ONE

# *Observing Bodies*

THIS CHAPTER IS ABOUT THE DISCOVERY OF A DISEASE. As soon as I write that, I want to fulfill the expectation—mine and my readers, I assume—to give a date and name a person who discovered this disease. However, this disease was discovered many times because discovery of disease was an ongoing process; a discovery had to be researched and confirmed, questioned, and discovered again to be believed. Older histories of diseases and conditions begin by recognizing the person who identified, described, and named the disease. In this chapter I rethink the medical discoveries, the processes of the production of scientific-medical knowledge, and the means by which that knowledge becomes concretized as fact. Discovering a disease entails identifying, defining, and naming the disease as well as winning acceptance of the evidence and the name. This disease was discovered—and named—multiple times throughout the nineteenth and twentieth centuries.

First identified and named in the nineteenth century, German measles was discovered again in the 1940s as a cause of birth defects. The disease came to be understood as a teratogen, an external environmental factor that harms the developing embryo and fetus in utero. Throughout the nineteenth century and much of the twentieth, no one in the medical world imagined such an association. Physicians did not regard the disease as dangerous. Indeed, one of the chief characteristics of German measles was its relatively minor symptoms compared with those of other contagious diseases. In 1941, an Australian specialist in ophthalmology announced his finding that when women

contracted German measles during pregnancy, the disease severely harmed the developing fetus, causing congenital cataracts and frequently fatal deformities of the heart. Researchers soon knew that the infection during pregnancy also caused deafness and mental retardation in the fetus as well as miscarriages, stillbirths, and infant deaths. These insights rewrote medical and popular knowledge of German measles specifically and also reshaped the general scientific understanding of viruses, epidemics, and pregnancy. Now known in an entirely different way, German measles was essentially a new disease.

Medical discoveries about German measles in the nineteenth and twentieth centuries grew out of modern practices of observation of the body. As Foucault showed for the late eighteenth century, the rise of "the clinic" in Paris—or the practice of anatomizing a series of dead bodies and then looking at patients in hospitals for the signs of internal pathology—produced a new relationship between the physician and the sick as well as new knowledge and new social practices. In Foucault's analysis of the clinic, the sick (and the dead) became objects of analysis, passive subjects, means for producing information and categorization. Doctors and scientists at the Paris clinic now prioritized the medical eye and the gaze over other senses and other methods of gaining knowledge, such as the ear that listened to the patient's verbal report of her or his own body.[1] Yet the reliance upon listening did not disappear. The habit of observation by twentieth-century mothers and their communication with doctors were essential components of new medical discoveries about German measles. The German measles case shows that both modes—seeing the patient's body and listening to the words of the patient and family observers—coexisted and contributed to the major mid-twentieth-century discovery of rubella's danger to the fetus. This discovery of the 1940s built upon medical listening in a pediatric medical encounter. In collaboration, mothers and doctors produced new knowledge that transformed the significance and meaning of this disease.

Through the mother's observation of a sick body and her decision to show that body to a doctor, a patient is made. The situation surrounding German measles is an example of the central role played by mothers in producing patients, cases, data, and medical discoveries. My analysis of German measles returns another active observer and active intermediary to the process of modern scientific discovery: mothers, as the traditional and most intimate caretakers of the sick body, have been historical coworkers in the production of scientific knowledge.[2] As doctors began to regard

a particular type of patient first as an example of a specific disease—as a clinical case—and then as one of many cases—as points in a spectrum of data—they produced new medical and scientific knowledge and made new discoveries in the nineteenth and twentieth centuries. Grounded first in gendered and maternally based observation, knowledge, and insight, physicians translated the sick individual into medical and scientific information and importance.

If we focus exclusively on an individual named as the "discoverer" of a disease, key components of that discovery are lost and left uncredited and untheorized. Both the process of translating gendered and home-based knowledge into scientific knowledge and the concomitant transformation of sick individuals into data and evidence are made invisible. The physical and intellectual work of unnamed female observers of the body was used, even required, but subtracted from publications, public honors, and historical memory of the scientific process of learning, interpretation, and discovery. Since these processes of biomedical discovery were both obscured at the time and then later perpetuated in the thinking habits of subsequent scientists and historians, the knowledge, labor, and civic commitment of women—often as mothers—to science and medicine have been buried and erased. Observing the body, analyzing symptoms, sharing knowledge, and sharing bodies and ideas with physicians and researchers for the development of science were not simple byproducts of maternal responsibility to care for family health. Rather, this active observation and involvement in the development of medical knowledge was a gendered civic and scientific duty that twentieth-century women embraced and upon which medical, scientific, and modern public health advances and practices depended.

## DIAGNOSIS. WHAT IS THIS RASH?

Noting the symptoms of rash and fever alone does not describe a disease. Nineteenth-century observers readily saw that there were two, three, or more diseases that included rash and fever and resembled or combined measles and scarlet fever. The question was whether there was something that was distinct from measles and scarlet fever.[3] Although German scientists agreed by the early 1800s that rotheln was a distinct disease, British and American physicians with a range of interests, including dermatology, children, and military medicine, continued to investigate the question throughout the nineteenth century. Discovery of disease was not a moment but rather a process. The medical literature on rotheln did not deal with any inherent dan-

ger of the disease itself. Nor did it detail the disease's treatment. Instead, the literature addressed diagnostic differentiation and naming.

Naming a disease is an essential component of diagnosis and treatment. Diseases have many names, however; and naming precisely what condition someone had was difficult in the nineteenth century when there were so many different names used by English physicians for red rashes. Rotheln, rosalia idiopathica, rubeola notha, epidemic roseola, rosella, rosalia, and rubeola, as well as false measles and secondary measles,[4] spurious measles, and rose-rash,[5] were all in use for this disease. It might also be named rosalia spuria or scarlatinea hybrida or dubbed a "bastard" or "hybrid" form of scarlet fever or measles.[6] Reflecting its mildness, the disease was also called "very mild scarlatina."[7] Surely there were also other names used among families, neighbors, and local healers that did not get preserved in the medical literature. A single unifying name for a disease is a modern device. It is a sign of the standardization of knowledge across regions, languages, sciences, and individual experiences. By the end of the nineteenth century, medical researchers had agreed upon a single name, yet multiple names persisted, and new names proliferated with the discoveries of the mid-twentieth century.

Throughout the nineteenth century numerous physicians tried to explain the differentiation among measles, scarlet fever, and German measles. Some declared the diagnosis obvious, but the number of doctors who attempted to describe the disease demonstrated that diagnosis was not simple. William Squire of London observed that it was not at all easy to distinguish this disease from measles by looking at the rash alone. Reviewing a series of cases and carefully noting the color of the rash, the swelling, the condition of the rest of the skin, the day of the rash's appearance, the tongue, and any fever, Squire argued that this was not a mixture of measles and scarlet fever but instead "a specific disease, having its own natural history and laws."[8] "It is most difficult to describe the difference in books," observed another doctor, "but when the diseases are seen in company, the distinction is easy and pronounced." However, another colleague disagreed. "Experienced practitioners," he reported, "have great difficulty in coming to a conclusion" about such cases.[9] The confusion continued for decades. "The more one studied these exanthemata," one physician admitted, "the more perplexing is their differentiation."[10]

Dr. Henry Veale, a physician for the British Royal Artillery, weighed in on these pressing questions with an epidemiological study of an 1866 epidemic in a boarding school in India. Veale tracked cases and carefully

differentiated among three diseases—measles, scarlet fever, and rotheln—to prove that rotheln was a distinct disease. Dr. Veale produced a table that outlined the symptoms for each of the three diseases. He differentiated among the three related diseases by incubation period, the type of rash and how long it lasted, and fever and how long it lasted as well as by coughing, vomiting, and sore throat. Even the rash of this single disease, he suggested, varied. In this small epidemic, some of the patients had a "dusky red colour" rash like measles while others, he noted, had a "bright rose" rash like scarlet fever. Clearly, the rash alone could not distinguish one disease from the others. He noted too that the rash's "hue was most vivid on the first and second days and [that] when the face, body, arms, and legs were attacked in succession, the eruption faded in the same order." The number of days that the rash lasted was one indicator of the diagnosis: rotheln rash faded on the third day, scarlet fever faded on the fifth day, and measles faded on the seventh day. A sore throat was typical with scarlet fever, unusual with measles, and occasional with rotheln.[11] These fine distinctions were based on familiarity with all of the diseases.

