nilsson's did, even though they were published earlier. They argue that Nilsson's timing was fortuitously better. His pictures of what look like free-floating fetal astronauts coincided with the space race, an association cemented into popular consciousness by the fetal "star child" that appears at the end of Stanley Kubrick's 1968 classic film, *2001: A Space Odyssey.* Nilsson's fetal images "acquired additional associations" connected to new social subjects liberated by the civil rights and other movements (Matthews and Wexler 2000:197). Rather than focusing on the differences between these sets of images, however, one could argue that all were part of the same movement to represent dead or dying specimens as visually appealing symbols of life. Hooker's fetuses were literally a bridge. Living—but only for a few more moments—they provided the vital link between the unpleasant reality of fetal death and an uplifting American origin story.

The appealing, animated embryos and fetuses we know today are the descendents of Hooker's research. While Hooker's research was once used by anti-abortion activists as evidence of the wonders of fetal development, today it would be roundly condemned by that constituency. Hooker's reliance on hysterotomy—which Flanagan had glossed as a way for "babies" to be "born very early"—is melodramatically described on one pro-life Web site as "simply a Cesarean section where the mother's abdomen and womb are surgically opened and the baby is lifted out. The baby is either left to die or is killed by the abortionist just before or shortly after birth by drowning, stabbing, choking, or suffocating her."[5] Ironically, *The First Nine Months of Life* was kept in print for many years by a publisher specializing in pro-life and abstinence-advocacy books.

In 2005, mention of Hooker's research could still be found on a few pro-life Web sites, where it was cited in support of the "Unborn Child Pain Awareness Act." The bill would require doctors to read the following statement to women seeking an abortion at twenty weeks gestation: "Congress finds that there is substantial evidence that the process of being killed in an abortion will cause the unborn child pain, even though you receive a pain-reducing drug." If women go ahead with the abortion, the bill requires doctors to offer an anesthetic for the fetus. Opponents of the bill say there is no scientific consensus about whether fetuses feel pain. Some supporters of the bill cite Hooker's research in support of their views, arguing that Hooker showed that fetuses respond to stimuli. But this is a misleading appropriation of Hooker's work. Hooker never studied "pain." His writings do not mention the concept of pain, and he did not distinguish between painful and nonpainful stimuli. In fact, he strongly preferred that his fetal subjects *not* be anesthetized, because anesthesia could throw off the accuracy of his results (Davenport Hooker 1958:15). By 2006, most up-to-date discussions of the controversial concept of fetal pain no longer cited Hooker. What remains of the Hooker-Humphrey collection is now stored alongside the Carnegie embryos in the National Museum of Health and Medicine in Washington, where it is described in bland terms that do not hint at its potential for sparking controversy. The "human and comparative material is stained to highlight nervous system development," reads the description on the Web site. "Sizes of specimens range from 50mm to 250mm." With this innocuous description, Hooker's research is vanishing into historical invisibility along with much other embryological research that relied on dead and dying fetuses.

CARNEGIE EMBRYO NO. 836 REBORN

In chapter 4 we were introduced to Carnegie embryo specimen no. 836, a stage-13 embryo found in 1914 when a hysterectomy was performed on the woman we know only as Mrs. R. Because 836 was considered such a perfect specimen—fresh, young, and perfectly sectioned and stained—it was chosen in the 1990s to be the prototype for an ambitious embryo digitalization project. Funded by the National Institutes of Health, the Digitally Reproduced Embryonic Morphology project (DREM, whimsically referred to as "the DREAM project"), was a collaboration between researchers based at Louisiana State University Health Sciences Center and the Human Developmental Anatomy Center where the Carnegie Human Embryo Collection is housed. The project aimed to produce digitized image databases for each of the Carnegie 23 stages of embryological development. It would do this by scanning into a computer all the sections of a specimen. Eventually, it was hoped that the sections could be reconstituted digitally using embryo imaging software that is currently being developed. In the case of specimen no. 836, this meant scanning each of its 247 sections into a computer at high resolution. A team of researchers retouched the digital images to correct flaws and inconsistencies, loaded the data onto user-friendly CD and DVD formats, and made it available to anyone who was interested. This technology allows researchers to see on their computer screens the *exact same specimen* collected and sectioned nearly a hundred years ago.

Dr. Raymond F. Gasser, professor emeritus of cell biology and anatomy at Louisiana State Health Sciences Center and author of many scientific articles and embryological atlases, is a leader of the DREM project and an associate curator of the Carnegie Human Embryo Collection. He told me that he chose 836 for this important role because he wanted a stage-13 specimen of superb quality, as well as one that had been sectioned along the transverse plane so it would be more easily intelligible. In contrast to some of the more bedraggled specimens in the collection, he said, 836 was in such perfect condition that it required little digital touching up, except to correct a few edges where the staining had faded. Once it was scanned, it would eventually be able to be digitally reconstituted using voxel (volume element) software that turns a two-dimensional image into a three-dimensional image. (Imagine turning a loaf of sliced bread back into an intact, uncut loaf, then rotating it to get a view from any angle.) The Internet makes it possible to send the images to researchers anywhere in the world. With this, the priceless specimen would be made available for research without risking that someone might drop a slide on the floor. These new imaging and dissemination technologies spawned a series of so-called "visible embryo" projects (Noe 2004; O'Connor 2003).[6]

Anyone with access to the Internet can now see 836 online. As I type these words, I can pull up a screen that will allow me to scan the embryo by region (crown, brain, heart, midgut, rump) and to scroll through the embryo section-by-section, zooming in (in the DVD version) on any segment to magnify up to five hundred times. I can look at a digitally reconstructed version of 836's external form—reminiscent of Osborne Heard's old plaster models—rotating on its axis. For a quick orientation to the embryo, I can "fly through" the embryo (from top to bottom, or, as the anatomists would say, "cephalad to caudad") at different rates of speed, in a sort of embryological rendition of the 1966 science fiction movie *Fantastic Voyage,* in which miniaturized humans take a quick trip through the interior of the human body. Teams of embryo imagers under a National Library of Medicine Next Generation Internet grant have worked to move large quantities of embryological data over the Internet, and to achieve the capability to slice through embryos (including 836) in any plane. They are currently working to show—in computer-simulated 3D glory—how a gene determines the development of a specific anatomical feature (Pentecost 2002). If 836 was born—so to speak—near the beginning of the twentieth century, it was reborn at the beginning of the twenty-first.

The future of embryo imagery is all about motion, and 836 has been at the forefront of the kinetic revolution. No. 836 was one of the first Carnegie specimens to be animated when the Human Developmental Anatomy Center Web site pioneered a model of an embryo rotating on its axis. Entering the Web site, one sees a gray plaster model of 836 against a black background, pivoting like the earth on its axis as though propelled by some mysterious volitional force. Other imaging techniques are now being developed to revive these dead embryos, making them appear to tumble, rotate, and grow from one stage to the next. A collaborative embryo morphing project based at the Oregon Health Science University features none other than 836. Motivated by their interests in computer-enhanced medical imaging and development of the human heart, the Oregon team has also experimented with morphing as a way "to resolve visual-spatial difficulties of studying ever-changing structures in three dimensions" (Pentecost, Icardo, and Thornburg 1999:45, 46).[7] They simulate the appearance of growth by aligning photos (or computer reconstructions) of sequentially staged embryos and superimposing one upon the next to give the visual effect of time-lapse photography. The

Oregon team's initial experiment used a "stage 13 embryo (CC836) to morph to stage 16 (CC6517)" (Pentecost, Icardo, and Thornburg 1999:46). Several teams of embryo imagers are now working intensively to create the future embryo images. They are upgrading the hardware and software that will make it possible to move morphing technologies to the next phase. "When our project is completed," the Oregon team writes, "users will be able to observe 3D morphing of the heart from any angle of stages 10 through 17. They may observe development and study spatial relationships of key cardiac structures, repositioning, stopping or starting, and reversing development as they desire" (Pentecost, Icardo, and Thornburg 1999:46). No. 836 is gradually being transformed into a life-affirming entity.

The Multi-Dimensional Human Embryo Imaging project, also affiliated with the Carnegie collection, was one of the first to make it look as though dead embryos were growing in front of our eyes. The project was headed by Bradley R. Smith, a renaissance man—artist, radiologist, and expert in biomedical visualization—who holds appointments in both radiology and biomedical visualization at the University of Michigan.[8] One of Smith's specialties is magnetic resonance imaging of mouse and human embryos. The National Institutes of Health (NICHD) funded a five-year project under his direction to scan intact human embryos using magnetic resonance microscopy. The goal of the project, in scientific terms, was to produce "a series of images of each embryo in three principal image planes (transverse, coronal, and sagittal), a series of volume-rendered images to represent surface features of each whole embryo, and a series of images to demonstrate time-lapse growth of the human embryo."[9] Over lunch in Ann Arbor, Smith was kind enough to explain the project to me in lay terms. He was able to acquire several, very young, fresh human embryos (through an agreement with a pathologist), put them carefully into tiny tubes, and scan them using magnetic resonance imaging (MRI). Using the six computer screens in his studio, he digitally manipulated the data to highlight specific features, such as the heart or brain. Smith, who is a talented artist, produced some of the decade's most beautiful, captivating embryo images for his 1999 *Scientific American* article "Visualizing human embryos" (B. R. Smith 1999).

Smith wanted to do more than simply scan the embryos—he wanted to make them move. He realized that the technology lent itself to movie making, to producing the semirealistic impression that an embryo was growing through time (B. R. Smith 2003). In this way, he said, the Carnegie specimens could move from two dimensions (i.e., the serial sections mounted on slides), to three dimensions (using MRI data), to four dimensions (by adding

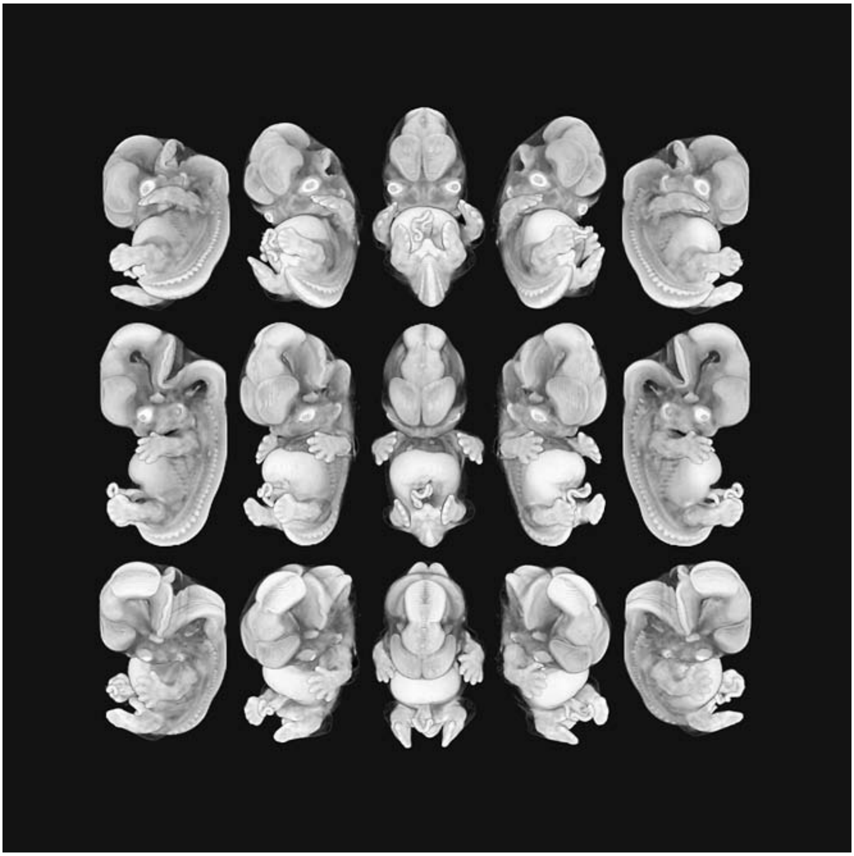


Figure 9. Magnetic resonance image of a fifty-day human embryo. Courtesy of Bradley R. Smith, School of Art and Design, University of Michigan.

time). Hence the title of the project, the "multidimensional" human embryo imaging project. Like the Oregon team mentioned above, Smith wanted to use morphing software to create what he called "pseudo-time-lapse movies." By superimposing one embryo image over another and playing the frames in "quick time" rather than in real time, he was able to create the tantalizing impression that "the" embryo—which was in fact a concatenation of several dead specimens—was alive and growing. It was easy for me to see how he could get caught up in the technical challenges and artistic potentials of portraying these specimens visually, and I admired his remarkable skill and creativity. I found the project both fascinating and disquieting. I worried about the subtle political repercussions of inviting dead specimens to move so beautifully, to capture our imaginations—in effect to breathe life.

