Infection

The uninvited universe

Gerald N. Callahan
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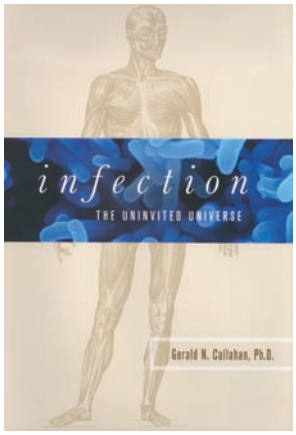

In *Infection: the uninvited universe*, Gerald N. Callahan, an immunologist at Colorado State University, dislodges the widespread belief that microbes are always a threat to human health. That this correction is necessary is evidence of the remarkable success of public health campaigns waged to control the transmission of infectious diseases through improved hygiene and routine vaccination. This volume complements his earlier text, *Faith, madness, and spontaneous human combustion* (1), which made scientific insights about the immune system accessible to a broad readership.

Any family history before the mid-20th century reveals deaths, particularly of infants and children, from diphtheria, measles, typhoid fever, and other devastating infections. Microbes do cause disease, and we are indoctrinated in early childhood to wash our hands, but should supermarkets provide disinfectant so that customers may wipe the handle of the shopping cart? Callahan explains the misconceptions about health perpetuated by the implication that we can make ourselves "germ free." Using anecdotes from his family's history and other sources, Callahan describes the complex balance between the human host and the microbes that make up our "uninvited universe" and how our well-being depends upon their presence.

Combining scientific terminology with analogies and metaphors, Callahan makes the point that microbial colonization of humans is usually benign and that disturbing this harmonious coexistence has risks. Incorporating the concept of "good germs" into the germ theory of disease should help physicians to educate patients about antibiotic overuse, which may help slow the emergence of antimicrobial resistance. One caveat is that the author seems to suggest that the hygiene hypothesis, which proposes that childhood exposure to infectious agents decreases susceptibility to allergic diseases, is more of an established biological fact than many would conclude at this time. Similarly, biomedical research about the role of microbial flora in the pathogenesis of chronic inflammatory diseases has not yielded definitive answers. These disorders are best characterized as multifactorial in etiology, even though the author's objective is to validate the general principle that colonizing organisms are valuable. That said, most people understand the importance of species diversity for maintaining sound ecological systems in the visible world of animals and plants. Readers of *Infection* should acquire a similar appreciation of the value of microbial diversity in the invisible ecosystem of the human body.

Beyond bacterial colonization, Callahan also discusses endogenous retroviruses, retroviral transposons present in the human genome and their significance in mammalian evolution, and the possible bacterial origins of mitochondria in eukaryotic cells. One may question whether metaphor supports science effectively when the onset of professional cyclist Greg LeMond's mitochondrial myopathy is characterized as "his bacteria began to fail," but the example does make our dependence on coevolutionary processes vivid. Whereas many people know that 10% of our dry weight consists of bacteria, information about the extent to which microbial genetic material is embedded in mammalian genes and cells is likely to be new and intriguing to general readers. In effect, microbes did not need any invitation — they were there at our creation.

Callahan subsequently describes ways in which disease results when the commensalism between microbes and humans becomes disrupted. He explains why infectious diseases are what he calls the "not-so-final" frontier, using the compelling examples of HIV/AIDS, malaria, diarrheal and respiratory tract infections, measles, and antibiotic-resistant *Staphylococcus aureus*. The SARS and H5 avian influenza virus outbreaks exemplify both the need for vigilance and the difficulty of predicting microbial behavior. Readers will find good explanations about how viruses infect cells and use immune escape mechanisms to ensure their survival and transmission. In some cases, the author implies stronger causality between microbes and complex diseases, for example between infections and schizophrenia, than is documented. Readers will need to appreciate the uncertainties and avoid confusing hypotheses that are under active investigation as fact. How human behavior influences the emergence of new infectious diseases is portrayed in compelling vignettes. Any subsequent edition will probably require a description of how global warming is creating conditions that favor epidemics.

In the final section, the author imagines the thoughts of the first person with SARS in Guangdong Province, China, and traces the subsequent global spread of this infectious agent. He recounts the death of a Colorado man from West Nile virus, tracks the introduction of the virus into the United States, and includes interviews with scientists that relay to the reader their experiences at the "front lines." These and the subsequent chapters on anthrax, plague, and the 1918 influenza epidemic are well researched, and Callahan supplements the facts with engaging stories and personal observations. Written for a lay audience, *Infection* provides a thoughtful perspective on developments in the last 30 years in the areas of infectious diseases and microbiology and of the challenges that remain.

1. Callahan, G.N. 2002. *Faith, madness, and spontaneous human combustion: what immunology can teach us about self-perception*. St. Martin's Press. New York, New York, USA. 256 pp.