Veale's analysis and differentiation of the diseases were definitive in the history of German measles. His evidence took advantage of an 1866 epidemic at a Bombay boarding school. Through careful differentiation of the symptoms, collection of data, and the physical tracking of people through time and space, Veale concluded that this disease (rotheln) was contagious and a specific disease independent of scarlet fever and measles. He described thirty "cases," boys and girls between six and eighteen years old, who all "presented the disease in the most distinct form . . . an eruption on the face, arms, and body, very similar to that of measles." Yet the first case, a twelve-year-old girl, had already had measles. Veale closely tracked the chronological appearance of the disease and mapped the location of the children and their beds in the school. When the first child became ill, she was isolated for a week. The next case was another girl who slept only two beds away from the first. The fourth case was a six-year-old boy, but the doctor learned that he had slept near his sick sister and then had taken the rash to the boys' dorms. Since nearly half of the children had already had measles, Veale knew this epidemic could not be measles. Contracting measles a second time was rare. Since scarlet fever had never been encountered in the Bombay presidency, and none of the children showed the "strawberry" tongue of scarlet fever, he ruled out scarlet fever.[12]

The school children in Bombay were not only regarded as sick patients; for Veale and other doctors like him, they also became objects of science,

cases that produced new knowledge in the British empire. School, an institution that massed children together, served as a space in which to see disease upon bodies and observe its course over time. Children in boarding schools, orphanages, and other institutions provided opportunities for scientists to plot the disease on individual bodies, to plot the movement of the disease on a map as it moved among individuals, and to plot it on graphs and tables that categorized symptoms, histories, and types of individuals. Young students served as sources for scientific observers interested in working out the problem of German measles and other infectious diseases. The school, like the hospital, and, as we shall see, the military training camp, all served as a clinical laboratory for nineteenth- and twentieth-century medical advances.

The concentration of people who suffered the disease consequences of their massing provided the means for research and for finding the solutions to protect them from the disease-ridden—and at times deadly—results of their congregation. Physicians attending children's institutions—like Dr. Veale in Bombay, Dr. May Michael in Chicago, and Dr. Shuttleworth in Lancaster, England—had a better vantage point for observing, distinguishing, and understanding diseases in general, including German measles. As Dr. Shuttleworth remarked at an international medical congress, it is only upon seeing a "*series* of cases . . . that one becomes convinced of the distinctive character of rotheln." His position as medical officer of an institution with five hundred children made him acutely aware of the differences among these diseases.[13] While others struggled to differentiate and diagnose this disease, Dr. May Michael declared the diagnosis "not difficult" in 1907. Describing an epidemic in a children's institution, she listed the quick onset of the disease, its mildness, the lack of respiratory symptoms, and the look of the eruptions, which all "stamp the disease as rubella."[14] Sick children at home also provided clinical opportunities for their medical parents. In the intimacy and amid the daily routine of home, doctors learned, for example, that a rash need not be apparent for this disease to spread to others.[15]

Veale and other interested physicians were immersed in one important aspect of the epidemiological and scientific work of the nineteenth century: differentiating and identifying specific diseases with their "own natural history and laws."[16] This work was part of the intellectual transition toward disease specificity and etiological specificity and away from notions that diseases arose from miasma, from bad and smelly air, from changes in the weather, or from individual internal physiological imbalances. Furthermore,

in this new thinking, disease affected all bodies in the same way—regardless of region, national heritage, race, or sex—and all bodies were to be treated in the same way rather than as unique individuals.[17] Veale observed children in far-flung parts of the British empire to address questions of great interest to physicians and scientists at home.[18] Bacteriologists focused on identifying specific germs that caused specific diseases. Germ theory eventually overturned scientific, medical, and popular thinking about disease causation and prevention and transformed medical practices. The experimental and intellectual work of Robert Koch and Louis Pasteur is well known.[19] Physicians in everyday practice too, however, contributed to this intellectual transformation toward disease specificity from a different direction. As clinicians, they observed patients, collected minute data on those patients, and observed in institutions and in their private practices the progress of a disease and its movement from person to person. With those observations, they began producing a science of diseases that regarded them as separate, specific, "natural" entities, each with its own "laws." This was not mere taxonomy but rather a sea change in the thinking of medical men and in the public too regarding the causes of disease and the appropriate responses to them.

Finally, Veale took the occasion to address the problem of naming. Not only did the proliferation of rashes make diagnosis difficult; so too did the multiple names assigned to the condition. "The name of the disease is always a matter of some importance," asserted Veale. "It should be short for the sake of convenience in writing, and euphonious for ease in pronunciation."[20] "*Rotheln* is harsh and foreign to our ears," he continued. "I therefore venture to propose *Rubella* as a substitute for *Rotheln.*"[21] The proposed name took care of the problem of having to read and speak German for both doctors and their patients while simultaneously sounding like both Latin and English. It still hinted at a red rash and an association with measles (generally called *rubeola*). Veale's suggested new melodious name did not register, however, with English-language physicians writing about the disease at the same time.[22] It would be many decades before *rubella* became generally used within the medical profession and a century before the general public became familiar with this name.

Out of all of the various names, the one that came to predominate was a simple one, *German measles.* The name arose in the midst of an 1871 epidemic in Massachusetts as a way to name the disease and distinguish it from the other epidemic rashes of measles and scarlet fever. Dr. A. H. Nichols "hit upon a name which was readily accepted by the laity,"

reported a Harvard colleague. Instead of using the hard-to-pronounce German word *rotheln,* the doctor simply dubbed the measles-like disease "German." The name worked. When an epidemic of a rash "of no very great severity" ran through Roxbury, Massachusetts, in 1871, medical attendants found themselves confused. Realizing that people who came down with this rash included those who had already had measles and scarlet fever as well as those who had never had either confirmed that this rash was a specific disease. Dr. B. E. Cotting, a Harvard man who reported on the spring 1871 epidemic and an earlier 1853 epidemic, claimed that the new name of *German measles* "originate[d] with us." Apparently a Scottish physician had also coined the term *German measles.*[23] As Veale had observed several years earlier, the English-speaking world found the name *rotheln* "harsh and foreign." Rather than adopting Veale's term, *rubella,* however, more than one English-speaking doctor had come up with the more casual *German measles.*

The new term retained both the association with and the distinction from *measles,* but it now appeared to be associated with a foreign country. However, adding the word *German* to the disease's name in order to avoid having to pronounce a German word (but still giving German science credit for identifying the disease) led to new confusions. Another American doctor, J. Lewis Smith, physician to New York's Infant's Hospital, who wrote about an 1873 epidemic, seemed to think that the disease was a foreign one, new to the shores of the United States. He described the disease as occurring "on the continent, especially in Germany" and rare. Indeed, he believed the New York City epidemic of 1873 to be "the first" outbreak of the disease on the American continent. His older colleagues had seen nothing like it in twenty years and believed it to be "an entirely new disease with us."[24]

Clearly, the 1873 cases of rotheln that Smith saw in New York City were not the first on the continent or in the United States, for Cotting had identified such cases in an epidemic twenty years earlier and in Massachusetts only two years before. On my own initial reading of Smith's article in an 1873 issue of the *Archives of Dermatology,* I thought, "He's wrong; it was not the first outbreak of German measles in the United States; he didn't know about the earlier epidemics and publications." I now see that the Smith report can be read in several ways. First, although he referred to "foreign" medical literatures, Dr. Smith had not read all of the most recent publications on the subject in the American medical literature. The full range of medical journal articles may not have been easily available or read during the nineteenth century. When scholars now analyze previous

scientific and intellectual developments, the uneven availability of materials should be kept in mind. Now, at the start of the twenty-first century, through the valuable *Index-Catalogue of the Library of the Surgeon-General's Office,* which indexes medical articles from around the world, and the rich journal collections preserved in university libraries, I have better access to the full range of nineteenth-century medical publications than did most physicians and scientists of the time. Finally, Smith's remarks point to the localism of medical knowledge. None of the New York doctors had previously encountered this disease, and apparently they had neither heard Cotting's 1853 talk nor read his paper published two years before the New York epidemic. It is highly likely that the disease had appeared in years past among New Yorkers. The Smith report's conclusion that rotheln had *not* previously been evident in New York probably occurred because no one had recognized it earlier.[25] There may have been "double diseases" or "hybrid measles" but not rotheln.