In general the Carnegie-affiliated embryologists were reluctant to wade into the thicket of debate over reproduction and abortion, although there were exceptions. In 1963, Bent G. Boving used his embryological expertise to argue that "conception" should be defined as the time when the fertilized ovum is implanted in the uterine wall. Fertilization, on the other hand, was the fusion of male and female gametes that took place in the fallopian tube rather than in the uterus (Boving 1963). This may seem like a trivial point, but Boving was adamant because the distinction was important to his position in support of the birth control pill, which was thought to inhibit implantation but not fertilization. The distinction continued to be relevant in the late 1960s when debates over abortion were dominating the headlines. In 1970, Boving urged the Columbia University embryologist Roberts Rugh, coauthor of the yet-unpublished book *From Conception to Birth: The Drama of Life's Beginnings* (1974), to change the book's proposed title. Not only did Boving disapprove of the word *conception,* he argued that the word *beginnings* should be reserved for the true beginnings of life which he said were located in the "remote geological past." Embryos and fetuses did not, he said, have any unique claim to "individuality" because the ovum and spermatozoon were also individual entities (Boving 1970). In contrast to Boving's liberal views, those of retired Carnegie embryologist Ronan O'Rahilly are often cited by abortion foes. In 2001 he went on record opposing the term *pre-embryo* because, among other reasons, "it may convey the erroneous idea that a new human organism is formed at only some considerable time after fertilization" (O'Rahilly and Müller 2001:88; see also Irving 1999).

It is rare for an embryologist working with the Carnegie specimens to take a political stance, but one of them has served on the American Life League's American Bioethics Advisory Commission and is an outspoken opponent of abortion, human cloning, embryonic stem cell research, and the use of aborted fetal tissue in vaccine development. When I met him at the 2003 Embryo Imaging and Education conference in Washington, he was happy to share his considerable expertise about the Carnegie embryos as well as his political convictions. He was the only one to argue from the podium that each embryonic life merits protection from the moment of conception, no matter what the circumstances of pregnancy. He argued that the greater good of science—development of a vaccine against smallpox, for example—could not justify research using cells from aborted fetuses. I could not help but wonder whether he would have approved of the research uses of 836 if he had known that the specimen came from a hysterectomy performed on a pregnant woman, or whether he realized that many of the best Carnegie specimens came from de facto abortions. It seemed ironic that thousands of dead embryos and fetuses needed to be gathered, sectioned, and made visible before they could start to represent life. But without the dead specimens, this narrative of life would have been inconceivable. Dead specimens made it possible eventually to transform "embryo"—either consciously or unwittingly—into an animated, lifelike creature.

The revivification of embryo specimens can be interpreted as a brilliant, astute way to extend and enhance the lifespan of the Carnegie embryo collection. In the era of animated embryos, the specimens are depicted *as though they are taking action, controlling their fate, exerting their will of their own accord.* They are increasingly described using the active voice. It takes a conscious effort to remind ourselves that a *specific* author has made a *specific* decision to attribute volition to an embryo. Digitalization, (re)animation, and visualization are techniques that have been used to animate embryos in the collective public imaginary. The virtual embryo projects, even more than their predecessors, turn each scanned specimen into a kind of "every embryo" that achieves virtual immortality as it circles the globe in cyberspace. Ironically, digitalization renders the specimen simultaneously necessary and superfluous. They are necessary, because specimens like that are hard to find (or create) anymore and because sometimes "nothing substitutes for seeing the model or for peering through a microscope to see a specific feature" (Noe 2004:50). And they are superfluous because once the model is available online, it is readily available to anyone who wants to appropriate it for whatever purpose. Embryo imagery is now used for all sorts of purposes—educational, artistic, propagandistic, commercial, entertainment—without any need to have access to a physical specimen. The paradox of embryos today is that they are both highly personified and individualized, and at the same time they symbolize the human collectivity, ourselves unborn. This is what Janelle Taylor means when she says that some people will insist that embryos should never be severed from the specific contexts in which they are produced, while others will "work hard to accomplish and enforce just this kind of detachment" (2004:204). The tension between these two tendencies—personification and anonymization—is captured in two *New Yorker* cartoons published a few years apart.

These cartoons capture one of the paradoxes inherent in blurring the traditional boundary between the born and the unborn: fetuses are increasingly personified and granted social identities, while privacy regulations threaten

Figure 10. Robert Mankoff, *New Yorker,* July 12, 1993.

to prevent parents from having access to crucial information about their own children, including their "race, age, and gender." The first cartoon captures the personification of unborn babies that occurred as a consequence of the routinization of ultrasound imaging in the 1980s, when it became possible for parents-to-be to learn the sex of (and thus to name) their babies-to-be. By the late twentieth century, in an era of identity theft, the joke had changed. Now doctors are required by privacy regulations to withhold information about the most critical, sensitive components of identity—race, sex, and age—even from a child's own father. Both cartoons tap into the weirdly depersonalized way that the power to create fetal and infant subjects has been transferred from parents to doctors.

The early embryologists, in contrast, expressed no interest in the sex of their specimens although they could be fascinated by the extrinsic ocular muscles of an embryo only four millimeters long. This seems strange, given that several of the embryologists (including Mall) were married to suffragettes, and sex differences were very much on people's minds in the years before women got the vote in 1920. Why did the early embryologists seem unconcerned with

Figure 11. Peter Steiner, *New Yorker,* April 29, 1996.

the sex of their specimens? On the other hand, maybe the question should be turned around. Rather than asking why the embryologists were not preoccupied with the sex of embryos, maybe we should ask why it matters to us. When and why did people come to regard the sex of an embryo as important? The answer, I suspect, is that sex differences make a difference in pregnancy when they will also make a difference in adult social worlds. If people can determine sex prenatally, then they can start to regard embryos and fetuses as miniature participants in those worlds, as homuncular little boys or girls. In China and India, sex determination in utero can result in the production of different kinds of embryos and fetuses: dead female embryos and fetuses, and live males (and a vastly skewed adult sex ratio). In the United States, prenatal sex determination contributes to the personification of fetuses, because once we know the sex of a fetus, we can begin to think about it as a person (Rothman 1986). But until at least the middle of the twentieth century, Americans did not name fetuses or sort them by sex, because that simply was not possible. Although expectant parents certainly often speculated about the sex of the child they awaited, they could not project the adult social world back into the womb the way we do today.

It was a matter of some interest to embryologists, therefore, when in the 1990s the highly enhanced digital magnification of 836 revealed a previously unknown feature of the tiny embryo—if it had survived, it would have become a girl. Until recently, it would have been impossible to determine the sex of sectioned embryo specimens. Even to an expert eye, the genitalia of male and female embryos looks the same until the end of the third month, sometime after the embryo reaches a crown-rump length of fourteen millimeters (Spaulding 1921). In most cases, sex is not clearly distinguishable to the naked eye until near the end of the fourth month (Thompson 1984:368). Because 836 was only four weeks old, there was no way to identify the sex by sight. Not until DNA analysis was developed did it become theoretically possible to perform genetic tests on the fetal cells, but only by destroying the precious slides. This all changed in the 1990s, when 836 was scanned into a computer and magnified to the point where individual cell contents could be inspected on a large screen. It was then that the observant Gasser noticed the telltale Barr bodies—which identified the specimen as an incipient female (Miller 2006)—in the cell nuclei. Knowing that 836 would have been a girl only matters to the extent that we might be willing to think of an embryo as the person she—it?—might have become if it—she?—had lived.

For at least the past forty years, pictures have been used to encourage people to see the continuities between fetuses and babies: warm colors, thumb sucking gestures, close-ups of tiny hands and feet (see Condit 1990). More recently, moving pictures have been utilized to augment the same effect. The latest computer technologies—such as 4D ultrasound—push that goal even further by showing the fetus in utero, in motion. When anthropologist Lisa Mitchell studied the technicians who perform ultrasound exams, she found that that they tend to "ascribe intention and emotion to fetal movement and body position" (Mitchell 2001:130). When fetal movements are ascribed special importance, and when dead specimens are made to simulate movement and growth, we are witnessing a cultural trend that blurs the boundaries between living and dead to depict all embryos and fetuses as icons of life. I doubt that many of the contemporary embryo imagers consider their work in this light. Yet it is hard to deny that morphing technologies reinforce the story that every embryo is on an unstoppable trajectory from fertilization to birth. Morphing and Quicktime movies "work," in a political sense, by lining up dead embryos and having them perform a controversial, embryo-centric script that says, "choose life." In this highly charged environment, embryo images can hardly remain neutral.

Between the time that 836 went into semiretirement in the 1970s and the time it reemerged into the limelight in the 1990s, there had been a dramatic escalation in embryo politics. Against this backdrop, one wonders how the various visible embryo projects could stay clear of the fray, yet this is precisely what most of them—at least on the surface—aim to do. Many of the embryo imagers are undoubtedly more interested in helping medical students study embryology, or seeing what effects they can achieve with the latest imaging software, than they are in reproductive politics. Given the potential of reproductive politics to poison a scientific career, one cannot blame them. In fact, any effort to stay away from overt political skirmishes might be perceived as a smart way to assume the appearance of neutrality, which is crucial to the embryologists' scientific legitimacy. Scientific authority is a mighty force in the embryo wars, where pictures and "data" are appropriated as propaganda and where embryo images and procedures that carry a medical imprimatur are highly valued precisely because they claim to be politically neutral (Casper 1999).

Carnegie no. 836 is approaching its hundredth year as an embryo specimen. Acquired in 1914, it has served as famous model, poster child, and fundraiser. It has left young men sleepless, sparked bitter custody battles, and been feted at jubilant celebrations. While it was once a passive research object, it is now a participating member of the research team, using its celebrity status to raise funds for scientists, museums, and corporations. No. 836 is ironically more active than ever, pirouetting and somersaulting for the cameras. This has unarguably been an impressive life for a dead embryo.

FROM CONCEPTION TO DEATH

In late 2002 the publication of a new book about gestational development was announced with great fanfare. *From Conception to Birth,* by Alexander Tsiaras with text by Barry Werth, is a glossy, oversized coffee-table book.[10]

Tsiaras is an entrepreneur, computer artist, and owner of a medical-art-and-imaging corporation called Anatomical Travelogue. Using proprietary computer software, he transformed data from CT scans and magnetic resonance imaging into unorthodox, brightly colored *visualizations*—he stresses that they are not photographs—of embryos and (mostly) of fetuses. Werth encourages readers to watch the miracle unfold with his mantra, "What's the baby doing now?" The book was marketed to be a blockbuster, its release date (just before Christmas) calculated not-so-subtly to coincide with another miraculous birth. The publicity people pulled out all the stops: an accompanying exhibit at the National Museum of Health and Medicine, a cover story in *Time* magazine, interviews with Tsiaras on the *Oprah Winfrey Show, Fresh Air,* and the *Today Show.* The publicity shows that embryos are not only icons of life, they are big business.

Tsiaras's visualizations are an unmistakable example of how embryos have come to function as icons of life. The book relies on the usual grab bag of visual tricks and devices that feminist scholars have identified in other fetal images. It is oversized and heavy, as if to emphasize that this is a weighty topic. The pictures are also oversized, magnified to encourage readers to exaggerate the amount of space that embryos occupy, both literally and metaphorically. Many of the embryo images appear head-up and in profile, as though head-down or head-on would be too confusing. (The Carnegie embryologists sometimes discussed the topic of "which way up." George Streeter used to quip that "he put monkey embryos 'up side down' because monkeys hang from trees and humans don't" [Ramsey 1974].) Tsiaras's embryo images are separated from the bodies of pregnant women who appear (infrequently) on separate pages where they are fuzzy (literally "out of focus"), in black and white and gray (to depict "boring"), and married (judging by the conspicuous rings and, in one picture, the male arms encircling a pregnant woman's belly). The last page is a color photograph of the author's (very cute) infant son. Tsiaras might be forgiven for indulging his fatherly pride, but inclusion of the picture can also be interpreted as a reminder that the purpose of pregnancy is babies. "Choose life."

Tsiaras says that his visualizations are "quite intentionally beautiful." No blood, no tears, no decay, no violence. He is quoted as saying, "Our principal responsibility is to supply information. But if we *add beauty to it* we enhance the information" (Painter 2002; emphasis added). In emphasizing beauty, Tsiaras was following in the footsteps of embryo imagers all the way back to the German physician and anatomist Samuel Thomas von Sömmering (1755–1830), who used beauty as a criterion when selecting specimens to depict in his *Icones embryonum humanorum* (Duden 1993:41–42). For the most part, Tsiaras imitates the brown, red, and pink palette pioneered by Lennart Nilsson. He also borrows from Nilsson the technique of using back-lighting to enhance the ethereal beauty of the embryos. One journalist wrote floridly of "a plum-colored womb equipped with a night light" (Painter 2002). Color is a big improvement over the fuzzy, gray fetal images produced through ultrasound, as a tourist brochure gushed: "If your clearest look inside a womb has come courtesy of a sonogram, prepare yourself for the next generation: colors of remarkable richness and subtlety, maximum clarity, and a breathtaking wealth of detail" (Museums Washington 2003). Most of Tsiaras's embryos are set against black, empty backgrounds. These are the free-floating fetal "astronauts" noted by Zoe Sofia in her analysis of the floating fetus in the movie *2001: A Space Odyssey* (Sofia 1984). They are hermetic, self-contained, and devoid of all but the most tenuous links to women.

