

Introduction

PARASITES ARE ALL AROUND US. Consider the ones that infect humans: hundreds of species live in human intestines, skin, lungs, muscle, brain, liver, blood, and everywhere else they can find a niche. Some of these parasites can live *only* in humans. When you realize that virtually every species of animal has a similarly large collection, and then acknowledge that plants have many as well, you begin to understand how numerous parasites really are. Even parasites have parasites.

Parasites are an odd and exceedingly diverse assortment of life forms that defy generalization: essentially their actions define them. The word *parasite* was first applied to humans, used to describe people who live by taking from others. The self-serving activities of such people are damaging to their hosts, whose resources they deplete. A *parasite* in the biological sense is similar: a parasite lives on, or in, another species, getting everything it needs from its host. In keeping with the cultural view that a parasite is a despicable creature, the strictest biological view holds that parasites damage their hosts.¹

Curiously, however, the word *parasite* isn't used consistently to describe all life forms that live in this way. Bacteria, fungi, and viruses that multiply in the tissues of other species are traditionally excluded. Tiny predators, such as mosquitoes, are excluded as well because they feed on, but don't live on, their hosts. In a medical sense, at least, parasites include protozoa,

worms, and certain things with legs, such as mites and insects—but only those that must spend at least part of their lives in or on the tissues of other living things.

We usually hear about parasites when they make people sick. Or we encounter them as a subject of revulsion—disgusting creatures to be annihilated as speedily as possible. Someone who unexpectedly discharges an intestinal worm is likely to grab the nearest makeshift weapon and pulverize it within seconds, despite the creature's utter inability to attack. If we discover an infestation of head lice, we quickly go on the attack, even if we have to douse ourselves with insecticides to win the battle. Even our enthusiasm for mistletoe, a traditional symbol of magic and affection, loses its luster when we learn that the plant is parasitic.

Our view of parasitism is a narrow one. Parasites not only have far-reaching and important impacts on the earth's ecology, but they have much broader effects on our daily lives than we realize. We humans believe that we orchestrate our own affairs, good or bad, and that events are steered by action and counteraction, turned by decisions of world leaders or collective will. We read history books and newspapers and seldom find parasites there. They are there, but we don't see them. In this book, I explore this wider world of parasites.

Many human experiences unfold after a chain of apparently insignificant events that make sense only when viewed in retrospect. Our encounters with parasites fit this category. A simple and innocent change in human behavior can open the door and let them in. On a personal level, you don't see parasites coming, yet before long you're boiling your drinking water, passing tapeworm segments into your underpants, or fighting a raging fever in a hospital bed. On a social level, parasites affect everything from exploration and war to food regulations and terrorist plots. They create an unpredictable ripple effect that can undermine many a human endeavor.

In this book, you'll meet some of the parasites that are hidden between the lines of history books and newspapers, and you'll learn about the things that people have done to them, or with them, and the collateral effects they've had on people. These parasites come from various taxonomic groups of animals and protozoa, and most are physically harmful to their hosts, though each has its place in the natural interactions of living things.

Parasites do not make value judgments about their hosts or take sides in the human conflicts they get involved in. They show up because an

opportunity is an opportunity. In fact, they aren't unequivocally bad. They *can* be beneficial in unexpected ways. Parasites have shortened wars, protected ecosystems, and helped us craft standards for food and water that have made both infinitely safer. In the redeeming tradition of the silver lining, some of the parasites most dangerous to health have positive effects for someone when they get mixed up in human affairs. And, perhaps even more difficult to accept, a few intestinal companions may actually provide some health benefits.

In the pages that follow, I seize the parasites one by one, drag them into the light, and ask, "What are you and what are you up to?" To find them, I will take you to unfamiliar places: the woods and jungles of the world, desert oases, warm soil, bathroom plumbing, insect guts, and all the terrain of the human body, for this is where they lurk. And we'll have to be there at the right time: when something important is happening in people's lives.

Our questions will probe tantalizing mysteries. Examining each parasite in the context of the event uncovers the scientific pearl, the clue in the creature's natural history that pulls everything together. Scrutiny reveals, for instance, that domesticating a wild animal can unleash an epidemic of parasitic disease in people; that *Plasmodium* spp., agents of malaria, have a history of turning murderers and terrorists over to authorities; and that a tapeworm can hijack a personality and substitute a completely different, perhaps dangerous one.

We'll probe the human psyche as well, looking objectively at our fear of parasites and asking whether our revulsion makes sense and how far it can push us. To what lengths will people go to avoid parasites or get rid of them? Suicide? Child abuse? Murder? All of these. It's often difficult to predict or understand human reactions to parasites.

Our bad attitude springs partly from the fact that we're not used to seeing parasites. Hidden away within host tissues, most are invisible to us. They are all around us but we don't see them. It's relatively easy to pretend, even believe, that they exist only in other places. But parasites are thriving in the twenty-first century. In fact, people have left a lot of doors open in the past few thousand years, allowing more parasitic mayhem in human lives than ever before.

We are better at spotting parasites today than we were in the past, and better at understanding what they've been doing behind the scenes to change our lives. We know some ways to hinder them, but our victories are few. New ones appear even as we continue to battle the ones we've

already got. Parasites can cause significant social chaos, even now, as they continue to slip between the lines of history.

This book can't retell the history of the world as it would have been without our uninvited guests: that's a history we will never know. We can shed light on the past, study all the facets of parasites, good and bad, and try to predict how the future might unfold if we were to take one course or another. In the end, however, we will encounter that familiar ripple effect, as random, small, unpredictable events accumulate and help shape great affairs.