Although *German measles* became the standard name for the disease among English speakers, some strenuously objected to it on both scientific and nationalist grounds. Dr. Mulheron called it "positively misleading." "Rotheln," he reminded his colleagues, "merely indicates the existence of little red spots." "German measles," in contrast, he pointed out, "implies a modification of measles through some peculiarity of the German temperament, diet, climate or mode of life, a supposition which is, of course, ridiculous."[26] The appellation *German* brought out both nationalist hostility and pride. Dr. Klein proclaimed *rotheln* to be a fine name. "*German measles,*" he declared, "is [an] unwarrantable American fabrication."[27] To the contrary, another medical observer claimed that the French or English equally deserved credit for identifying the disease.[28]

In 1881, Chicago, Michigan, Missouri, Indiana, and Nebraska reported local epidemics of rotheln (or, as its reporter observed, "German measles, rubeola, measlings, spurious measles, false measles, bastard measles, *rubeola sine catarrho*"). Yet the question of whether this was a separate disease or a mild version of scarlatina or measles and the matter of its name still vexed physicians. "If this be an independent disease, as I believe it is, the first thing we want," Dr. Charles Warrington Earle of Chicago remarked, "is a name upon which we can all agree, pronounce, and understand."[29] In 1881, two international congresses of physicians confronted the problem, declared that the disease existed, differentiated it from measles and scarlet fever, and agreed upon a name. It should be called *rubella.*[30] Despite the international attempts to control the name and the medical understanding

of the disease, doubt, confusion, and a variety of names persisted among physicians and the public.[31]

In the midst of the confusion, however, doctors agreed that mildness was a characteristic feature of German measles. "The constitutional symptoms were so mild," Dr. May Michael observed, "that it was difficult to keep the children in bed." In another thirteen-page article on a local epidemic, a single sentence addressed how to care for the person sick with this disease: "Rotheln . . . requires very little treatment. I commonly give small doses of quinine to my patients," ended Smith, physician of New York. "Happily," wrote another, "the disorder is in itself an unimportant one, in that it perhaps never destroys life." Another physician labeled it "an inoffensive complaint."[32]

Despite its mild nature, German measles worried doctors and mothers alike because of its more dangerous, and sometimes fatal, associates, measles and scarlet fever. The correct diagnosis of German measles mattered. "The physician's error in diagnosis," warned one observer, "may be the means of spreading measles or scarlatina throughout a family or an institution."[33] The rash might be confused with smallpox as well. "It was probably very fortunate," a Detroit physician dryly observed in 1881, that German measles "prevailed here before the occurrence of the late small-pox epidemic." Otherwise, he was sure, some of the victims of German measles "would have been sent to the pest house." He told of an infant with eczema whom "certain eminent professors" had diagnosed as having smallpox. "The infant escaped the infected lazaretto, and probably certain death," he continued, "because by mere chance she afterwards fell into the hands of a practitioner who happened not to believe that every eruption during the prevalence of small-pox is necessarily small-pox."[34] As this story underscored, the safety and survival of the sick depended on accurate differentiation of diseases and diagnoses. Thankfully for the child, according to this doctor's story, more skeptical and careful physicians read the rash correctly. This doctor's point was not only about smallpox versus German measles versus eczema but also about competitors and status within the medical profession.

It is unlikely that the doctor had seen the baby girl "by mere chance," however. Instead, a skeptical parent, most likely the mother, had made sure that another doctor saw their daughter to get a second (and preferred) opinion. Parents did not passively follow the directives of medical experts but instead followed their own readings of their children's bodies and medical science. Parental observation, diagnostic skill, and skepticism became "mere chance" in this doctor's account. At a time of intense competition

among physicians, parents and patients had a wide variety of doctors from which to choose and actively sought different medical opinions.[35]

Differentiating between the dangerous diseases of scarlet fever and measles and the harmless German measles was difficult, however. Physicians continued to publish long descriptions of their observations of dozens and hundreds of cases; they described in great detail how one might distinguish this disease from its "half-sister" of measles or scarlet fever. All agreed on the presence of a red rash (in most cases); all agreed on the disease's kinship with measles and scarlet fever, but authors varied on the size and shape of the rash, the timing of its appearance, the existence or lack of fever or sore throat, and the incubation period. The best way to determine whether a patient had German measles, it appeared, was knowing if the person had already had measles and scarlet fever. Following the accepted rule that once a person had experienced these diseases, she or he gained immunity and could not contract them again, a doctor could conclude, through the process of elimination, that the patient now faced German measles. Additionally, if the doctor (or the mother) knew well what measles and scarlet fever rashes looked like, then he or she would be able to identify German measles. One of the most succinct descriptions of the disease and its diagnosis characterized it this way: "a disease in which the red spots are smaller than measles and larger than scarlet fever."[36] As these confusing comparative descriptions show, parents and doctors might easily mix up and misdiagnose these diseases.

## IN THE NEWS AND IN THE MILITARY

As a mild disease, German measles was hardly newsworthy in the ways that other, more deadly diseases could be. Bubonic plague epidemics in San Francisco, smallpox in Milwaukee, typhoid and "Typhoid Mary" in New York, tuberculosis in Atlanta, leprosy in Hawaii and among Spanish-American war veterans, and other frightening diseases all filled newspapers at the turn of the twentieth century.[37] Nonetheless, because it appeared in epidemic form, German measles did show up in newspapers in the sections dedicated to sports, entertainment, and schools. The manager of the Washington (DC) Senators baseball team worried about the game against the Boston Red Sox when he learned that his players had been exposed to German measles.[38] Track stars, college basketball players, and rowers were reported stricken with the disease; the tours of opera singers were interrupted.[39] When elementary schools and colleges—including Harvard,

with its "rich college boys"—periodically experienced an epidemic, they closed their doors, quarantined the sick, and cancelled classes, shows, parties, and other mass events in order to control the epidemic's spread.[40] As one doctor observed, "German measles is not a serious disease, but it is certainly a great nuisance, particularly in an institution."[41] German measles quickly spread among groups, infecting those who had not encountered it before. The sick did not generate enormous worry, but they nonetheless required nursing attention and isolation.

German measles also posed problems for the military. Bringing together hundreds and thousands of new troops in training camps or at central stations to be shipped out to foreign lands created ideal conditions for the spread of contagious diseases. If one man showed up sick with German measles or another contagious disease, it could easily spread among others who had never been exposed to it. Although soldiers were not lost to this disease, they could be laid low, and troop deployment could be delayed for weeks. For instance, one British army garrison had to deal with a German measles epidemic that ran from February through June of 1913. More than two hundred soldiers came down with German measles. Measles and scarlet fever also struck at the same time. As the soldiers were isolated and treated, the two hundred men offered their doctors another opportunity for analyzing and differentiating diseases. The observing physician used a prevailing metaphor when his words likened the disease to a military attack. During the "invasion period," Major J. G. McNaught observed, the sick felt "out of sorts" for a day or two. For many, the first indication of illness was a rash.[42] Some draftees also endured acute arthritis and joint pain.[43] Although German measles was not the most common disease to strike the U.S. army during World War I—influenza and venereal diseases topped the list—it nevertheless accounted for many days lost. Army hospitals admitted more than 17,000 soldiers for German measles and estimated "211,645 days lost from duty."[44]

Soldiers also spread infectious diseases to citizens of nearby towns. During World War I, the congregation of draftees and National Guard troops "caused epidemics" in the United States. Failure to diagnose diseases, differentiate among them, and isolate cases increased the numbers. German measles and measles both arose at Camp Pike in Arkansas and spread to North Little Rock and Little Rock, resulting in hundreds of cases in both towns. At its peak, Camp Pike hospitalized more than 1,200 men with measles and German measles.[45]

War contributed to the understanding of this disease and even to its (re)naming. During World War I and World War II, the disease took on a

more ominous and suspect cast. Jokes about "German" measles indicated the nation's anxiety. Nationalist hostilities during wartime infuse a culture, and diseases and epidemics may also be interpreted through the lens of war. In this case, the disease represented an actual enemy: Germany. German measles in wartime represented war as personalized—the enemy, insidious. Oftentimes German measles appeared as a joke, as when the Beloit basketball player about to go to France in World War I "succumbed to his first German attack" and was quarantined with German measles.[46] Presumably, upon recovery the patriot would be even more determined to get the enemy that had attacked him first. Reporters enjoyed the wordplay of linking disease with the enemy, inventing headlines that declared, for example, that German measles "invaded" the Brooklyn Navy Yard and writing a lead sentence that observed that the navy men had "had their first taste of Teutonic frightfulness." Although the *New York Times* reported on at least twenty cases, doctors downplayed the importance of the disease and explained that this situation was to be expected when the military brought together so many men from different regions. "German measles is an unimportant affliction," observed New York City's health commissioner, "and nothing to make a fuss about."[47]

Other jokes pointed to people's fear of betrayal. A rash might reveal a person to be a traitor. A collection of "Bright Sayings of Children" told this anecdote: "The mother asked the doctor what the trouble was, and he replied, 'German measles.' After the doctor had gone, Bud . . . said, 'Mama, don't tell anyone what the doctor said.' "[48] The child understood the political implications of association with "the Germans" and wanted the cause of his rash to be kept a secret. Women war workers, according to one report, were "perturbed by suggestions of pro-Germanism in their midst. . . . Measles has broken out. Miss Marion Curtis has developed the 'German' kind, to the horror of her friends."[49] The legal surveillance of and violent physical attacks on German immigrants and citizens and the attacks on all things German at the time of World War I were, of course, no joke at all. German measles jokes revealed anxieties about any perceived association with the enemy.