Readers are encouraged to think of Tsiaras's embryo images as "new and improved." The flyleaf tells bookstore browsers that these images are far superior to anything that has come before: "Fuzzy sonograms and doctors' explanations can provide basic information, but through Alexander Tsiaras's remarkable achievements in medical imaging technology, parents can see, for the first time, the awe-inspiring process of a new life unfolding in stunning, vivid detail." One flyer said, "Welcome to ourselves, as we've never seen us before."[11] To claim these images as "new" is a bit of an overstatement; Tsiaras' visualizations are part of a lineage that dates back through Nilsson and Mall, all illustrating the embryological view of development. The scanning techniques and computer manipulation of the images may be innovative, but the story line is at least a hundred years old.

From Conception to Birth promotes itself with the claim that it is scientifically accurate, yet the book might work better as mixed-genre info-tainment or docu-drama than as science. Tsiaras does not direct the book to a scientific audience. Nor does he claim to teach readers anything new, but rather only to reinforce what they already know to be true. He is adamant that his visualizations not be mistaken as photographs, but he does not explain how he creates them or tell readers how to find the raw or unenhanced scientific data. His challenge, then, is how to portray the impression of "scientific accuracy" without revealing the steps through which his data were converted to results. How does he do this? First, simply by claiming that the images are scientifically accurate. Second, the book intersperses real photographs with visualizations, which gives the impression that all the images might be read as photographs. And finally, the book uses an old textbook trick, using labels and leader lines to direct the reader's eye to specific anatomical features. This has the double effect of interpreting the visualizations so they appear more legible and giving the book the feel of a medical textbook, teaching the reader what to look for and what to see.

How accurate is it? *From Conception to Birth* ignores scientific facts about pregnancy that might spoil its upbeat message. It does not mention, for example, the fact that high percentages of fertilized ova fail to implant in the uterine wall, or that spontaneous abortion is common, or that for many women conception does not result in birth. Even some scientists reject the claim of scientific accuracy. I talked with one embryo imager who dismissed Tsiaras's images as "scientifically uninteresting."[12] Another respected embryologist told me—and here I'm quoting—that he "would prefer not to see my name in the same sentence with one whose inaccurate book is provided with the outrageous claim that it is 'painstakingly accurate.'"[13] If *embryologists* find the images inaccurate or outrageous, then toward whom is the claim of scientific accuracy directed?

Ironically, most of the images in the book are based on scans of *ex utero* dead embryos and fetuses. One could easily overlook this fact, as television talk show host Ann Curry did when she interviewed Tsiaras on the *Today Show* and assumed that the images depicted *living* embryos and fetuses. "And this doesn't hurt the baby when you use the technology in this way?" she asked.[14] A visibly uneasy Tsiaras had to explain that the images were taken from specimens in medical collections. He did this without uttering the word "dead" (which might have ruined the seamless continuity implied in the title of the book). The truth about where the images came from is more complicated than what Tsiaras revealed on national television.

The specimens Tsiaras used had recently been accessioned into the hundred-year-old Carnegie collection. As it was explained to me by an anonymous source, Tsiaras needed MRI data from fresh, intact embryo specimens in order to create his visualizations. These data could not be extracted from existing Carnegie specimens because most of them were between sixty and a hundred years old and already sectioned. Tsiaras was able to use human embryo MRI data that had been generated by the federally funded Multi-Dimensional Embryo Imaging project. For that project, a multi-institutional team had acquired fresh human embryos from a Pennsylvania hospital. A paper agreement allowed these new, fresh specimens to be formally incorporated into the Carnegie collection while MRI imaging was performed. Specimens and data were then turned over to the Human Developmental Anatomy Center where the Carnegie collection is kept. Tsiaras got access to the MRI data by arguing that he was legally entitled to it because the original project had been publicly funded. None of these details are spelled out in *From Conception to Birth.* The book says only says that the embryos came from miscarriage and unspecified "medically necessary procedures." Tsiaras was a good businessman who knew how to spin an embryo-imaging opportunity to an embryo-hungry public.

Tsiaras's embryos are a remarkable political achievement predicated, in part, on hiding the details about how they were produced. Gertrude Stein once wrote, "A picture may seem extraordinarily strange to you and after some time not only does it not seem strange but it is impossible to find what there was in it that was strange" (Stein 1938). Stein's words summed up my feelings as I turned the pages of *From Conception to Birth.* On one hand, I found Tsiaras's visualizations beautiful and seductive, but on the other I marveled at the century-long accumulation of unspoken cultural assumptions required for the images to *work.* The images could only be captivating to an audience that accepts and believes in a biological origin story that invests enormous importance in microscopic events that occur inside a pregnant woman's womb—cells uniting and dividing, genes turning on and off, tissues growing and becoming organized into patterns. (This is the cutting edge stuff of developmental biology, which the National Institutes of Health spend hundreds of millions of dollars each year to understand.) Because the important action takes place inside the body, out of sight, the biological origin story has always been a visual story (see Hopwood 2005). That Tsiaras's visualizations could seem "extraordinarily strange" had not occurred to me until I gave a presentation at the University of Washington, where a foreign student told me that she found the book not fascinating but vulgar. The whole idea of such a book, she said, showed extremely bad taste. Her reaction reinforced my impression that fetal displays condensed cultural assumptions, in this case about fetus-obsessed Americans.

"EXTRAORDINARILY STRANGE": THE COMPARATIVE DIMENSION

Cultural and historical comparisons can open windows into our own culture-bound assumptions. When the Dutch anatomist Frederick Ruysch (1658–1731) collected "monstrous" fetal specimens and arranged fetal skeletons into artistic poses in the seventeenth century, he was operating under an entirely different set of assumptions about what fetal death meant. By teaching classes to local midwives, Ruysch got access to fetal remains and infant corpses. He collected deformed fetuses including conjoined twins and two-headed babies, and he made preparations such as the partial head and face of a child resting on a small lace doily inside a bottle of preserving fluid.[15] In addition to his wet-tissue specimen preparations, Ruysch boiled fetal corpses down to the bone and created elaborate dioramas out of the skeletons, morbidly whimsical creations decorated with body parts and flowers. He had no compunction about drawing attention to his own role in authoring the fetal displays, but three hundred years later, aesthetic standards for displaying fetal remains had changed considerably.

The late nineteenth-century embryo collectors did not call attention to themselves as Ruysch did; they preferred to retreat into the background. They intended their embryo and fetal specimens to stand alone, to convey the impression that meanings should be drawn from the unadorned corporeal material. Authorship of the collections—the labor that went into producing the specimens—was ignored or swept aside (Stewart 1984:156); the bodies were supposed to speak for themselves. Medical historian José van Dijck, who has traced the history of anatomical exhibits from sixteenth-century Europe to the present, points out that "nineteenth-century exhibitions of organs in glass jars show a preference for unadorned, straightforward anatomical parts" (2001:106). Body parts were no longer displayed as spectacle, but as part of the authoritative culture of biomedicine. This trend continued throughout the twentieth century, with formaldehyde fetuses presented as though they *were* the unadorned, natural scientific truth. The displays were supposed to show the power of science, and they pretended to be a "pure representation of the human body without the contamination of human intervention" (Dijck 2001:117). In looking back at Ruysch's dioramas, however, one thing becomes clear: there is no such thing as "the" unadorned fetus, because every way of thinking about and representing fetuses reflects assumptions that are deeply tied to specific peoples and times.

Fetal specimen displays yield plenty of clues to cultural assumptions about posture, adornment, and bodily integrity. In the nineteenth century, for example, preparations of fetal skeletons were mounted upright, standing on their feet. This is of course technically inaccurate: fetuses in the natural position would have been curled ("fetal position"), head down. But I have never seen a collection of rolled-up fetal skeletons, just like I have never seen clothed fetal specimens. Is there such a thing as the "natural" position for displaying fetal specimens? Rosamond Wolff Purcell's photograph, taken in the Leiden Museum of Anatomy, shows two jars, each containing a single fetal specimen with African features (Purcell and Gould 1992:28). The specimens were apparently brought to Europe as a curiosity during the slave trade. Both specimens are adorned with strings of black-and white beads, threaded in bracelets and belts around their ankles, knees, wrists, elbows, necks, and waists. A bone needle attached to a string had been threaded through the skin on the top of each head, to suspend the specimens and keep them from settling to the bottom of the jars. It is an arresting display. I asked myself why anyone would string a deceased fetus with beads, while another voice inside my head murmured, "Why not?" I recalled anthropologist Alma Gottlieb's descriptions of Côte d'Ivoire, where Beng mothers commonly painted their babies' bodies and faces with intricate designs. Yellow lines across the scalp, black dots around the eyes, white stripes across the forehead—the designs are intended to prevent or cure illness, or sometimes simply to make the baby beautiful. "Can there by any doubt," asks Gottlieb, that the mother "is an artist" or that "her baby serves as her canvas"? (Gottlieb 2004:130). If all specimens convey traces of the cultures that produce them, perhaps beaded fetuses were the nineteenth-century African equivalent of these beautiful Beng babies. Or of the twenty-first century American digitally enhanced embryo beautification project.

EIGHT

The Demise of the Mount Holyoke Collection

It was a cold gray afternoon in February 2005 when the phone rang in my office. A reporter from the local paper was looking for someone to comment on the discovery of four fetuses found buried in a backyard in nearby Springfield. I hadn't heard anything about it. He explained that the police had arrested a man on unrelated charges, and one of the man's employees told police that the man had ordered him to bury some fetuses. The cops started digging at the site, the neighbors got curious, and someone called the newspaper. When the police unearthed four jars of formaldehyde containing human fetuses, everyone suspected the worst. Had the man been involved in clandestine activities, maybe illegal abortions? The man protested, saying he'd done nothing wrong. The fetal specimens had belonged to his father, he explained, who had been a physician at a Springfield hospital. When the father died, the son inherited them. At a loss for what to do with them—he couldn't quite put them on the mantel, like the bottled pet in a *New Yorker* cartoon from the 1990s—he ordered the worker to bury them.

I assured the reporter that there was probably a straightforward, unsinister explanation. Doctors had been in the habit of saving fetal specimens from the second decade of the twentieth century through the 1950s, I explained, and it would have been common for them to have a few on the shelf. There would have been many such specimens around, especially the larger ones

"Of course, he's very low maintenance."

Figure 12. Gahan Wilson, *New Yorker,* October 26, 1998.

(which weren't interesting to the embryologists). Doctors, hospitals, and educational institutions would all have had their own collections. In fact, I told him, there were remnants of such a collection in storage at Mount Holyoke College. His story ran the next day, quoting me and including a reference to the specimens at Mount Holyoke (Flynn 2005; L. M. Morgan 2006b).

A few weeks later, a handwritten letter appeared in my mailbox, addressed to me care of the long-defunct "Department of Zoology." A Mount Holyoke alumna and retired obstetrician-gynecologist, Dr. Ruby G. Jackson, had seen the newspaper article and wanted me to know that she had carried fetal specimens to Mount Holyoke when she was a student. Jackson recalled transporting specimens from the Springfield hospital where she worked while she was enrolled in professor Christiana ("Chrissy") Smith's embryology class around 1941–42, during the war. Jackson explained that she had been an office assistant to a surgeon. She obtained "a single specimen of a young (human) embryo given me by one of the hospital lab staff," which she gave to her instructor. One of the surgeon's associates, "Dr. E——," she writes, "then began to save specimens for me, which I conveyed to Miss Smith in formalin bottles." This was considered perfectly appropriate, she tells me. "I recall driving up with the jars and bottles beside me in the car, with no thought of being questioned—nor was I ever stopped for anything. I'm quite sure I'd have given a direct answer—'for lab purposes'—and not been doubted." No one ever asked her to acquire specimens, she says, "the 'collection' just developed" (R. G. Jackson 2005).

It was a strange coincidence. Jackson's specimens had been provided by Dr. E——, who had worked *at the same Springfield hospital* as the arrested man's father, at roughly the same time. It was at least theoretically possible that their respective specimens had come from the same surgeon. Obviously, the culture of collecting fetal specimens was well entrenched there in the 1940s. The only difference was where the specimens ended up: Dr. Jackson's were incorporated into a scientific collection, while the others became the subject of a police investigation. But the reporter's questions reminded me that the history of compiling embryo and fetal specimens has been almost completely forgotten. In medical education, the field of descriptive morphology had been overtaken by genetics and molecular biology, and anatomists were relying less on corpses and more on computer techniques to teach their subject matter. In the process, embryo specimens were set aside. Many anatomists and pathologists destroyed their remaining specimens, donated them to museums, or passed them down to their children. When one son buried his inheritance in a vacant lot, the disinterment sparked a flurry of media attention. The paradox of my position did not escape me—I was unearthing fetal specimens, too.

