

Mutant Bacteria and the Failure of Antibiotics

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Mutant Bacteria and the Failure of Antibiotics
The Killers Within: The Deadly Rise of Drug-Resistant Bacteria
by Michael Shnayerson and Mark J. Plotkin

Reviewed by
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Hospitals have germs. And germs have a remarkable ability to develop resistance to the antibiotics we rely on to kill them. These facts are well known to the medical community and have been a source of great concern for years. A number of books and articles for both the lay reader and the professional have been written on the subject, each in its way raising a red flag that says, in one way or another, we have to control the use of antibiotics lest we lose them to smart bacteria that learn to become immune to their toxic effects.

Michael Shnayerson and Mark J. Plotkin, authors of *The Killers Within: The Deadly Rise of Drug-Resistant Bacteria*, have now joined the army of alert writers who are concerned about the dangers of antibiotic resistance and its implications for the return of infectious diseases that cannot be effectively treated. The authors argue that today's hospitals are not only spreading bacteria from patient to patient, but are also harboring a tougher breed of bug one that is resistant to antibiotics.

Most infections are either bacterial or viral, and bacterial infections are susceptible to antibiotics. These drugs are designed to attach to enzymes on bacterial cell walls, either preventing the microbes from replicating or killing them outright. Unless, that is, the bacteria mutate and change their enzymes, thus preventing the drug from attaching.

Penicillin was greeted as a panacea when it was developed in the early-20th century. In the decades since, the authors claim as have

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others before them that the overuse of antibiotics for every possible illness has educated bacteria, creating opportunities for mutations to occur: If misuse of antibiotics created drug resistance in the first place, poor infection control in hospitals allowed the bugs to spread.

Bacteria may be small, but these one-celled organisms can divide and reproduce into more daughter cells than the human population of Earth in just fourteen hours.

Plotkin, an ethnobiologist, and Shnayerson, a contributing editor to *Vanity Fair*, report what they have learned from interviews and the scientific literature about how bacteria develop resistance and the role genes play in this process. They express admiration for bacteria's clever defense mechanisms, including the evolution of enzymes that attack antibiotics and tiny pumps that vomit the drug out of the cell.

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In the first half of this book, the authors try to scare the general public into recognizing the seriousness of the threat (chapter titles include *The Silent War*, *Nightmare Come True*, *Flesheaters*).. Yet despite the scare tactics, the authors succeed in creating a suspenseful narrative.

Indeed, their claim that the medical industry has not taken growing drug-resistance seriously enough and has failed to improve antibiotics suggests a fatal conclusion fitting of Stephen King: People are dying of bacterial infections that were treatable a few years ago.

By shadowing scientists around the globe including the genetic detectives and microbe hunters who work with the world's most dangerous pathogens, as well as epidemiologists investigating outbreaks of bacterial infection the authors craft an informative thriller with vivid descriptions and tales of scientific sleuthing.

The book tells the story, for instance, of William Noble, a microbiologist at St. John's Hospital for Diseases of the Skin in London, who, in the early 1990s, created a strain of *Staphylococcus aureus* that was resistant to the antibiotic vancomycin by exposing the microbe to another bacterium with resistant genes. A few years later, a vancomycin-resistant *S. aureus* was isolated from a lung-cancer patient in Japan, suggesting that Noble's laboratory experiment had happened in nature.

Like hospitals, the meat industry is a source of rising drug-

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resistance. Small doses of antibiotics (called growth-promoters) added to animal feed contribute to the development of resistant strains by familiarizing bacteria with the drugs without actually threatening them. The authors argue that substantial research shows that these resistant bacteria are easily transferred to humans eating these animals.

Toward the end of the book, the authors leave behind the horrors of resistant bacteria and begin to describe the search for new antibiotics. Until recently, most natural antibiotics have been found in soil and fungi. Among the scientists trying novel approaches to discovering antibiotics are researchers who collect saliva from lizards in Indonesia and distill sewage water in the former Soviet Republic of Georgia.

These researchers are experimenting with animal peptides and miniscule viruses that act as natural antibiotics. Peptides punch their way through the bacterial cell membrane regardless of these enzymes.

Scientists in Georgia have been using viruses called phages for decades to puncture the bacterial membrane but with the purpose of injecting DNA. Phages take over the bacteria's genetic machinery in order to produce more phages, rather than bacteria. An interesting footnote in this passage is that phages are also the basis of genetic engineering: Geneticists insert certain genes into phages, prompting the bacteria to manufacture those genes.

The subject of resistant bacteria is not breaking news. The problem has been widely discussed in the medical community although the general public may not be as familiar with the issue. While the authors focus on the ignorance and blindness of the medical community towards this problem, they also reveal the obstacles preventing new antibiotics from being developed and problematic behaviors from being changed.

For readers interested in the topic, *The Killers Within* provides an overview of the biological, medical, policy-oriented and personal perspectives involved. And for those who have the stomach to digest the chilling dangers posed by resistant bacteria, this book will be a thrilling read.

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Shnayerson, Michael and Plotkin, Mark J. *The Killers Within: The Deadly Rise of Drug-Resistant Bacteria* Little, Brown and Company, Boston (2002).