By World War II, the disease had been entirely renamed and made patriotic. German measles was now dubbed "the Liberty itch" by at least one newspaper columnist and "Victory measles" by patriots in New Jersey.[50] Political cartoonists for the newspapers again took the opportunity to joke about disease, fear of the enemy, and the fear of being seen as a traitor. In one, a mother peered at her daughter's speckled face and cried, "Heavens

above! I believe you're coming down with German measles, and like as not, the airplane factory will think your pop is a Trojan horse or something and fire him. Oh, you naughty girl!"[51] In this vignette, the child with German measles threatened not the family's health but rather its social, political, and financial security. A bit in a 1941 *Chicago Daily Tribune* reported, "An 11 year old who was informed that her cousin had come down with German measles promptly asked her mother if she would break out with swastikas."[52] The idea of a political insignia marking the body as disease is funny, but it also provoked nervous laughter. Were there Nazis or Hitler supporters in the United States? Could the body expose inner thoughts and political commitments? Paralleling the fear that a pregnant woman's thoughts and emotions might mark her baby, the joke indicates the deep sense that imperfect, marked bodies might be signs of bad thoughts or betrayal.

As the world entered war again, German measles reappeared among the troops and in training camps around the globe. In New Zealand and in the United States, German measles delayed troop deployment.[53] Military training camps quarantined their new soldiers and shut down all social activities, including church.[54] A "severe" epidemic of German measles arose in 1940 among troops in Australia and spread when soldiers went home to wives and families.[55] As the United States entered the war, the problem quickly became apparent at home. The California Department of Public Health, for instance, reported in 1942 that the number of cases of childhood infectious diseases had nearly doubled from the previous year. The jump to almost 200,000 cases by May was attributed to the new concentrations of military men and defense industry workers, many "from rural areas who had not been previously exposed to communicable diseases." Measles, mumps, chicken pox, and German measles were all up.[56]

Babies also arrived in greater numbers in 1942. "Chicago Births Rise 2.6 Per Cent in First 6 Months," announced a *Chicago Tribune* headline. With the Great Depression ending as a war economy geared up, young couples married and had babies. The same health report also noted that "the sharpest increase shown by health figures was in cases of German measles; 826 for the first six months of 1941 and 4,417 for this year."[57] With almost seven hundred cases per month—a number that approached the six-month total of the previous year—it was evident that Chicago was experiencing another epidemic of German measles. The epidemic, however, did not get a newspaper headline. Neither the emerging "baby boom" nor the damaging effects of German measles on babies had yet been identified and named for the public.

With physicians and nurses serving in the military and a limited number of doctors available on the home front, mothers went to doctors only when necessary. Seeing that something was not right with their newborns' eyes, several Australian parents brought their infants to eye specialist and surgeon Dr. Norman Gregg, an ophthalmologist at the Royal Alexandar Hospital for Children in Sydney. Both of her baby's eyes, one mother told the ophthalmologist, had "had conjunctivitis at birth." Several weeks later, "she noticed a white mass in the left pupil."[58] The parents of another baby had seen "a scum over each eye at birth."[59] The infants had "unusual" cataracts that required surgery, a rare condition. Child after child, case after case appeared in Dr. Gregg's office in 1941. Gregg described the unique condition of the infant patients: when a child's pupil was in its normal state, "the opacities filled the entire area. After dilation, the opacities appeared densely white—sometimes quite pearly—in the central area." In older babies (over three months), the eye moved in a "jerky, purposeless nature."[60]

As always, in doctors' offices, clinics, and hospitals, mothers and children congregated in waiting rooms. There, mothers inevitably said hello, admired babies, and compared stories, interpretations, and theories. One afternoon two mothers "chatted" and "expressed concern about the rubella they had had early in their pregnancies." Now Gregg had a "clue."[61] To find additional patients, Gregg queried individual colleagues about whether they had seen infants with cataracts and soon sent a questionnaire to the entire Australian medical profession. More cases were found. Upon physical examination of the children with cataracts (or during autopsies), Gregg and his colleagues often found a less visible, internal rubella-related defect as well, heart disease.[62] Gregg eventually amassed the data to make his case: German measles during early pregnancy caused congenital cataracts and heart lesions in the newborn. Gregg based his conclusions on seventy-eight cases, which included thirteen of his own patients. There were fifteen deaths in the group. Gregg presented his findings at the October 1941 meeting of the Ophthalmological Society.[63]

When local newspapers reported Gregg's findings, several women who had read the news immediately put two and two together with their own pregnancies and children. Three mothers personally picked up a phone and called Dr. Gregg to add to his discovery: German measles during pregnancy appeared to cause deafness as well as the eye and heart problems that the doctor had identified. "During the following week," Gregg

later said when describing the progress of his learning about the results of maternal rubella, "I had telephone calls from three mothers, informing me that they had suffered German measles early in pregnancy; each thought that her child was deaf, and each wished to know if this deafness could have resulted from the infection."[64] Gregg paid attention to the mothers on the phone. He and the other Australian researchers soon confirmed that deafness was one of the major results of maternal rubella.[65]

Dr. Norman McAlister Gregg had made an important discovery: a virus, long regarded as minor, was teratogenic. The news was startling. The notion that a virus could harm the developing fetus through the body of the pregnant woman was unexpected. Dr. Gregg's discovery transformed knowledge about German measles, highlighted a new characteristic of viruses, and revealed a heretofore unsuspected threat to pregnant women.[66] Australian Nobel prize winner Macfarlane Burnet declared that "the recognition of the consequences of fetal infection with rubella was the most important contribution ever made to medicine in Australia."[67] Gregg was an extraordinary individual who pursued a problem that other physicians and scientists had not noticed. A good listener who believed mothers, Gregg investigated their suspicions and theories about the disease. Gregg carried out a careful epidemiological study and presented a thorough and thoughtful analysis of his findings. Of the epidemic that the mothers had experienced, Gregg remarked that he had never "seen German measles of such severity and accompanied by such severe complications: . . . the swelling of the glands of the neck, the sore throat, the involvement of the wrist and ankle joints . . . were all very pronounced." He left open the question of whether the mothers had been infected with an unusual form of the disease, possibly in combination with a sore throat coming out of the military camps.[68] Without Gregg, it could well be that the teratogenic effects of German measles might never have been discovered in Australia in 1941 or during the 1940s at all.

The discovery was not Gregg's alone, however. It was mothers who made the intellectual leap that associated German measles during their own pregnancies with the health problems that they later observed in their children. Mothers first thought aloud about German measles during pregnancy and later when noticing eye problems in their infants; a second set of mothers connected their having had the disease during pregnancy with deafness in their toddlers. It was mothers who brought their children to see Gregg and other doctors, who responded with alacrity when asked for a detailed history, who read the newspapers and made connections

between diseases during their pregnancies and the health status of their babies. Mothers observed and made the link. Doctors listened. These Australian mothers cared for their children and observed their bodies and their development. It was a mother's job to feed, nurse, clothe, and care for her children. It was also a mother's job to notice potential health problems, to take her observations seriously, to investigate, and to go to experts for help, information, and medical care.[69] Those experts included other mothers, maternal advice literature, neighbors, druggists, public health authorities, social workers, and nurses as well as physicians and medical specialists like Dr. Gregg.