My conversation with the reporter inadvertently thrust *me* into the limelight when the story ran in the newspaper the next day. The article said that Mount Holyoke's fetal collection was stored in a "variety of containers" including "a jar labeled grapefruit sections, and others were in mayonnaise and mason jars" (Flynn 2005). The statement was accurate and those were my words, although I had not meant them to sound quite so morbid. I was trying to explain how commonplace fetal collecting was fifty years ago, but of course the reporter was looking for a zesty angle and I had unwittingly given him exactly what he needed. A few of my academic colleagues took offense at the comment about the jars. They suspected that I had called the reporter, eager to publicize my own work. They were pretty angry at me, holding me responsible for what they thought was the reporter's unflattering portrayal of Mount Holyoke.

This sudden alteration of my role made me uncomfortable. Up until this point I had been able to behave like the typical academic investigator, spending long days in the archives, reading heaps of book and articles, listening at professional conferences, and talking about the project with other academics. On the rare occasions when this routine got too tame for me, I would write an op-ed piece or letter to the editor (Casper and Morgan 2004; L. M. Morgan 1999b), but I never hoped to stay at the center of controversy for very long. I naively hoped that I could write the story of specimen-collecting and convince readers that today's fetal subjects are the legacy of a now-forgotten past, all while retaining my academic equilibrium. Now I was forced to step up and declare my position.

The collection, I told my colleagues, is nothing to be ashamed of. The embryo collectors attached an entirely different constellation of meanings to this "material" than we do, and we should not judge them by our concerns. Yet this does not mean that the embryo-collecting project is above reproach. Looking back, we can see that it was an intensely gendered, often patronizing, and sometimes colonialist project that separated women—their lives, bodies, and futures—from the embryo and fetal subjects that have become so omnipresent in today's world. By construing each embryo as a "self-evident fact of nature," the embryo collectors contributed, however unwittingly, to edging women out of the modern embryological origin story (Hartouni 1997:125). We live with the repercussions of embryo collecting, I said, in wrong-headed policies that imagine pregnant women as the most imminent threat to fetal health. My goal in bringing Mount Holyoke's collection to light, I tried to explain, was precisely to bring together three topics that are usually kept separate: the history of scientific embryo collecting, the rise of the animated fetal subject, and feminist calls for reproductive justice.

When this explanation failed to appease some of my colleagues, it dawned on me that my desire to combine these topics was precisely why I was in the doghouse. No one wanted Mount Holyoke's zoological specimens discussed in the same breath with 1930s-era therapeutic abortion or an amusing animated fetus that plays air guitar on Australian television.[1] I was reminded of Monica Casper's discussion of her "most hard-earned lesson," when she lost access to her research subjects while conducting an ethnographic investigation of fetal surgery: "My own commitments, politics, and mapping strategies were in part responsible for where I ended up" (1997:234). Like Casper, I was committed to a "conceptual framework for linking the cultural politics of abortion and reproduction" to technoscientific practices—in my case, to the practice of human embryo collecting (Casper 1997:234–35). Like it did for

Casper, this commitment was beginning to take a painful toll. In the end I was grateful to my colleagues for their honesty, which helped me to realize that our disagreements are part of a larger conversation about who has power to define the multiplicity of meanings attached to fetal subjects. My project—to question the conceptual stability of the categories "embryo" and "fetus" through time—is not their project (Michaels and Morgan 1999:8). My project requires that "embryo tales," including the procurement of Mount Holyoke's fetal specimens, be resituated within the multiple contexts of women's lives. It also requires reflection on the influence of "culture of life" rhetoric on fetal specimen collections.

SPECTERS OF DEATH

If in the previous chapter we met specimens as *icons of life;* this chapter introduces their vile doppelgangers, specimens as *specters of death.* My goal is to highlight a paradox: while lifelike, animated embryo and fetal images are becoming ubiquitous, they are increasingly juxtaposed against another set of images that depicts dead embryos and fetuses (including specimens) as tragic, threatening figures. Lifelike versus lifeless. In this polarized context, embryos are rarely permitted to remain neutral or unmarked. Instead, people quarrel over the place that embryos should occupy along several linked continua: edifying/abhorrent, polluted/pure, entertaining/alarming, tainted/innocent, good/bad. We have seen how embryo specimens are transformed into creative artistic projects, digital scientific models, and exhibits celebrating the embryological origin story; now we will take a look at how specimens are led down a darker path and made into polluting, tragic, and criminal figures.

The polarization that turns specimen into ghoul is both cause and effect of an extremist political agenda that works actively to equate dead fetuses with abortion. For years now, the anti-abortion movement has worked to ensure that people will automatically think "abortion" when they see a dead fetus, and vice versa. *DF = A.* Relentless repetition of this symbolic equation works to divert attention from other things that abortion—and dead fetuses—can and do signify (including freedom from the need to bear and raise unwanted children). My purpose here is not to rehearse a familiar argument, though, but to show how the political context influences the fate of embryo and fetal specimen collections. As we have seen, an enormous amount of labor is expended to police the border between anatomical embryo specimens, on one hand, and politicized, emotional debates over abortion and fetal tissue research, on the other. Several powerful constituencies, including biomedical researchers, are among those invested in keeping the two domains separate. Yet the boundary is constantly being breached, which is what I did when I revealed the existence of Mount Holyoke's fetal collection to a reporter.

Slippage between these domains has ironically hastened the disappearance of specimen collections. There are plenty of good reasons for anatomists, like everyone else, to cull their accumulated stuff, and housecleaning is often cited as a reason why wet-tissue specimen collections have been disappearing since the 1960s. But "time is a better eraser than embalmer," wrote Stephen Jay Gould (Purcell and Gould 1992:31), and the unexpected but all-too-frequent appearance of fetal specimens in twenty-first-century life has been a powerful motivation to clean out the proverbial anatomist's attic. The destruction of fetal specimen collections hints at a deep-seated desire to forget the history of embryo collecting and make way for a triumphant narrative about the beginnings of life.

Historian Ruth Richardson's book *Death, Dissection, and the Destitute* (2000) helped me to realize that the "historical silence" around human embryo collecting might be a "threefold effect of the [collecting] itself" (Richardson 2000:280). Richardson was puzzling out the reasons why Britain's Anatomy Act had been ignored by historians, but her insights apply also to the forgotten embryo-collecting project. The first of her threefold effects is the "silence of complicity" on the part of anatomists, researchers, and curators who had nothing to gain and everything to lose by revealing their collecting practices. (Think of Davenport Hooker and John Rock.) The second effect, Richardson says, is the "silence of acquiescence" by those "in the wider society who benefit, perhaps guiltily," by consuming embryos in a variety of ways (for purposes of clinical therapy, education, amusement, and propaganda). Richardson's third and final effect applies better to the Anatomy Act than it does to embryo collecting: "The fact that the misfortune of poverty could qualify a person for dismemberment after death became too painful for contemplation; became taboo. The memory went underground of a fate literally unspeakable" (Richardson 2000:280–81). For the case of embryo collecting, the argument would have to be somewhat different, namely, that a feel-good embryological origin story cannot not rest atop a pile of fetal remains.

The work of remembering and forgetting is enormously important in shaping the identities that will be associated with dead fetuses, with specimens, and with collections (see Layne 2003:36–37). Memory work consists of a series of small, seemingly sensible decisions about what to discard, what to keep, and what to keep to oneself. It includes choices about what to do with old collections. Should they stay or should they go? When two students at Cornell University recently opted to update and publicize Burt Green Wilder's nineteenth-century brain collection, for example, they embraced a somewhat embarrassing chapter in the history of science. Brains are not as controversial or emotionally laden as fetal specimens, though, and the restoration of the "brain museum" was done with a lighthearted touch that would seem disrespectful if applied to fetal specimens (Lang 2006).

When it comes to wet-tissue embryo and fetal specimens, by contrast, memory work is more apt to involve deliberative (if not always conscious) acts of forgetting. Forgetting takes work, including decisions about what language to use. Embryo and fetal specimens are often described using flat, obfuscatory language, as in an article describing an embryo collecting effort launched in Britain in the late 1990s: "We have successfully collected intact embryos from cases undergoing termination of pregnancy (TOP). Embryonic material was collected from 62% of attempts using a technique of surgical aspiration carried out under ultrasound guidance" (Bullen, Robson, and Strachan 1998). The word *abortion* is never used.

Omission can be a kind of erasure, a form of forgetting. This was evident when *Newsweek* magazine featured a photograph of a fetus on the cover in June 2003, which led a precocious child to ask, "How did they make that picture?" It was a Nilssonesque specimen, posed to look as though it were emitting light and magnified approximately five times, but nowhere could I find an explanation of how it was made. Perhaps the editors decided it was politically safer to leave the work of visual interpretation to the reader and *not* to specify that the specimen was dead. Every time a fetal specimen is made to stand alone and unauthored, though, the opportunity to talk about the social production of specimens is sidestepped, making it seem as though fetuses create themselves. It's a feedback loop, the net effect of which is that some specimens are literally destroyed—put into biohazard containers and hauled away to incinerators—while others are hidden behind elliptical language, missing credits, or just plain silence.

ENVIRONMENTAL PROTECTION

The teaching specimens at Mount Holyoke were managing to hold onto a veneer of scientific respectability, but just barely. In the summer of 2005, a rumor went around that the Environmental Protection Agency was paying surprise visits to college campuses and levying hefty fines if hazardous chemicals were found to be improperly stored. Strict compliance with federal standards meant that all jars containing formaldehyde had to be properly sealed, labeled, and stored. This was not the case in some of Mount Holyoke's science storerooms, including the one where the old fetal specimens were kept. A few professors jumped at the opportunity to get rid of them right away, along with all the other old specimens and detritus. Not only would this put the college in compliance with the EPA, it would resolve the delicate matter of an anthropologist whose interest in the collection had already resulted in a couple of newspaper articles (Flynn 2005; Goldscheider 2003; Tynan 2005). A few people worried that the media attention might provoke pro-life picketers, who would show up at the college gates demanding that the remains be buried. In other words, the political environment needed protection, too. They thought it would be more expedient to get rid of the specimens, in effect to bury them first.

In fact, by this time most of the decomposed specimens in Mount Holyoke's collection had already been purged. All that remained was a 1960s-era display of cleared, sectioned human fetuses in a hallway cabinet and a dozen or so of the prettiest specimens tucked away to be forgotten in a locked cabinet. There were good reasons to destroy the remaining specimens. As one of my colleagues pointed out, no one had used them in more than forty years and no one was likely to use them in the future. They were in obvious disrepair, and the department lacked the personnel and expertise to care for them when the fluid needed replenishing. Another biologist argued that students—especially women of reproductive age—should not be even remotely exposed to formaldehyde, which is now thought to be a potential carcinogen. Some of the biologists lamented that they had no adequate space to display a fetal collection (although they had conspicuously not included such a space in the beautiful thirty-eight-thousand-square-foot, just-completed science complex). They generously offered me whatever specimens I might want, and even suggested I could move the whole collection across the street to the anthropology offices, but I declined. At my urging, they arranged for a photographer to take pictures for the archives. Someone consulted a museum about whether it would take the remaining specimens. The plan was clear—the fetal specimens were on their way out.

Mount Holyoke was a bit slower than some other institutions to discard its fetal specimens, but the decision was by no means unique. Countless other fetal collections, small and large, have been quietly destroyed since the 1970s because they were no longer used in zoological or medical education. In embryology, morphological studies were already being replaced by experimental embryology in the early twentieth century. In biology, ecosystems approaches and molecular studies replaced the anthropocentrism and natural history approaches that characterized an earlier era, and embryology and physiology instruction moved from undergraduate schools to medical schools in the 1960s.

Fetuses were not the only specimens to vanish in recent decades. The ethics and aesthetics of museum display have changed considerably, and every museum with sufficient resources has replaced its dioramas of dead stuff arranged in stiff poses. Even dinosaurs have been updated, animated, and made to come alive in movies like *Jurassic Park* (Franklin 2000); on the "dinosaur" Web site of the American Museum of Natural History, one dinosaur image appears to be running and another blinks.[2] In this context, the bottled fetal specimens look like relics from a bygone age, just as the prescient Flanagan said fifty years ago. All across the United States, dusty natural history displays have been replaced by lively, interactive exhibits mounted in bright halls with high ceilings. At the same time, the ethics of owning and displaying human remains have changed to emphasize respect for relatives, communities of origin, and national and cultural patrimony. The Native American Graves Protection and Repatriation Act of 1990 heightened public sensitivities about exhibiting dead bodies and body parts (Burrell 2005; Starn 2004). Considering these changes, it is no wonder that fetal specimen collections are disappearing.

The remaining fetal specimen collections must be carefully managed to avoid getting caught in the crossfire over abortion (C. Cole 1993:45). One curator told me that she would not put fetal specimens on display "because they might cause a problem." Her self-censorship was not without cause, because fetal specimens are increasingly trapped within an ideological dichotomy that says fetuses must represent either *life* or *abortion*. According to this ideology, there are only two kinds of fetuses: "good" ones that represent life, beauty, innocence, and our collective well-being, and "bad" ones are unattractive, morally polluting, ethically suspect, and make us squeamish. Keeping fetal specimens in storage ensured that the curator would not have to answer questions about where the specimens came from or why they were on display, but it also keeps patrons from seeing them or learning how they came to be.