Mothers provided the data. Early reports and tabulation of cases on the effects of rubella during pregnancy were peppered with references to mothers and their observations of their children. "The cataract was noted by the mother," Gregg reported in his first presentation of his findings at the October 1941 Ophthalmological Society meeting. ". . . . In another case the mother gave a history. . . ."[70] As Gregg described the series of cases, unnamed mothers appeared for a moment now and again. As he explained his method of looking for additional cases of this rare condition, mothers again appeared in tables detailing maternal histories. "In each new case," Gregg reported learning, "the mother had suffered from that disease early in her pregnancy, most frequently in the first or second month. In some cases she had not at that time yet realized she was pregnant."[71]

As researchers investigated whether German measles caused deafness, mothers' memories and observations again documented the connection. Parents identified deafness at a later age, when the children were two and a half years old or older. When parents recognized a problem—such as delay in a child's beginning to talk—doctors discovered hearing loss. At the point that "speech development is obviously retarded," observed one expert, "the anxious parents seek advice, and then the true situation, the presence of deafness . . . is revealed."[72] Evidence was also noted in the following: "Case Number 78. Mother believes that child is almost 'stone deaf.' May hear a tray being dropped but not motor-cars, aeroplanes, telephones, or alarm clocks. . . . Case Number 104. When the child was aged 10 months, the mother noticed that he did not appear to hear the sound of cutlery being dropped." Another mother reported that her "child did not cry normally—had a sort of squeal." At almost three years old, he was found to be deaf.[73]

Deafness was suspected and proved through everyday life—in interactions with parents and family, in responses to everyday sounds. What the babies heard and did not hear, what parents and medical observers ex-

pected, these reports show, was context and time specific. By World War II, the everyday sounds that a child should have noticed and reacted to included not only the words *mum* and *dad* and the sounds of the kitchen—the movement of the wood stove door, falling forks and knives—but also the sounds of modern means of communication and transportation: cars, airplanes, telephones, and radios. Today, one would expect to also include televisions and computers. The turning of wagon wheels and the mooing and crowing of farm animals were not among the expected sound repertoire of these modern, urban babies. Nor was the city clock or church bells. Hearing had become a particularly important sense during World War II and crucial to survival. Sirens and knocks on the door warned people of air raids and speeding police cars and fire trucks. Unable to hear the warnings, the hearing-impaired child might be left in danger.[74] In this culture, deafness could be perceived not only as the loss of a sense but also as a condition that endangered deaf people themselves.

One pediatrician, inspired by Gregg's queries and findings, reported what he described as "typical German measles backwardness." Dr. Donald Vickery identified a series of problems different from those first identified by Gregg: the baby "is not yet speaking"; the toddler "makes no attempt to put sentences together." Another parent "complained" of—rather, she observed, worried, and reported—her baby's "sleeplessness since birth." The child lay "awake for hours playing at night." Others believed their children were not growing properly and were "deaf," "backward," or "a problem child." Based on observations of fourteen children under his care, Vickery described "typical German measles backwardness" as a combination of "so-called deaf-mutism," microcephaly (in ten), "general instability of their nervous systems, lying awake for hours at night, showing a failure to concentrate and taking a peculiar, fleeting, prying interest in things."[75] None of the children had cataracts or vision problems. Vickery added an important dimension to the growing knowledge about the effects of maternal rubella. His term for describing these conditions, *backwardness,* however, did not become part of the standard medical vocabulary for what by the 1960s came to be called *congenital rubella syndrome* or *CRS.*

The male, educated, professional, medical scientists' names appear on the published papers, and some of them are still remembered; the mothers in this story of the discovery of the teratogenic effects of a virus are anonymous. Yet embedded within each of these reports and further embedded within the raw data itself are parents, and mothers in particular. As mothers brought their babies and toddlers to the experts, as they answered questions,

recalled illnesses, observed events, told stories, and filled out forms, the details they shared were transformed into data. Data was amassed and a discovery made and confirmed by other scientists. The individual mothers and children disappeared into memory, story, histories, cases, and data. The point here is to recognize the complexity of the scientific, social, and gendered process of "discovery." This discovery required visual observation and careful listening, insight, confidence, and collaboration among physicians and parents. Gregg himself recognized this truth and singled out parents for appreciation. He and his colleagues were "particularly gratified," he remarked, "by the extreme interest and keenness shown by parents, who are particularly anxious to assist in every possible way."[76]

In his first report of his unexpected discovery, Gregg considered the prognosis. He spoke of the children and the surgeries and technologies that might become available for their care as well as the problem of prevention. "It is difficult to forecast the future for these unfortunate babies," he began. "We cannot at this stage be sure that there are not other defects present which are not evident now but which may show up as development proceeds. The cardiac condition also makes the prognosis doubtful. One baby [who] had survived two operations some months ago suddenly died quite recently at the age of seven months." If these cases "are the result of infection of the mother by 'German measles,' " Gregg asked, "what can we do to prevent a repetition of the tragedy in any future epidemics? . . . The only sure treatment available," he answered, "is that of prophylaxis." Gregg called for educating the public about the newfound danger of this mild disease and working to stop the spread of epidemics to expectant mothers: "We must recognize and teach the potential dangers of such an epidemic . . . and do all in our power to prevent its spread and particularly to guard the young married woman from the risk of infection."[77]

"What can we do to prevent a repetition of the tragedy in any future epidemics?" Gregg asked. Until its final paragraphs, this first paper on the harm caused by German measles is a scientific description of a disease and its manifestations and an epidemiological report. Then, in the final paragraphs of his talk, Gregg alluded to an emotional response to the effects of this epidemic described in a series of seventy-eight "cases." These seventy-eight cases represented seventy-eight children, seventy-eight women, their pregnancies, their babies, and their families. In calling the effects of this epidemic of German measles a "tragedy," Gregg alluded to the sorrows, suffering, and pain felt by parents and their children and expressed empathy for them. At the same time, the existence of a child born with congenital

malformations, whose life was expected to be shortened and compromised, was understood, in common thought, to be a "tragedy."

As Gregg and his Australian colleagues collected clinical cases and investigated his initial findings, they quickly identified not only the symptoms of congenital rubella syndrome but also the social issues associated with it. By the time that the children first identified as affected by maternal rubella were two and three years old, physicians were expressing concern about their educational future (no doubt echoing a concern raised by parents). Gregg's prognosis for the children's futures considered not only the children's survival or the shape of their bodies but also the prospects for their education. Deaf and blind children, physicians and state education officials expected, could be educated and capable of economic independence in adulthood. The prospects for the "ineducables," in contrast, were not optimistic. The need to provide for their care was "urgent." Gregg advocated for early "training," especially for the "deaf mutes." Education should begin, he believed, at a young age and in the home. Those who would be teaching the children at home—in other words, the mothers—should "receive proper instruction." The Department of Education of New South Wales rapidly took up the question. It formed a study committee and planned to assess the educational possibilities for each affected child. Notably, in 1944, Australian education officials began planning for the schooling of children affected by rubella long before they entered school.[78] Nevertheless, one expert observed, "The training and teaching of a deaf-mute child are extremely slow and difficult."[79]

Furthermore, this host of medical and social issues affected the family as a whole. Gregg expressed particular concern for the mothers: "In some cases the strain imposed on the mother in caring for the child is more than she should be expected, or permitted, to endure." These words of caution and concern for the mother, like the very discovery of the effects of rubella on the developing fetus, grew out of Gregg's careful listening to mothers in his practice and, presumably, from his own observations of their distress as they coped with babies who slept little, with surgeries, with the difficulty of communication, and with social isolation. "There is a very grave risk not only of undermining the health of the mother," he commented, "but also of ruining the whole atmosphere of the home and disrupting the family. In such cases it is considered that the only solution is to place the child in an appropriate institution."[80]

Institutionalization for the severely retarded was the standard advice of the time. Decisions about whether or not to institutionalize were neither

exclusively medical nor exclusively personal, but social and cultural. The disabled child was understood to be a threat to the family as a whole. In the United States in the 1940s and 1950s, new admissions of mentally retarded children to public institutions doubled. Half of all parents of such children reported being advised by doctors to "immediately" institutionalize their children. Many doctors strongly urged parents to separate themselves from their newborns at the time of delivery. Family members, clergy, and the community at large added to the pressure. Families that resisted these pessimistic judgments and resisted placing their children often found that as the children got older, they eventually reached a point at which they felt they had no choice but to place their children in an institution for their education and care.[81] Rearing and teaching a child with sensory losses required special skills as well as moral support and social services. When institutionalization was the norm and support for rearing a disabled child at home minimal, families found it difficult to do otherwise. If moral support, material help, and services did not exist and responsibility fell on the mother, then mothers' distress was going to be a normal and socially produced outcome of having a disabled child, and institutionalization was often the answer.