SCANDALOUS FETAL STORES

Given some of the scandals that have appeared in the press over the last few years, it is no wonder that specimens have become tainted. In 1999, for example, the British public learned that the pathology department at Alder Hey Children's Hospital in Liverpool had for years illegally been retaining children's organs and whole fetal specimens without the parent's knowledge or consent. The investigation of this "fetal store" showed that specimen collecting was widespread throughout the entire national hospital system, and more than two hundred other hospitals were found to have engaged in similar practices. Authorities exposed the scandal, opting to provide Christian burial for the remains. Approximately fifteen hundred unidentified "babies' bodies, foetal tissue samples and blocks and slides," most of which "predate 1980," were laid to rest in the Baby Garden of Allerton Cemetery in 2004 (Royal Liverpool Children's Hospital 2004). The *Guardian* newspaper said, "each baby was dressed in a lemon or white gown, was covered in a 'blanket of love', and laid in an oak casket bearing a numbered plaque" (D. Ward 2004).

There are three points to be made about the Alder Hey affair. First, the scandal had the effect of discrediting *all* fetal and infant specimen collecting by casting *this instance* as a depraved criminal scheme. In fact the principal culprit, Dutch pathologist Dick van Velzen, *had* violated the law by stripping children's organs at autopsy without parental consent. Furthermore, hospital practices had not kept pace with public ideas about the meanings attributed to fetal tissue. The point was made by Waldby and Mitchell: "A paternalistic, medically driven approach to the collection of tissues has failed in the task of managing the different meanings and values that tissues have for the various parties involved" (2006:38). This formulation left no legitimate justification for holding onto old specimen collections.

Second, much of the press coverage overlooked the fact that anatomists routinely retrieved organs during postmortem examinations, that many of the fetal specimens and organs were collected in the "pre–van Velzen period," and that the practice "seems to have been of general application," meaning it was commonplace, even routine (Royal Liverpool Children's Hospital 2001). If the practice of keeping "babies' bodies" as specimens struck some British observers as demented, it is worth remembering that the practice had been utterly unremarkable just a few decades earlier. What would it mean to realize that the horror belonged to contemporary observers rather than to an earlier generation of anatomists?

Third, the decision to provide Christian burial was a potent statement about how fetal death is framed in the United Kingdom (and in the United States). Why would unidentified fetal remains automatically be assumed to be Christian? Are Christians more respectful of fetal death than other faiths are? Was it Christianity that motivated the decision to clothe the specimens and place them in caskets rather than to incinerate the remains? The decision to provide burial rites has to be seen as a political act, in accordance with an ideology that permits fetal personhood to be enacted through burial and other commemorative practices (see Layne 2003:222). Imagine what Mall and his colleagues would have thought if someone had suggested they clothe the specimens, cover them with flannel blankets, and send Bill Hartley out to find tiny oak coffins.

The Alder Hey scandal was not the only instance of fetal specimens retained by hospitals. Similar discoveries were reported in Tokyo and Paris in 2005. In Japan, families learned that the government had kept the remains of at least 114 fetuses and infants delivered by leprosy patients in the wake of World War II (*Japan Today* 2005). In Paris, the *New York Times* reported that hospital authorities "found the remains of 351 stillborn infants and fetuses that were stored illegally in the morgue of a prominent children's hospital, some for more than two decades." On hearing this news some politicians called the discovery "surreal" and pronounced themselves "enormously shocked," yet the president of the union of gynecologists and obstetricians, Dr. Guy-Marie Cousin, had a different reaction. He told the *New York Times* that storing fetal specimens was a perfectly normal, common practice. There was, he said, "no scoop, no scandal," and he cautioned against overreacting. "I am astonished to see how astonished everyone is," he reportedly said, because "research on fetuses . . . was indispensable both for teaching and for research. Are we condemned to abandon it?" (Tagliabue 2005).

His question—"are we condemned to abandon it?"—was a poignant articulation of the collision course that pitted medical researchers against angry family members. Dr. Cousin was well aware that the embryos, fetuses, and infants collected by hospitals for over a century were once hailed as "jewel[s] in the treasury of science" (Corner 1944:15). From his perspective, the results of research on these specimens led to better prenatal care and medical treatments for diseases of pregnancy and infancy. Now embryologists and pathologists were to be silenced or coerced into whitewashing the history of specimen collecting. Dr. Cousin's astonishment captures the irony that doctors were now being expected to collude in the fiction that specimen collecting had never been a respectable scientific enterprise. If I were him, I would have wondered which situation was more surreal.

Fetal specimens and the very notion of specimen-hood were fast becoming politicized. This was not a battle that medical researchers were eager to engage, because they did not want to confront grieving parents and parents-to-be, especially when it was clear that the weight of public sentiment would fall on the parents' side. The implications were dire. Embryologists, pathologists, anatomists, gynecologists, and obstetricians—the professions most responsible for generating embryological and obstetrical knowledge, were losing the historical privilege that had allowed them to decide how fetal remains should be interpreted, handled, utilized, and disposed. Human embryo collecting would either have to be discontinued, or the practice could move underground or overseas. There are recent indications that new embryo collections are being developed outside the United States. An investigation of possible underground legal or illicit embryo collecting is beyond my capability, but the scientific literature does contain accounts of new human embryo collections being developed in Newcastle upon Tyne and in Kyoto (see Bullen, Robson, and Strachan 1998; Shiota et al. 2007; Yamada et al. 2006).

The volatility of this debate needs to be seen at least partially as a reaction to controversies over embryonic stem cell research, which drew attention to the potential ability of embryonic and fetal tissue to heal people and prevent disease. Fetal tissue has been used therapeutically at least since the 1950s for the development of vaccines that now prevent millions of cases of polio, rubella, chicken pox, and hepatitis A. One of the ironies of the fetal tissue research controversy is that some diseases now preventable by vaccine, such as rubella, used to cause untold numbers of fetal deaths through miscarriage. Some of those miscarried fetuses undoubtedly ended up in the Carnegie collection, where they were used to train embryologists and neonatologists who worked to prevent and treat fetal cardiac anomalies, neural tube defects, craniofacial disorders such as cleft palate, and so forth. In other words, fetal tissue research has saved the lives of untold number of embryos, fetuses, and already-born persons. Yet the discourse of fetal tissue research almost never overlaps with that of endangered specimen collections.

Within this context, one can better appreciate the plight of administrators, scientists, and curators who find themselves forced to navigate this explosive terrain. Museum administrators take different tacks. The National Museum of Health and Medicine Web site describes its developmental collection in straight-laced terms: "Maintains the largest collection of embryologic material in the United States . . . a primary source for centralized research in developmental anatomy."[3] The Prenatal Exhibit at the Museum of Science and Industry in Chicago until recently advertised itself by appealing to the classical theme of our collective origins: "The forty specimens in this exhibit . . . offer a unique look at the journey we all made."[4] The Mütter Museum in Philadelphia aims to bring in the horror-movie and forensic-television crowd, advertising its "*disturbingly informative*" exhibits in a creepy, dripping, Halloween-style font. Museums invariably mention the historical, educational, and scientific value of their collections. Sometimes, as we saw earlier, they take preemptive action, heading off questions with semimisleading euphemisms that refer to "natural causes or accidents" and "medically necessary procedures." Such language is meant to imply that the collections are bland, clinical, and, most importantly, *not the result of abortion*. For curators of smaller collections, one strategy for avoiding controversy is to remove specimens from display or to ensure that they will be utilized only in ways that underwrite conventional embryological origin stories. Using whatever means they can, curators aim to keep their specimens out of the line of fire.

CULTURES OF LIFE AND DEATH

Where *DF = A,* the "line of fire" is only a thinly veiled reference to the U.S. abortion wars. When I told friends about the fetal specimens locked in a storeroom at Mount Holyoke, remember, their imaginations went wild. Was there a clandestine abortion clinic at a women's college in the 1930s? When Springfield residents heard that fetuses had been unearthed in their neighborhood, they too wondered whether doctors had performed illicit abortions and buried the evidence. The more I learned about the history of conventional embryo collecting, the more it struck me as odd that people would assume that dead fetuses must be evidence of abortion. The frequency with which I fielded different versions of this question marks the question itself as significant. The question is a result of the disappearance of fetal specimen collections from public view and from polite conversation. Furthermore, *DF = A* justifies and underwrites the disappearance of fetal specimen collections. All of this is complicated by the infiltration of "culture of life" rhetoric into public discourse.

The phrase *culture of life* was coined in 1993 by Pope John Paul II to refer to the idea that human life is sacred "from conception to natural death." The pope used it as shorthand for the Catholic Church's opposition to abortion, most modern forms of contraception, euthanasia, embryonic stem cell research, assisted suicide, and the like (but not war). The phrase was adopted in a less pontifical but no less dogmatic sense by President George W. Bush and other Republican candidates during the 2000 U.S. presidential campaign, where it was associated with the conservative wing of the Republican Party, and Bush used it repeatedly to signal his opposition to abortion and embryonic stem cell research. As "culture of life" rhetoric percolated through American society, the Christian Patriots for Life embarked on a campaign to "re-humanize" fetuses by giving them imaginary names and personalities. "My name is Andrew Jefferson," reads the text for one fetus on their Web site, "I am current president and spokesman for the Federation of Americans Waiting to be Born."[5] As the pro-life movement intensified its efforts to personify and humanize any and all fetuses, one outspoken advocate tried to confound the boundary between planned and unplanned pregnancies.

It started in November 1999, when Fox television talk show host Matt Drudge wanted to show viewers a photograph of a twenty-one-week-old fetus's arm emerging from the womb during an operation. The photograph had been taken during an experimental surgical procedure performed on a woman named Julie Armas, to correct spina bifida in the fetus she was carrying. (Spina bifida is a potentially debilitating neural tube defect in which spinal tissue remains uncovered by skin, and in this case doctors were attempting to close the hole on the baby's back prior to birth.) It was indeed a remarkable picture. The photographer, Michael Clancy, caught the shot just as a long, thin arm stretched out into a pool of light from an incision in the exposed uterus. The surgeon lifted the tiny hand on his yellow-gloved finger to insert it back into the uterus just as Clancy snapped the shutter.

Without knowing the context of the surgery, however, the photograph could read as any surgical procedure—even a late-term abortion—as the doctors plunged their scalpels into the womb. Drudge obviously wanted the photograph to be interpreted as denouncing abortion, and the picture quickly became a flash point for anti-abortion activists. Right-to-life groups dubbed it "the hand of hope." As M. A. J. McKenna wrote on the front page of the *Atlanta Journal and Constitution,* "Pro-life forces claimed it as an icon, an unassailable critique of abortion. Pro-choice thinkers protested: The surgery was improving a fetal life, not ending it. Medical ethicists pointed out that society had once again employed a medical technology before thinking through the implications" (McKenna 2000). Drudge fell on the pro-life side of the debate. He wanted to use the photo to illustrate a story about so-called partial-birth abortion, which was then in the headlines and which he opposed (*Newsweek* 1999:50).[6] A ban on the procedure was being brought before the U.S. Congress, and this "amazing" picture could change the course of debate. The Fox editors overruled Drudge, preventing him from using the picture. They argued that because it was taken during an operation to save a wanted baby's life, it should not be deployed to represent the prospect of fetal death through abortion. Unwilling to back down, Drudge lost the battle and his job.

Drudge failed to achieve his goal, but his logic was clear. He wanted to give the impression of a universal, timeless fetus that could unite Americans in awe of the fetal subject. He tried to separate fetuses into two kinds: alive, innocent and in need of protection; and lamentably, horribly dead. Unnatural dead fetuses seem to have a grip on the social imaginary, judging by the steady stream of tawdry newspaper articles about freshly dead fetuses found buried in backyard gardens, tossed into dumpsters, left in toilets, and washed into sluice gates at sewage treatment plants. Here is just a small sample of headlines:

"400 embalmed unborn children found in garage" (McKeesport, Pennsylvania, August 2005)

"Fetuses found in sewage treatment plant" (Harwinton, Connecticut, June 2005)

"Fetus possibly found during Easter egg hunt" (Chicago, Illinois, March 2005)

"The baby found in a Marlin trash bin Sunday was actually a fetus and had died in the uterus" (Waco, Texas, July 2005)

"Remains of human fetus found near Randleman home" (Randleman, North Carolina, June 2005)

"Stored fetuses shock movers" (Manatee County, Florida, April 2005)

"Human fetus found in yard" (Kalihi, O'Ahu, Hawaii, May 2005)

"Fetus is found in Park Slope toilet" (Brooklyn, New York, May 2005)

"Police unearth over 400 baby bones in India" (Madhya Pradesh, India, February 2007)

"Aborted babies found in garbage at dump site" (Nairobi, Kenya, July 2006)

"Fetuses found at Bogota airport" (BBC September 29, 2005)

In a stranger-than-usual twist, the *Los Angeles Times* reported that a plastinated fetal specimen was snatched from the Body Worlds 2 museum exhibit at the California Science Center in 2005 (Becerra 2005). Although the two female thieves were captured on a surveillance tape, they were not apprehended. They left a note, but did not explain why they wanted a fetal specimen.

The discovery of dead fetuses is typically marked as "shocking," although even cursory attention to the headlines suggests that such discoveries are fairly common. Use of the word *shocking* recalls Taylor's comment that "shocking" fetal images are "meant to underwrite a very particular political agenda, and [to] silence all other discourses" (Taylor 1992:74). Newspaper articles about the shocking discovery of fetal remains have the same effect. Just as predictably as journalists always use the word *shocking,* they *never* consider that dead-fetuses-out-of-place might be the result of social policies that leave women without access to contraception, abortion, or medical attention.

The dead-fetuses-out-of-place genre of journalism gives voice to cultural anxieties about where the dead unborn should be literally and figuratively situated. It associates dead fetuses with the dark side, implying that they must be the consequence of infanticide, theft, smuggling, abortion, or criminal depravity. The stage was thus set for congressional action when the decomposed body of an eight-month fetus washed up on the shore of San Francisco Bay in 2003, followed a day later by the corpse of a woman named Laci Peterson. Peterson had been eight-months pregnant when she disappeared just before Christmas 2002. Her husband, Scott Peterson, was subsequently arrested and convicted of murdering his wife and their unborn son, who Laci called "Connor." The National Right to Life Committee and other anti-abortion organizations lobbied in support of the Unborn Victims of Violence Act, which was signed into law in 2004 to acknowledge fetuses as separate victims when killed during the commission of a federal crime. The crime was horrendous enough without manipulating "the double homicide of Laci and Connor Patterson" for propagandistic purposes, but many people were eager to use Connor's dead body to represent the evil of abortion (Crouse 2003). After a diet of such stories, it is little wonder that dead fetuses have become symbols of all that is horrible.

A 2001 opinion column by conservative pundit Linda Chavez shows another effort to associate dead fetuses with abortion. Chavez was reacting to news that the Body Worlds exhibit might soon come to the United States. German anatomist Gunther Von Hagens's controversial exhibit of plastinated bodies had by 2001 been shown in Japan, Germany, Switzerland, and Austria. It was about to open in London and Seoul, and the number of visitors who had seen the exhibit topped six million. (In 2004 it premiered at the California Science Center in Los Angeles, and has toured several science museums across the United States.) Chavez did not admit to having seen Body Worlds, but she hated the concept. She lambasted Von Hagens for his use of "actual bodies and body parts . . . mutilated and put on display to entertain" (2001). She was offended that a *German* doctor would violate the sanctity of the body or reduce it to an object, implying that German anatomists must bear the historical burden of Nazi medical experimentation (see Hogle 1999). Chavez singled out Von Hagens's display of a "woman whose pregnant belly is peeled back to reveal an 8-month fetus curled inside." She was skeptical of Von Hagens's claim that the terminally ill pregnant woman knowingly donated her body to be prepared in this way. "Can anyone really believe," she asks, "that the pregnant women who are part of his horror show knew that their bodies were to be cut open to expose their unborn babies?" Chavez does not come right out and say that dead fetuses should not be displayed, although she concludes by saying that Von Hagens's exhibit is designed to "celebrate . . . the culture of death."

Because Chavez was writing in 2001, shortly after the phrase "culture of life" had entered the U.S. presidential campaign, there could be no misinterpreting what she implied: the "culture of life" opposes abortion *and* the display of dead "unborn babies," while the "culture of death" presumably supports both. Chavez implied that the display of dead fetuses would appeal to supporters of abortion rights. I tried to imagine how the embryo collectors might have responded to Chavez's column. She said, "There is a real difference between using human remains for scientific purposes and exploiting them for shock value." But the Alder Hey controversy demonstrates that there is fierce disagreement over how scientists are permitted to use fetal remains, and Chavez did not explain the difference between "scientific purposes" and "shock value."

Chavez's hypocrisy did not end there. She neglected to point out that the exploitation of fetal remains for shock value is a standard tactic in the anti-abortion movement. Activists have been known to thrust dead fetuses at women during clinic protests, pull them out as evidence in the courtroom, and literally to throw dead fetuses at politicians on the campaign trail. The extremist Pro-Life Action League in Chicago has conducted "body finds," swiping fetal remains from pathology labs and sending them to anti-abortion groups around the country for well-publicized burials. In 1998 the San Bernardino County coroner in California released the remains of fifty-four aborted fetuses to a Christian pro-life group. The group named each fetus and, with television cameras rolling, paraded fifty-four little white caskets to the cemetery for burial. The coroner had been holding the fetuses for a year, as evidence in a case against the truck driver who had dumped them illegally in a field. He knew that fetal remains are classified as medical waste, for which incineration is the only legal means of disposal. Yet he was willing to exploit them, irrespective of the families' wishes, for an anti-abortion publicity stunt. These examples, along with Chavez's column, are evidence of the work required to promote the $DF = A$ mantra.

Sociologist Nikolas Rose defines the "politics of life" as a movement concerned with "our growing capacities to control, manage, engineer, reshape, and modulate the very vital capacities of human beings as living creatures" (N. Rose 2007:3; see also Franklin 2000). In this context, dead fetal specimens are increasingly recruited to serve as exemplars. An example came to me recently in the form of a letter from an independent filmmaker. For her new film about the life of a woman during wartime, she hoped to create an opening sequence of a "gentle timelapse [of] the beautiful developmental stages of a baby growing in utero, from protozoic *[sic]* to the fully grown fetal stage." She was writing to me, she said, as "one of the few people in the country uniquely qualified" to help her identify existing embryo and fetal specimen collections. She wanted to film the various stages of growth and merge them to create the visual effect of growth. Her idea sounded quite similar to some of the pseudo–time lapse applications described in the previous chapter. This was a case of fetal art imitating "cultures of life."

That the politics and cultures of life are culturally specific was brought home to me in Argentina, where in 2006 I saw a museum display of the preserved remains of murdered infants. The Museum of the Judicial Morgue in Buenos Aires is a high-ceilinged, semicircular room ringed with glass cases. Each case holds a grisly display of violent crimes committed during the first half of the twentieth century, along with anatomical curiosities taken from culprits and victims. Along with the decapitated heads of executed criminals and the skin tattoos of sordid felons, one cabinet contained large jars, each holding an upright infant corpse. One baby still had the murder weapon—a rag—stuffed in its mouth, another had a cord tied tightly around its neck, a third had its throat slit. I have a fairly strong stomach, but this was a nauseating display. My guide explained that most of the babies had been killed in the 1930s by their mothers, who were, he said, "mainly immigrants from bordering countries."

As the guide moved on to the next case (why would someone make a life-size plaster model of a dismembered woman?), I lingered behind. I wondered whether the temptation to describe baby killers as aliens is universal. I wondered why someone had decided to put the bodies of murdered infants on display in a forensic museum. "This would never be allowed in the United States," I thought to myself. Not that there are no atrocious exhibits of gory young humans on display in the United States (recall the aborted fetal galleries online), but this display was meant to illustrate, in an unexpectedly graphic way, a class of crime for which I hadn't realized there was a class. Criminal infanticide did not fit into the cultural category I had carried with me into the room, according to which dead babies in formaldehyde would read as anatomical specimens. This struck me as ethnographically intriguing. It meant that a different classificatory system was in place, one that draws attention, perhaps, to depraved immigrant women who kill babies and threaten the body politic. Even though the Buenos Aires exhibit ostensibly had nothing to do with abortion, these subtexts linked it to some of the more guesome depictions of abortion I had seen in the United States. In both cases the women (mothers and would-have-been mothers, respectively) are cast as villains. Maybe this display had more in common with the United States than I thought, if the message was that women who "choose" to kill their babies are alien and unnatural.[7] Wholesome mothers take note.

With the exception of this extraordinary exhibit, most young human specimens exhibited in museums are designed to demonstrate one of two things: normal prenatal development (as at the Museum of Science and Industry in Chicago) or gross developmental anomalies (as at the Mütter Museum in Philadelphia and the National Museum of Health and Medicine in Washington). Both are medical frames and thus limited, given the potential of embryo and fetal specimens to spark the imagination, and alternative framings can be seen in the work of artists who incorporate fetal specimens into their work. My next few examples focus on artists who are pushing the limits of medicalized embryological discourses by using specimens to generate alternative meanings and associations.

BRINGING OUT THE NEVER-BORN

Photography is arguably the least offensive medium for portraying fetal specimens as artistic subjects (a lesson that Mr. "Human Earrings," described in the previous chapter, might have wanted to consider). British artist Helen Chadwick, for example, took photographs of human and animal "embalmed fetuses" to explore "the borders to art provided by the grotesque" (Franklin 1999:73).[8] Chadwick's photographic compositions of "stilled embryonic lives" created "a range of perspectives on embryos: as nature and artifice, as jewel and corpse, as solitaries and companion objects, as intimate memorial and scientific fetish" (Franklin 1999:76). Another photographer to provide a range of perspectives is Rosamond Wolff Purcell, who traveled the world touring the back rooms of anatomical and natural history museums to find and photograph unusual fetal preparations. One remarkable photograph shows sunlight shining through a glass vessel containing seven almost-translucent fetal remains, suspended by thin wires and arranged in size from biggest to smallest. She liked it, she told me, because the bigger the fetus, the darker the shadow it threw on the floor. I liked it for her metaphor. Substance matters.

The provenance of photographs is not always as transparent as it was in these examples. In 2001, the Center for Bio-Ethical Reform mounted an installation of bloodied and dismembered fetuses on the sidewalks of the California State University campus in Stanislaus. The installation billed itself as the "Genocidal Awareness Project," offering a graphic look at the "genocidal" act of abortion. When English professor Scott Davis interviewed the volunteers working at the exhibit, he said they were "quite proud of the high production values, and the amount of effort it obviously took to compose (and, in some cases, digitally reconstruct) these images." But the volunteers would not discuss or did not seem to know the answer to his question, "Who took these gruesome photographs?" (Davis 2003). It is by now a familiar theme: the frequent appearance and uncritical consumption of similar photographs used to galvanize emotionally and politically charged themes, without being able to trace the images or find out how they were produced. Greater transparency about how such photographs were acquired would go a long way toward educating the genocidal-awareness volunteers about the multiple circumstances that lead to pregnancy loss, maternal mortality, and live-saving therapeutic interventions.

Photography is relatively safe precisely because the specimens are at a remove from the viewer. It is more risky to use fetal specimens in performance art and theater. At the Philadelphia Fringe Festival in 2000, Tim Trelease performed a forty-minute show called *The Specimen Speaks.* He was living in Philadelphia at the time, and had been inspired by visits to the Mütter Museum and conversations with its irreverent and good-humored director, the late Gretchen Worden. Trelease wondered whether scientists have emotions, and how anatomists might have felt about the practice of making specimens, putting things in jars. The play centers on a stillborn infant whose doctor-parents put it in a specimen jar. When it starts to speak to them from inside the jar, the doctor-parents are forced out of their clinical indifference (Van Dongen 2000). I did not see the play, but the descriptions made it seem like Trelease was projecting contemporary ambivalence about fetal specimens into the past. In order to achieve the objectified medical gaze, specimen collectors would have had to suppress their essential vulnerability to don a facade of emotional detachment. But if this was indeed Trelease's opinion, I disagree. There is no essential vulnerability when it comes to fetal subjects, and the repertoire of emotions available to specimen collectors in 2000 was quite different than it was in 1907 or 1957. I perceive in Trelease's work the echoes of a question I raised earlier: what stories are fetal specimens asked to tell?

The riskiest of all artistic media for displaying preserved fetal remains is sculpture. In 2005, Chinese artist Xiao Yu put a sculpture titled *Ruan* on exhibit at the Bern Art Museum in Switzerland. It was a cross-species anatomical pastiche, a figure with a real human fetal head and the eyes of a real rabbit, attached to the body of a stuffed bird. The whole thing was submerged in a specimen jar full of formaldehyde. The fact that Xiao Yu is Chinese figures significantly in what happened next. China's economic rise to power was at the time creating apprehension in the West, resulting in a stream of anti-Chinese news stories. Some of these stories focused on the illicit exploitation of Chinese bodies, including reports that women had been forced to undergo late-term abortions to comply with China's one-child population control policy. The American press was just beginning to express concern about whether Chinese people had given consent to use their plastinated cadavers in traveling human anatomy exhibits (Wilson 2008). Into this highly charged milieu walked Xiao Yu.