Gregg's medical colleagues in Australia "congratulated" him on his significant findings and jumped into German measles research with alacrity.[82] They soon corroborated Gregg's findings, but the medical profession elsewhere in the world accepted his discovery more slowly. An abstract in the premier British medical journal, the *Lancet,* on the Australian research pointed to a series of problems in the case presented by Swan et al. in the *Australian Medical Journal.* The unidentified author found the study to be poorly designed, and thus "safe conclusions" could not be made about whether rubella "during pregnancy affect[ed] the chances of the baby being born with congenital defects." The Australian research lacked data for babies born without abnormalities, how these data were collected was unclear, and the very diagnosis of rubella itself, for this *Lancet* critic, was a question mark. Although there was no evidence of incorrect diagnosis, he claimed that "the doubt must remain, for even fever clinicians find rubella difficult to diagnose with certainty." The difficulty of differentiating rubella from measles and scarlet fever that had produced numerous medical articles in the nineteenth century now raised questions about Gregg's findings. As controlled clinical research trials became the new norm in the 1940s, this scientist regarded the Australian findings as dubious because the researchers had failed to meet high research standards.

"More extensive and better controlled observations," he insisted, "must be made before we can be sure of it." Further research, this writer urged, was needed before Gregg's case was "proved."[83]

The *Lancet* reviewer raised further doubts by pointing to the beliefs of generations of mothers. "The lay public," he remarked, "have always held that congenital malformations have an extrinsic explanation—from being frightened by a dog to falling downstairs—and it will be strange if the influence of a minor illness in the first months of pregnancy, accompanied by a rash, has escaped attention."[84] Here, in a strikingly unusual move among members of the medical profession, the Australian physicians' clinical findings were doubted, even scorned, because they did not mesh with the "lay public's" thinking. To point to women's fears of what physicians called "maternal marking" as a source of doubt—for surely if they think a dog can cause birth defects, they would have noticed a rash!—was simultaneously to scorn Gregg and give false credit to traditional "lay" thinking.

The dubious response of the *Lancet* reviewer points to how new and unusual Gregg's discovery was. The fact that it had originated in Australia and arisen during wartime contributed to the medical world's slow uptake of Gregg's finding. But penicillin was quickly adopted worldwide during World War II, so war alone cannot explain the doubt expressed in the *Lancet* article. Although research on rubella, the writer was sure, "is being carried further *out there,*" he urged research in Britain as well.[85] Medical colleagues "out there" in Australia first made the intellectual leap and presented early epidemiological findings indicating that the rubella virus caused congenital malformations, but this writer found their research methods deficient. Australia was far away, a former colony, part of the commonwealth, a land of prisoners, cowboys, kangaroos, and the "outback." Medical ideas, knowledge, and research findings from "out there," it appears, were questionable in part because of their foreign and exotic origins.[86] The writer pointed to research in Britain and the United States that suggested that nutrition, maternal age, and environmental factors affected fetal development,[87] but the idea that a virus that infected the pregnant woman could harm her developing fetus was still new and strange to most clinicians.

Gregg's finding forced a conceptual shift in medical thinking, but for scientists working in embryology or pathology who knew that viruses crossed the placenta, Gregg had confirmed what they knew experimentally. For embryologist and expert on the developing eye Dr. Ida Mann of Oxford, Gregg and his colleagues had accomplished something of "far-reaching importance." They had provided "the awaited clinical evidence

of certain embryological truths." Dr. Mann's remarks pointed to the segregation of scientific knowledge. Gregg and his colleagues had "focused attention on phenomena which, although well known to biologists, have received too little attention from clinicians. By proving beyond question the causative relation between a virus infection early in pregnancy and the appearance of certain congenital defects in the infant, these workers have laid the foundation for a host of observations of like nature which . . . will probably alter profoundly our views on the causation of congenital anomalies in man." Careful clinical research proved in human bodies "the results of experimental embryology."[88]

As ophthalmologists in the United States confirmed Gregg's findings in their own patients, they wondered if this new menace could be attributed to a far-off, exotic continent and to war. Perhaps it came from Australia, thanks to "increased traffic" with the wartime ally.[89] A California physician who collected reports of scores of cases of cataracts and heart defects in newborns whose mothers had had rubella early in pregnancy wondered whether the disease had traveled from Australia across the Pacific to the California coast and was "now making its way across the country."[90] These speculations suggest the automatic association of dangerous diseases with foreigners and far-off lands, but the remarks also reveal a discovery in process. It was not yet clear what Gregg's report and the accumulating data meant. One possibility, entertained by these authors, was that this was a new version of an old virus since these effects had never been noticed before. Oddly, troop movement itself did not merit scrutiny as a possible piece of the American story although Gregg had indicated the importance of the massing of troops in camps where epidemics started and then spread to civilians.[91] Nonetheless, babies with rubella-related congenital defects had been identified at one "naval hospital" in San Diego, according to one report, and appeared to be concentrated on the West Coast, home to numerous military bases.[92]

Despite the skepticism expressed in Britain's premier medical journal, by the late 1940s, Gregg's discovery of the teratogenic effects of rubella had won international attention and confirmation. Individual physicians wrote to medical journals of one or a handful of cases that corroborated Gregg's findings. The Institute of Medical and Veterinary Science at Adelaide (Australia) researched the effects of maternal rubella in depth and published numerous articles in the *Medical Journal of Australia.* Several years after Australians first learned of Gregg's discovery, it started to become general knowledge among American physicians and to reach the public.

When Australian virologist (and later Nobel prize winner) Macfarlane Burnet toured the United States in 1943, he brought news of Gregg's discovery to the attention of physicians, and the information percolated out through medical meetings and reports. In 1946, Dr. Edith Potter, professor of pathology at the University of Chicago, reported on the discovery in the *American Journal of Public Health,* and in 1947, Dr. Conrad Wesselhoeft, clinical professor of infectious diseases at the Harvard School of Public Health, announced Gregg's findings and commented on the new "serious problem" posed by this minor disease in a major two-part article on "medical progress" in the *New England Journal of Medicine.*[93] Although *Newsweek* and *Time* newsmagazines each reported on Gregg's discovery in 1944 and 1945, popular media paid little attention to it. Neither did physicians who wrote for the public. In the *Chicago Tribune*'s syndicated "How to Keep Well" column, for instance, mention of German measles appeared now and again, but it was not until 1947 that a full column outlined the effects of rubella during pregnancy.[94]

Signaling the acceptance of Gregg's findings and the rejection of the *Lancet's* doubts, the British Medical Association awarded the 1949 Katherine Bishop Harman Prize to Dr. Charles Swan, one of the Adelaide researchers, for his internationally comparative report on rubella's effects on pregnancy.[95] Swan had compiled, summarized, and analyzed all of the existing correspondence, notes, and studies on the effects of maternal rubella. The report appeared as a thorough two-part article in the *Journal of Obstetrics and Gynaecology of the British Empire.* In it, Swan detailed the data that had been compiled in Australia, England, the United States, Finland, Sweden, Switzerland, and South Africa. Studies from around the world confirmed the harmful effects of rubella on the developing fetus and identified the period of pregnancy when the disease caused the most damage. Those effects included congenital blindness and vision defects, heart defects, deafness, intellectual impairment, and "miscellaneous abnormalities" such as skeletal deformities, poor muscular tone, and slowness in the eruption of teeth.[96] During the earliest stages of pregnancy, when a woman might not even know of her pregnancy, the risk of harm from contracting rubella was the highest. The risk of a mother's "giving birth to a child with congenital anomalies following the contraction of rubella in the first 4 months of pregnancy," Swan reported, "ranges from 83.2 percent in the first month to 61.1 percent in the fourth month, with an average of approximately 74.4 percent." In contrast, he continued, the risk of birth defects dropped later in pregnancy: "In the last 5 months of gestation, the

risk ranges from 11.1 per cent to 29.9 percent."[97] These rates—over 80 per cent in the first month and more than half for the first half of pregnancy, according to the world reports—were extremely high. Typically, somewhere between 1 and 2 percent of newborns had serious congenital malformations.[98] Researchers found miscarriage and stillbirth to be associated with the disease as well.[99] Given the evidence, Swan believed therapeutic abortion in such cases "entirely justified."[100]