Xiao managed in one sculpture to fuse postmodern recombinant anatomy with premodern comparative anatomy, and to reap a xenophobic reaction. It was only a matter of time before a visitor complained. The visitor, it turned out, was Adrien de Riedmatten, a former candidate for the right-wing Swiss People's Party, who said he wanted to know, "where this baby comes from and if it was killed for this work. We know about the problems of late-term abortions in China," he continued, "and we have the right to ask ourselves questions."[9] I do not know whether he was deliberately trying to inflame anti-Chinese prejudice by suggesting that the head might have come from a late-term abortion, or whether his self-designated role as fetal police officer was intentionally calculated to foster the *DF = A* agenda. Either way, the exhibit was pulled from the museum. Meanwhile, Xiao told reporters he had "bought the head in 1999 for a few dollars from a man who was cleaning out a scientific exhibition hall." That is, the fetal head in Xiao's sculpture was a recycled anatomical specimen; it could even have come from the collection that Cowdry started at the Peking Union Medical College. Only by resituating the $DF = A$ equation within the history of embryo collecting, however, can we envision the links between such disparate characters as Adrien de Riedmatten, Xiao Yu, and Franklin Mall.

With so much effort expended to reinforce the link between dead fetuses and abortion, some readers may wonder whether I protest too much. There can be no arguing with the fact that abortion does produce dead embryos and fetuses. But my point is different: women lose pregnancies all the time for many reasons not related to abortion. Indeed many threats to fetal well-being do not reside with women or mothers but with social policies that deny women access to health care, for example, and that expose both men and women to toxic substances (see Casper 2003). It is within the government's power to control mercury exposure, for example, yet the American government's response to environmental mercury contamination has been to urge pregnant women to avoid eating too much fish rather than to shut down polluters. Embryos can die if a pregnant woman simply cleans out the cat's litter box and contracts toxoplasmosis. Most embryonic and fetal deaths in fact result from unknown causes, usually presumed to be "genetic, infectious, hormonal, and immunological" (Weselak et al. 2008). They have nothing whatsoever to do with induced abortion. In other words, $DF \neq A$.

One sometimes still finds "babies in jars" on display in anatomical and natural history museums, but such displays are now rare. Museums, hospitals, and schools have been discarding their collections of unsectioned, wet-tissue embryo and fetal specimens. This is especially the case at small institutions, where there is little justification for keeping specimens that now appear (in the words of a colleague at my own institution) as "revolting-looking, gray, dingy, unattractive." Fetal specimens have become useless and old-fashioned, they say, not to mention smelly, hazardous, and too expensive (or politically volatile) to keep. This trend is a disappointment to me. I would prefer to keep the old specimen displays, if only as a way to keep from capitulating to one or another dominant fetal narrative. The circulation of competing interpretations is an important indicator of the multiplicity of meanings that fetal subjects are asked to carry. It is more important than ever, given the polarized political climate in the United States, to include the unbeautiful specimens in the repertoire of circulating fetal images. It is important for people to know fetal subjects that were never personified, as well as those that are evidence of a paternalist era when doctors took the prerogative to appropriate fetal remains without permission. When fetal specimen collections are destroyed or removed from display, the effect is to create room for "culture of life" narratives by erasing the links between specimen collecting and a contested cultural origin story.

Fetal specimen collections are a reminder that death—including death before birth—is a part of life, and that tiny embryos are worth only what we are collectively and individually willing to make them mean. New embryo collections are appearing now, in places where scientists convince venture capitalists of the promissory embryo future. Everywhere in the world, people project cultural assumptions into their understandings of embryonic life, an observation that goes a long way toward explaining the history of embryo collecting in places like Baltimore and Mount Holyoke College. I will always wonder whether the justification for destroying Mount Holyoke's remaining specimens was unconsciously motivated—at least in part—by unarticulated discomfort over the cultural politics of abortion and fear that the specimens might raise uncomfortable questions. Maybe not. In the end, though, it may not matter. There is no need to confront these issues anymore. Most of the collection has been destroyed, the appearance of propriety at a women's college has been restored, the vague yet persistent suspicions of illicit activity have been quelled, the cultural imperative that causes dead fetuses to vanish has been fulfilled, and the specimens can be forgotten.

NOTES

CHAPTER 1

1. Thanks to Melissa Rosenstein for bringing this to my attention.

2. *In the Beginning* (U.S. Department of Agriculture, Bureau of Dairy Industry, Extension Service, Division of Motion Pictures; Everett Idris Evans, supervising specialist, 1935) is available at the Prelinger Archives, www.archive.org/details/IntheBeg1937. Thanks to Michael Dietrich for bringing this film to my attention.

3. See Condit 1990; Gilbert and Howes-Mischel 2004; Hartouni 1997; Michaels 1999; Mitchell 2001; Petchesky 1984, 1987; Stabile 1999; Stormer 1997; Taylor 1992.

4. The emergent fetal subject had been identified in the 1980s by social scientists, including Rosalind Petchesky (1984, 1987), Kristin Luker (1984), Janet Gallagher (1987), and Faye Ginsburg (1989).

5. From 1990 into the new millennium, a number of important studies documented the social appearance of fetal subjects. The German historian Barbara Duden wrote two books about the history of women's disembodiment and the rise of fetal subjects in medicine and art (Duden 1991, 1993). Katherine Newman's historical study of fetal iconography in art and science was titled *Fetal Positions* (Newman 1996). Sarah Franklin wrote an important essay analyzing the roots in bioscience of the cultural preoccupation with fetuses (Franklin 1991, see also 2000), while she kept a close eye on developments in assisted reproductive technologies including in-vitro fertilization, stem cells, and cloning (Franklin 1997), and, with Celia Roberts, on preimplantation genetic diagnosis (Franklin and Roberts 2006). A well-illustrated analysis of pregnancy photographs dissected Lennart Nilsson's

famous images on the cover of *Life* magazine in 1965 (Matthews and Wexler 2000). The consequences of fetal politics for policing pregnant women's behavior were analyzed by in a series of provocative essays by Valerie Hartouni (1997), a study of how smoking in pregnancy became stigmatized (Oaks 2001), and studies of legal and legislative efforts to codify fetal personhood and jeopardize women by Cynthia Daniels (1993) and Rachel Roth (2003). Feminist literary and cultural studies scholars such as Lauren Berlant (1997), Donna Haraway (1997), Susan Squier (1994, 2004) and E. A. Kaplan (1994), and Carol Stabile (1992, 1999) analyzed the appearance of fetal imagery in texts and films. Following Barbara Katz Rothman's work on amniocentesis, a number of feminist anthropologists analyzed the uses and meanings of obstetrical ultrasound, including Lisa Mitchell (2001), Eugenia Georges (Georges and Mitchell 2000), Janelle Taylor (1998, 2004, 2008), and Tine Gammeltoft (2007). Rayna Rapp's book-length study of prenatal genetic testing was extraordinarily influential, following as it did a decade of articles on the impact of reproductive technologies on the moral and political landscape of the United States (Rapp 1991, 1993, 1995, 2000). Anthropologists also watched as American-style abortion debates and fetal discourses were exported to Ireland (Oaks 1999), Japan (Oaks 1994), Ecuador (L. M. Morgan 1998). With the rise in immigration politics around the year 2000, social scientists devoted greater attention to the emerging phenomenon of fetal citizenship (Holc 2003; Rose 2006).

6. From MissPoppy.com, www.misspoppy.com/catalog/xcart/customer/product.php?productid = 16346&cat = 283&page = 1 (accessed August 7, 2006).

7. On this point I disagree with Kristin Luker, who argued that by mid-nineteenth century the public and the medical profession "all seem to have drawn on relatively widely available and popularly accepted beliefs about the development of the embryo" (1984:26).

8. See Clarke 1998; Franklin 1997; Haraway 1997, 2004; Hartouni 1997; Oudshoorn 1994.

9. For intellectual and conceptual histories of embryology and contemporary ethical debates, see Allen 1978; Clarke 1987, 1998, 2004; S. F. Gilbert 1991; Gilbert, Tyler, and Zacklin 2005; Green 2001; Haraway 2004 [1976]; Maienschein 1991, 2003; Mulkay 1997; Noe 2004; Pauly 2000. The history of late nineteenth-century human embryology, with a focus on German personnel and material modeling, has been admirably described and analyzed by the British historian Nick Hopwood (1999, 2000, 2002, 2007).

CHAPTER 2

1. 4-H Club Web site: lancaster.unl.edu/4h/Embryology/EmbryoPhotos.htm; see also University of Illinois Extension Web site, Incubation and Embryology page, www.urbanext.uiuc.edu/eggs/index.html (accessed June 25, 2005).

2. I am indebted to Lesley Sharp for helping me to clarify this point.

3. *Franklin Paine Mall: The Story of a Mind* is a loving, informative look at a fascinating and turbulent period in the history of medical education, as well as a flattering portrait of the author's teacher. Florence Rena Sabin was a reluctant biographer. Sabin was more or less forced to take the job only after two of Mall's associates—Herbert Evans and Ross G. Harrison—failed to write the biographical sketches of Mall that they had promised to the National Academy of Sciences. Twelve years after Mall's death, Harrison cajoled the American Association of Anatomists into passing the job along to Sabin, but without her knowledge or consent. When she found out, she was flabbergasted. "You can imagine how astonished I was . . . about Doctor Harrison's saying that I was to make the biographical sketch of Doctor Mall for the National Academy. There is not one word of truth in it; I have never heard of such a thing; am not doing it, and certainly Doctor Harrison cannot slip out by any such means as that. He has procrastinated now for twelve years and he cannot get out of it by saying that somebody else is going to do it!" (Sabin 1929). But of course Sabin did do it, probably because she realized that if she didn't capitulate, it wouldn't get done. Besides, she felt a real obligation to ensure that it be done right, in part out of her friendship with Mall's widow, Mabel, who was intensely loyal to her husband's memory and who read every word of the manuscript before it was published. If Sabin glossed over some of the difficult aspects of Mall's life and character, she did it to spare Mabel.

4. Thanks to Eva Paus for translating this from the German.

5. Women would continue to be regarded as "fetal incubators" throughout the remainder of the twentieth century. Brain-dead pregnant women would be kept on life-support systems in hopes that their fetus would reach viability and could be delivered by Cesarean section (Hartouni 1997). And in April 2006, the Centers for Disease Control and Prevention issued a report recommending that *all* women be treated as pre-pregnant, whether or not they planned a pregnancy in the future (Payne 2006).

6. Later, in the early 1960s, a drug called thalidomide was given to pregnant women to ease morning sickness. When many of the exposed children were born with severe disabilities, the medical profession was forced to reconsider the impermeability of the placental barrier.

CHAPTER 3

1. For further information about the *Wunderkammern* and the sixteenth- and seventeenth-century European penchant for curiosity cabinets, see the New York Public Library's Web site, Humanities and Social Sciences Library, Exhibitions page, www.nypl.org/research/chss/events/curiosities.html (accessed August 17, 2007).

2. Something of the same argument is made today by researchers who argue

that fetal tissue research (on retinoblastoma, effects of toxic substances on the fetus, spinal injuries, hemophilia, Parkinson's disease and other neurodegenerative disorders, diabetes, and respiratory distress syndrome) is being impeded by restrictions on access to fetal tissue from induced abortion (although not from spontaneous abortion or stillbirth) (Hellerstein 1988:3042).

3. Money is not the only element that defines a commodity; Hoeyer (2007:329) points out that the commodification of human body parts requires only that their human subjectivity is ignored, they are used instrumentally, and they are amenable to being exchanged. The embryos collected during the early twentieth century certainly meet these criteria and so might be defined as "commodities," although this is not what Mall had in mind.

4. This point is also made by Warwick Anderson (2000:730) in his discussion of the scientific exchange of brains of kuru victims.

5. The 2000 edition of *Stedman's Medical Dictionary* defines it as the period "from conception until *approximately* the end of the second month."

CHAPTER 4

1. Inspired as he was by Sabin's success, Mall would have liked to bracket Sabin's fine specimen with additional models both younger and older in order to show the developmental progression, but this was not to be.

2. This paragraph is paraphrased from L. M. Morgan 2006a:20.

3. Today 30 percent of hysterectomies performed in the United States are undertaken to treat fibroid tumors (Meyer 1997:179).

4. Thanks to Judy Mollica for geneaological research assistance.

5. Lisa Mitchell makes a similar point (2001:11).

6. The photographs apparently did not survive, although the HDAC file contains a pencil "tracing from photograph" of the "split ovum."

7. See the Polysciences, Inc., Web site: www.polysciences.com/Catalog/Department/Product/98/search___22for+use+in+preserving+soft+and+delicate+tissue_22/productId__700/categoryId__130/ (accessed January 17, 2009).

8. See Hopwood (1999) for more on the historical development of serial sectioning in embryology.

9. Hopwood (2002:58) says, "Keibel was so strongly associated with modelling embryos that in July 1914, at a farewell party to celebrate his call to a chair in Strasbourg, the company finished their meal with a human embryo modelled in marzipan."

10. Embryologists could be quite resourceful when they selected modeling materials. Professor Lois TeWinkel, who taught vertebrate embryology at Smith College from 1933 to 1968, reportedly "utilized knitting as a medium for producing pliable three-dimensional models of embryos" (*Smith Alumnae Quarterly* 1968).

11. Thanks to Keith Moore for helping me to interpret the importance of this embryo.

12. More than a decade later, Evans consented to coauthor an article on the topic, written primarily by George Bartelmez, another Carnegie-affiliated embryologist; see Bartelmez and Evans (1926). However, he did no further research on 836 nor on the topic of somite development.

13. National Museum of Health and Medicine Web site, Human Development Anatomy Center, Collections page, http://nmhm.washingtondc.museum/collections/hdac/burdi-patten.html (accessed November 8, 2008).

CHAPTER 5

1. The phrase *egg hunt* is used by Hertig and Rock (1973:124).

2. For more on Miriam Menkin, see PBS 2006.

3. The practice of performing hysterectomy on a pregnant woman is considered unethical today. In London in 2002, a surgeon (by then retired) was severely reprimanded because he had performed a hysterectomy on a pregnant woman in 1993. LifeSiteNews.com, May 31, 2002, www.lifesite.net/ldn/2002/may/02053109.html (accessed August 19, 2007).

4. The first reliable human pregnancy test, based on hormone levels in a woman's urine, was developed in 1928 (Leavitt 2006).

5. Scientists still value "fresh" embryo specimens, but today the practice is given a Dickensian slant by contemporary abortion foes describing the techniques used by researchers looking into treatments for Parkinson's disease: "Two mornings a week, instead of going to her campus lab, Norris drives to a private women's clinic in Denver, where she spends several hours in a small harvesting room, removing tiny pancreases from the remains of 16 to 24 week fetuses brought to her in sterile pans from the operating room where the abortions are being performed" (quoted in Maroney 1993:510).

6. For an example of how social organizations bring embryos into existence while ignoring the possible health consequences to women, see Hands Off Our Ovaries Web site, http://handsoffourovaries.com/ (accessed July 12, 2007).

7. Shellee Colen's concept of "stratified reproduction" draws attention to the fact that some groups of women (such as wealthy professional white women) are encouraged to reproduce while others are discouraged (such as teenagers and poor women) (Colen 1995).

8. Catherine Cole says, "Loyola University's display of fetuses, embryos, and body slices at the World's Fair struck a delicate balance between respectability and sideshow shock value" (1993:55).

9. Thanks to Lesley Sharp for this point.

10. For a fuller discussion of contrasting cultural ideologies about the genesis of personhood, see Beth A. Conklin and Lynn M. Morgan (1996).

11. Today, syphilis has not been eradicated but is readily treated with penicillin; in 2002, there were thirty-two thousand cases of syphilis reported in the United States, and over four hundred cases of congenital syphilis in newborns. Syphilis—CDC Fact Sheet, Centers for Disease Control and Prevention Web site, Sexually Transmitted Diseases page, www.cdc.gov/std/syphilis/STDFact-Syphilis.htm (accessed July 16, 2007).

12. Mall was either very certain of his colleagues or very naive when he suggested that "physicians of good standing" would never participate in "criminal abortion."

13. "It is especially noteworthy that an overwhelming number of young pathological specimens come from physicians whose practice is among the upper classes, while fetuses normal in form and from the middle period of pregnant are unusually common from the working classes. . . . I am inclined to associate the pathological specimens in the first group with the social evil, and the normal specimens of the middle period of pregnancy with unfavorable economic conditions" (F. P. Mall 1917:3).

14. As Burdett says: "The nation-state and statistics: they are not surprising companions, given that 'statistics' *means* the state's numbers, numbers which register and record the state's affairs and interests" (1998:49; emphasis in original).

15. Mall's response to the health commissioner is not preserved, but on March 12, 1909, the commissioner responded to a letter from Mall asking when it is necessary "by law to obtain a permit from this Department to remove a foetus from any section of the city to your laboratory" (Bosley 1909). The correspondence between Mall and the commissioner is evidence of the legal limbo surrounding the categories of embryo, fetus, and infant. The legal confusion, in turn, reflected the social uncertainty and lack of conceptual clarity about how to distinguish among embryos, fetuses, and infants.

16. State laws regulating the acquisition, possession, and exhibition of human bodies often exempt medical and educational institutions, which offers another example of how the state's interest in fetuses (for example) takes account of medicine's interest. All cadavers are, in this sense, biopolitical subjects.

17. It is interesting to note from today's vantage point that the attorney general's broadest possible interpretation did not include preformed embryos, which were excluded from legal consideration.

18. In other states as well, the public was being instructed in the proper disposal of fetal and infant remains. In 1912, a Kentucky court gave the following opinion in "the less than orthodox burial of a premature infant that had survived only two weeks": The appellant "may not cast it into the street, or into a running stream, or into a hole in the ground, or make any disposition of it that might be regarded as a nuisance, be offensive to the sense of decency, or be injurious to the health of the community" (Terry 1986:426–27).

19. This health commissioner's action can be interpreted as an early instance

of the commodification of human embryos and fetuses. Disguised as a benevolent action by the state, the commissioner's action helped to channel precious commodities—human embryos and fetuses—into the biomedical realm instead of toward the funeral industry. For further discussion of the covert commodification of bodies and body parts, see Sharp (2000b).

20. See the Adoption History Project, Baby Farming page, www.uoregon.edu/~adoption/topics/babyfarming.html (accessed August 19, 2007).

21. Members of the interfaith commission were "some of the best-known men and women of Baltimore" (Lane 1916a:157). They were elite social reformers, whose "leaders intended a dual commitment to scientific knowledge and social reform. The scientific disciplines constituting public health would be used to improve health conditions, solve practical problems, and shield public health professionals from direct political interference. The mantel of scientific legitimacy could protect against the interference of local political groups whose interests might be challenged; the commitment to social reform on a scientific basis would provide a safer alternative to the revolutionary ideas of the socialists" (Fee 1987:2–3).

22. In *Motherhood Lost* (2003:10), Linda Layne discusses the awful implications of the word *miscarry,* which some women interpret as an insult on their ability to carry a pregnancy to term.

CHAPTER 6

1. *Newsweek* featured a fetus on the cover also in September 1999, as did *Time* magazine in 2002. In 1980, *Parents* magazine featured a four-page spread titled "The world's first photos of early life in the womb" (Schuman 1980). These are just a few examples of an obviously popular genre that dates back almost fifty years.

2. Thanks to Margaret Lock for bringing this reference to my attention.

3. O'Rahilly and Müller consider *tail* a "discarded term." They suggest substituting the term *caudal eminence* (2001:12), which is no less pompous than the "caudal appendage" preferred by earlier anatomists.

4. The tendency to view animals and humans along a continuum of evolutionary development was encapsulated in biological theory by Ernst Haeckel (1834–1919), a German biologist and philosopher who argued that the evolution of the entire animal kingdom was recapitulated in the embryonic development of a single organism ("ontogeny follows phylogeny"). According to Haeckel's recapitulation theory, young human embryos pass quickly through all evolutionary history on their way to assuming the human form (see Gould 1977; Werdinger 1980). Recapitulation theory could be empirically tested by comparing embryo features among different species. While Mall was amassing his collection of human embryos, other embryologists set up breeding colonies to produce embryological serial sections of swine, mice, guinea pigs, muskrats, cats, cows, monkeys, sloths, rabbits, and opposums. Explicit comparisons among species were common.

5. For an example of those who keep alive a debate over the significance of human embryonic tails, see Jesus, Dinosaurs, and More Web site, www.angelfire.com/mi/dinosaurs/tailbone.html (accessed July 17, 2007).

6. One author cites Mall among the champions of racial justice (Beardsley 1973:50).

7. The signature on the letter is undecipherable. It was written from the J. H. R. Molson Laboratories of Pathology and Bacteriology, McGill University, May 23, 1905, and can be found in the CIWDE Papers at the Alan Mason Chesney Medical Archives of the Johns Hopkins Medical Institutions.

8. The letters from Adolph H. Schultz to George Streeter, spanning the years 1920–22, are in the Alan Mason Chesney archives at Johns Hopkins.

9. Contemporary echoes of scientific racism reverberate, for example, in comments attributed to James D. Watson, codiscoverer of the double-helix structure of DNA, in 2007, in which he reportedly implied that Africans had generally lower intelligence than Euroamericans. I am grateful to Monica Casper for mentioning the parallel between Watson's comments and the racial embryology project.

10. I am grateful for the kindness of Dr. E. Grey Dimond, Professor and Provost Emeritus at the University of Missouri, Kansas City, for forwarding my query to Dr. Zhang.

CHAPTER 7

1. Monica Casper points out that the prohibition on making human remains into jewelry may be changing, as various companies with names like "Ashes to Ashes" and "Cremation Keepsakes" offer to incorporate "cremains" (ashes from cremation) into jewelry such as lockets, pendants, and rings.

2. Therapeutic abortions were starting to be performed more frequently in the 1930s, as doctors realized that illegal abortions were taking a significant toll on women's lives. In an effort to reduce the rate of maternal mortality associated with illegal abortion, they expanded the list of justifications for therapeutic abortion to include diseases such as tuberculosis, as well as to protect a women's life, health, or sanity (Hooker 1939:7; Reagan 1997:139–43). Hysterotomy was justified when therapeutic abortion would be accompanied by sterilization.

3. Some of Hooker's footage has been digitized and posted online by the Virtual Human Embryo Project, a collaboration between the Louisiana State University Health Sciences Center and the Human Developmental Anatomy Center; http://virtualhumanembryo.lsuhsc.edu/videos/Fetal_activity_index.html (accessed May 28, 2008). I am grateful to Michael Sappol for the Web sleuthing that located this link.

4. See Vanderbilt Students for Life Web page, Robert L. Sassone, The tiniest humans, http://studentorgs.vanderbilt.edu/sfl/lejeune_testimony.htm (accessed December 30, 2008).

5. See www.ashcofriendsforlife.com/abortion_methods.htm (accessed September 18, 2005; look for page under "cache"; do search for "Ashtabula County Friends for Life," and go to "abortion methods").

6. The "visible embryo" projects described here are not part of the Visible Human Project sponsored by the National Institutes of Health, although some of the same institutions are involved in both endeavors. The visible-embryo projects were a significant advance in teaching embryology, and researchers focused on pedagogical applications using the new imaging technologies. Other visible-embryo research looked at gene expression in embryological development, focusing on making models of human cardiogenesis in an effort to understand the hypothesized developmental basis of adult heart disease.

7. The Oregon team chose Carnegie no. 836, not because they knew it was already famous, but because they wanted to illustrate the end of the looping stage of heart development, before the heart became "septated" (divided into chambers), which turned out to be stage 13 or 14. Furthermore, they needed a specimen in which the cardiac tissue specifically—in addition to the general overall grade—was perfectly preserved and represented in the serial sections.

8. A sample of Brad Smith's creative work can be seen at www-personal.umich.edu/~brdsmith/CreativeWork.html (accessed January 28, 2009).

9. See the Multi-Dimensional Human Embryo project Web site, Detailed Project Description page, http://embryo.soad.umich.edu/aboutProj/projDetails.html (accessed November 12, 2002).

10. Used copies of *From Conception to Birth* were readily available online as this book went to press. The same title was used thirty years earlier by Rugh and Shettles (1974).

11. See Museums Washington 2003.

12. Anonymous, telephone interview with author, October 29, 2002.

13. Anonymous, correspondence with author, January 22, 2003.

14. Ann Curry, interview with Alexander Tsiaras, *Today Show,* October 29, 2003.

15. Ruysch's recipes for preservation fluids were a closely guarded secret, and his collection was so well preserved that some of the specimens are still on display in the St. Petersburg Museum in Russia.

CHAPTER 8

1. "Courier Mail celebrates 50 years of rock music in the womb," Inspiration Daily Web site, www.duncans.tv/2005/courier-mail-womb-rock-music (accessed June 1, 2008).

2. American Museum of Natural History Web site, Dinosaurs page, www.amnh.org/exhibitions/dinosaurs (accessed May 30, 2008).

3. See the National Museum of Health and Medicine Web site, http://nmhm.washingtondc.museum (accessed July 29, 2007).

4. See www.msichicago.org/exhibit/body_prenatal/index.html (accessed July 29, 2007, but has since expired).

5. Christian Patriots for Life Web site, www.cpforlife.org/culture_of_life.htm (accessed August 20, 2007).

6. I thank Rachel Roth for drawing this to my attention. The surgery was successful, and the child, Samuel Armas, is now portrayed as a young hero in anti-abortion circles. The incident has since been adapted for television programs including *Scrubs* (the "My Road to Nowhere" episode) and *House* (the "Fetal Positions" episode).

7. Thanks to Monica Casper for helping me to sharpen this point.

8. I adapted this subheading from a special issue of *Atrium,* the magazine of the Northwestern Medical Humanities and Bioethics Program, called "Bringing out the dead" (*Atrium* 2005).

9. Source: Avant-garde Chinese artist defends fetus-bird artwork, *China Daily,* August 10, 2005, www.chinadaily.com.cn/english/doc/2005–08/10/content_467851.htm (accessed January 28, 2009).

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The abbreviation AMC, which appears several times in this bibliography, stands for the Alan Mason Chesney Medical Archives of the Johns Hopkins Medical Institutions. CIWDE is an abbreviation for the Carnegie Institution of Washington Department of Embryology.

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