Mothers' responses to this new information about German measles underscored the pervasive fear of deformity and mothers' guilt. Swan described how blaming a disease rather than one's heritage for deformity could alleviate the guilt felt by mothers. Indeed, sharing medical knowledge about German measles with the public could be considered *pronatalist* (meaning the encouragement of procreation as the central priority of adulthood, especially for women). When mothers learned that a disease had caused the congenital malformations that their children faced, he explained, some felt newly freed to have another child. One woman who had read about German measles in *Time* magazine had worried "that there was a family taint somewhere" and had avoided having more children. Now, she realized, she could have more.[101] Swan and his colleagues "reassured" worried parents like this one that they could have additional children without fear of deformity.[102] Identifying a disease as the cause of birth defects made the mother and father innocent. Public knowledge about the effects of this disease could prompt women to try to avoid German measles and, Swan optimistically pointed out, prompt mothers with harmed children to get pregnant again and expand their families. This outcome was, he reported, "contrary to expectation" that if the "laity" realized the dangers of this disease, "undue alarm" would be the result.[103]

Nonetheless, Swan ended with a vision of tragedy—for individuals and for the greater society. "If large numbers of cases of rubella in pregnancy continue to occur," he warned, "they will constitute a social problem of some magnitude, for the consequences are not confined to the affected child. Indeed, the shadow falls upon the family, especially the mother and the other children, on the children as yet unborn, and on the community generally. The lot of children afflicted with a congenital abnormality of eye, ear, or heart is a sad one, but when two or more of these defects are present in combination, and the more so if there is superadded mental retardation, their fate is tragic in the extreme, and death at an early age can be only looked upon as a merciful release. Nevertheless, recent advances in cardiac surgery and in the perfection of deaf-aids offer real hope of the amelioration

of these handicaps."[104] This quotation reveals much. These babies were regarded by definition as tragedies. Dr. Swan expressed the culture's feelings about such children. His own meetings with children and their families and observation of the material realities shaped his view. At the same time, "tragedy" was a social construction and cultural assumption. New surgeries and technologies offered "hope," but in Swan's eyes, there was little hope for some. In severe cases, death was "merciful."[105]

The early medical literature on maternal rubella did not emphasize the number of infant deaths or the impact of those deaths on mothers and families. In his first report, Gregg reported fifteen deaths in seventy-eight cases.[106] Children died at one week, three weeks, four months, ten months, and three years or more.[107] For an expectant mother in mid-twentieth-century Western industrialized countries—where infant and maternal mortality had fallen and child survival was the norm—contemplating these early infant deaths would be terrifying. One baby, Gregg reported, "spent most of its short life" in a "hospital. . . . It was always extremely difficult to feed, and remained throughout a tiny wisp of a child. It finally succumbed to an attack of heart disease." Another weighed only six pounds twelve ounces when two months old. At one year, "it could not sit up, had no teeth, and screamed a lot. Death came suddenly from heart failure, but throughout the preceding day the baby continually banged its head on the pillow."[108] These clinical reports, in which the children are unnamed and the doctor retreats to referring to one child as *it,* hint at the pain felt by the children, their parents, and their doctors. Australian state mortality data also revealed the impact of German measles epidemics as infant cardiac deaths reached their highest numbers ever.[109]

These infants had difficulty feeding, presented as "failure to thrive," and experienced repeated surgeries. If "mental retardation" was "superadded," Swan described child death as "merciful." Intellectual impairment appears as *the* tragic characteristic. Swan's words expressed a gloomy forecast for the children's future—especially for the intellectually impaired—a view shared by many in the larger culture and in medicine and among parents. Perhaps he expressed the feelings of grief-stricken parents who felt relief that with death their child's misery had ended. Perhaps his words added to their grief by denying the loss they felt. Perhaps parents felt both emotions simultaneously.

Swan painted a dark picture. He represented the effect of German measles in pregnancy as a "shadow," one that fell particularly hard upon the mother. When the children were "mentally deficient," he quoted Gregg, "homes

were disrupted" and the mother's life "ruin[ed]."[110] Yet Swan imagined that things might be different and suggested a pronatalist vision. A vaccine might protect pregnant women and their babies. "It is to be hoped," he remarked, "that . . . in the near future . . . methods of immunization against the disease will render such drastic procedures as the termination of gestation unnecessary."[111] Early students of the effects of maternal rubella endorsed abortion and imagined the creation of a vaccine to prevent rubella among expectant mothers. By preventing disease, a vaccine would prevent both birth defects and abortions. In this imagined future, a vaccine became a miracle cure for complicated medical, social, moral, and legal issues.

The sense that women themselves could damage the bodies and minds of their babies was an age-old fear. Expectant mothers worried that, through their own thoughts, sights, and actions or simply through bad luck, they might produce crippling effects and malformed bodies. Although twentieth-century scientists generally dismissed such ideas, women themselves often suspected that they or the world around them could cause deformities, miscarriages, and stillbirths. By the mid-twentieth century, however, physicians and maternal health advisers warned expectant mothers that an infectious disease could threaten their pregnancies and the bodies of their children. Such an idea would have been dismissed as an unnecessary, even silly, fear and an old wives' tale only a few years earlier. Indeed, when Dr. Van Dellen first reported the effects of German measles on pregnancy in the *Chicago Tribune,* his column began by referring to old wives' tales and included a drawing of such women scaring a younger woman.[112] The new warnings about German measles originated with the observations of mothers. The German measles case is an example of how medical researchers transformed mothers' expertise and everyday observations of pregnancy and children's bodies into clinical data and scientific discoveries. These warnings became part of standard prenatal advice thanks to the observations of unnamed mothers and to a thoughtful ophthalmologist who cared and listened to them.

Why had the effects of German measles on pregnancy never been noticed before? What made 1941 in Sydney, Australia, different from other years in which German measles appeared in epidemic form? What made Dr. Norman Gregg the doctor who recognized the effects of this virus? Gregg was a unique and smart individual; he saw an unusual number of infants with a specific complaint, but he did more than take care of their

individual medical needs. He asked why, pursued an epidemiological investigation, and concluded that the rubella virus was the source of the unusual condition. Surely other physicians had previously seen children with these complaints, but they had not investigated them to find a new explanation; others would have dismissed these mothers' remarks as irrelevant while still others never would have connected two completely unexpected events—a virus and the birth months later of a baby with congenital malformations. Gregg, like all great discoverers, was not thinking in isolation but lived in a specific time and place. Intellectual components, including new attention to environmental factors in relation to pregnancy and congenital malformations and a declining reliance upon heredity as an explanation of their cause, were part of the larger intellectual atmosphere.

Equally as important, structural components of medicine and social conditions also contributed to making his discovery possible. Specialization in medicine made it possible for Gregg to notice an unusually high number of cataracts in infants. Because this condition was rare, parents who noticed it in their infants might have gone to various doctors without any one person ever noticing the large number of such cases. But as patients and doctors increasingly turned to specialists, an unusual outbreak of a specific condition might become visible. Because Gregg was a pediatric specialist, he saw a series of individuals in a short time period and realized that he was seeing more patients with this rare condition than usual. Furthermore, as a university researcher, he knew how to pursue an epidemiological question and how to convince his colleagues to distribute and answer a nationwide questionnaire. Gregg's own stature and connections within his profession aided him in each endeavor. Finally, the fact that by the mid-twentieth century, Australian mothers were well trained to observe their children's bodies closely and to bring anxieties, questions, and observations to expert doctors was a necessary starting point for Gregg's discovery.

The fact that the media too helped move Gregg's discovery forward deserves underscoring. Without the early newspaper coverage of Gregg's presentation at a meeting of specialists, the process of learning about the effects of rubella would have been slower.[113] Gregg himself worked with popular news media in order to alert Australian women to the dangers of German measles, appearing on Sydney's 2SM News Radio for instance. Through the news, mothers learned of Gregg's discovery and then contacted him with their suspicions of another effect of rubella. News coverage of medical research led to new interactions among individuals, professionals,

Figure 1. Dr. Norman M. Gregg, ophthalmic surgeon at Royal Alexandra Hospital for Children and Royal Prince Alfred Hospital in Sydney, was known as a kind and empathetic physician who knew how to talk with children and who listened to their mothers. Gregg's profession and nation honored him for his historic achievement in recognizing the teratogenic effects of German measles. He received numerous honorary degrees, was knighted in 1952, and named Australian Father of the Year ten years later. Photo used courtesy of the Royal Prince Alfred Hospital Museum and Archives.

and institutions and to new insights. Most obviously, the media's treatment of medical findings and investigations as news sped the transmission of new knowledge regarding the danger of German measles to the public.

Equally significant, but underappreciated, is the way in which the popular news media helped to speed knowledge from the public back to medical researchers. That collaboration among media, mothers, and medicine

in advancing medical knowledge can also be seen in a medical advice column in a Chicago newspaper. Readers typically sent Dr. Van Dellen questions to answer in his column in the *Chicago Tribune.* In 1947, Dr. Van Dellen reversed the usual flow of questions and asked his readers to give him information. The result revealed mothers' interest in health and their commitment to scientific research. Six years after Gregg's discovery, Van Dellen offered the newspaper's first full-length coverage of "defects following German measles." He described the "Australian" findings as "somewhat controversial." Some, he reported, "go so far as to indicate that if rubella occurs in the first month or two of pregnancy, congenital anomalies are certain to be present." The problem with much of the research thus far, Van Dellen explained, was that it started with the children who displayed anomalies, but one would prefer to follow pregnant women who had the disease since "it may be that many . . . gave birth to normal children." The doctor concluded his column with a query to his readers: "If there are any readers who had German measles during pregnancy, we would like to know in what month it occurred and what was the outcome."[114] Nearly one hundred women answered Van Dellen's request with detailed letters full of information. The strong response from Chicago-area women and their thoroughness resulted in an article on the formidable effects of the disease that was published in the profession's most widely read journal, the *Journal of the American Medical Association* (JAMA). The information provided in these letters showed that 87 percent of the children whose mothers had had rubella in the first trimester were "abnormal" and 42 percent of those whose mothers had been infected in the second trimester had congenital defects.[115]

Mothers responded to the doctor's newspaper query with impressive detail. "The caliber of the letters received," Drs. Stuart Abel and Van Dellen remarked, "was surprising."[116] "The majority were written intelligently and included considerable detail," they noted. The responses from busy mothers, many of them caring for children who needed unusual attention because of their health conditions, show a real commitment to their children and to adding to medical knowledge about the disease. "Many" of the letters, the doctors reported, "were written by persons with a professional background."[117] The women who read Van Dellen's column and wrote back appear to have been drawn from a highly educated class of women. Some may have been scientists and medical professionals themselves, perhaps now out of the workplace due to motherhood and gender discrimination, but they contributed to medical knowledge. This is all we know about the women

who wrote, but from these bits we can see that there were not only maternal commitments to children and scientific research but also professional and class commitments underlying the letters. By sharing all they knew about their own pregnancies and children and providing that individual information in "considerable detail," these women did scientific work and transformed their personal histories into data for medical research.

Popular news media alerted readers to the newfound "embryo menace." *Newsweek* framed its early reporting as breaking medical news and traced the movement of information from Australia to the United States. American "medical circles," the magazine reported, agreed that "the Australian discovery is of universal importance." It then told the story of Gregg's insights, the doubts of his "fashionable" colleagues, and Swan's confirmation that rubella in the first two months of pregnancy was likely to result in "a congenitally defective child in about 100 per cent" of the cases.[118] *Time* described German measles as a "pipsqueak disease," but new research revealed its dangers. "If pregnant women catch it," the magazine reported, "it can give their unborn babies heart disease, cataracts, bad teeth or even make them deaf mutes or idiots. Many . . . die in the first few weeks of life."[119] This was frightening news. Thanks to this magazine story, the quoted physician received letters from around the country alerting him about other "abnormal babies" whose mothers had had rubella in the first two months of pregnancy, but he did not receive a single report of a normal baby following maternal rubella.[120]

Nevertheless, the media sent a mixed message about German measles. Dr. Van Dellen's health column in the *Chicago Tribune* is a good example. Although he had devoted an entire column to the effects of German measles in pregnancy, solicited information from mothers, and published in *JAMA* on it, his columns generally continued to treat German measles as a mild childhood disease. His 1947 column was one of the first to give sustained attention to the dangers of German measles, but surprisingly, a lengthy column on the disease in the previous year had not included a single word regarding the danger to pregnant women. Instead, the column had focused on children and their care, noting, "It has been said that rubella is our mildest contagious disease." Van Dellen had concluded, "The greatest difficulty the mother has is to keep her little one confined as there are so few symptoms. Would that every infection proved so tame!"[121]

These curiously cheerful remarks on the mildness of this disease and the absence of any information regarding pregnancy reveal the different approach taken by newspapers and magazines compared with that of health

advice materials. The news media named German measles a "menace" and alerted the public to its danger while medical experts like Van Dellen downplayed the danger. In advice materials produced for the public, physicians adopted a paternalistic stance. They protected women from worry by not telling them of the hazards. *Time* magazine broke the German measles story by reporting on news heard at a medical meeting. Notably, another physician pointedly remarked later that the reporter had quoted the physician without permission.[122] The 1947 edition of *Expectant Motherhood,* a widely distributed guidebook for pregnant women by Nicholson J. Eastman, chief of obstetrics at Johns Hopkins University, said nothing about German measles. "Pregnancy should be a healthy, happy time," Dr. Eastman declared in the book's first sentence. That happiness, produced through a physician's "proper guidance," included reassuring women by leaving out information.[123] Dr. Van Dellen continued to emphasize the mildness of the disease in his advice column. In a later optimistic column on vaccine research, he remarked, "There would be no need to administer serum against less serious diseases such as chicken pox, German measles, and mumps."[124] Despite the threat to developing pregnancy demonstrated by evidence that he had collected himself through his own newspaper column, Van Dellen still considered German measles "less serious" and a vaccine unnecessary.

Medical advice books and pamphlets for expectant mothers kept silent about German measles and reassured them that things would be fine. Indeed, they directly associated seeing a doctor with having a normal baby. "When your physician examines you early and follows through carefully month by month," a 1947 Children's Bureau pamphlet promised, "the likelihood of your having a normal baby is increased."[125] Calling the idea that bad experiences might mark a baby "old notions," it suggested that the worried mother-to-be place her worries "on her doctor's shoulders. He can reassure you about the extreme rarity of feeble-mindedness or other abnormality."[126] Seeing the doctor offered examinations, paternal reassurance, freedom from worry, and normality. Implicitly, failure to see a doctor and follow his orders threatened abnormality. Since parents most feared that the new child's body or mind might be damaged and abnormal, that equation of medical surveillance with normality served as both a powerful endorsement of medicine and a powerful threat. The fear of unknown abnormality might keep expectant mothers in the doctor's office, following advice and paying fees. By the 1950s, the medical profession had accepted the connection between German measles and congenital malformations,

yet 1961 and 1962 Children's Bureau pamphlets for expectant mothers still said nothing about the disease. A picture leaflet, *When Your Baby Is on the Way,* again made the general promise that early surveillance by physicians and nurses would ensure healthy babies. "Most babies are born healthy and all right in every way," it began. "But once in a while a pregnant woman has trouble. Good medical care, starting early, will prevent or control most things that cause trouble. So go to your own doctor or clinic as soon as you think you are going to have a baby."[127]

Although ten years after Gregg's discovery health advice materials sent surprisingly few messages about German measles to pregnant women, plenty of women worried. "This knowledge has been widespread," health adviser Dr. William Brady observed, "and has naturally given rise to considerable apprehension on the part of pregnant women." A woman contracting the disease in early pregnancy, he reported, "stands a 50–50 chance of giving birth to a defective baby."[128] A mother's autobiographical story, told in a 1954 health magazine, clearly named the danger: "German measles handicapped my child."[129]

When Mrs. E. worried that catching German measles during pregnancy "could harm the baby," her husband called her "superstitious." She wrote to Dr. Van Dellen at the *Chicago Tribune* to find out who was right. Mrs. E, the doctor answered, was "not superstitious but modern."[130] The "modern" mother knew what this virus threatened and that her baby could indeed be changed and marked during pregnancy by outside influences. That mothers' age-old fears of the threat of deformity had become real and scientifically endorsed was a surprising change in medical science. Mothers who observed and suspected that events occurring during pregnancy could damage their children's bodies contributed to making this transformation in medical thinking. It would soon be the modern mother's responsibility to try to avoid this disease and to think about its consequences.