REVENGE OF THE MICROBES
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How Bacterial Resistance Is Undermining the Antibiotic Miracle

Abigail A. Salyers and Dixie D. Whitt
University of Illinois at Urbana-Champaign
Urbana, Illinois

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For Jeff and Greg
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Preface

Most people have a love-hate relationship with antibiotics. They love the fact that antibiotics still work most of the time and work quickly with few side effects. Anyone who has experienced therapy that only suppresses the symptoms of a disease, such as arthritis medications, or has endured therapy that is debilitating, such as cancer chemotherapy, has to appreciate the swift, effective action of antibiotics. But people also hate things about antibiotics. They hate the fact that more and more physicians are refusing to prescribe antibiotics for flu and that patients are being blamed for demanding antibiotics when they shouldn’t. They are also coming to hate the dire warnings about increasingly resistant bacteria whose advance may send us back to the preantibiotic era.

Many people, including some scientists, are also confused about antibiotics. Why can’t I have antibiotics when I have a bad case of the flu? I’m sick, aren’t I? Why do research scientists and public health officials tell me that I should be worried about bacteria that have become resistant to antibiotics while many physicians still deny that bacterial resistance to antibiotics is a significant clinical problem? What are antibiotics, anyway? And what does antibiotic resistance mean? Does it mean that I become resistant to antibiotics or that the bacteria do? Should I worry about the use of antibiotics in agriculture or should I listen to the spokespeople for the farmers’ organizations who reassure me that all is well?

It was this ambivalence and confusion that motivated us to come out of our comfortable niche as writers of textbooks and attempt to write a book for the general public about antibiotics and resistance to them. In undertaking this challenge, we began to realize some things that surprised us. First, college students receive virtually no information about antibiotics or other antimicrobial compounds. Even medical students in most medical schools get precious little instruction until they take pharmacol-
ogy in their later years. We have a whole generation of physicians, now in their 50s, whose education in microbiology may have consisted of only two or three weeks of lectures, with antimicrobial compounds taking up only a small slice of that time period. Perhaps even more surprising, most graduate students in biology receive little or no education in the field of antibiotics and antibiotic resistance. In fact, the one thing most of them learn about antibiotics and antibiotic resistance is that these are old-fashioned topics that no one is interested in anymore.

The second thing that surprised us is the extent to which average people are interested in the topic. We had never underestimated the intelligence of people in general, once their attention has been engaged, but we had doubts about the level of their interest. That doubt changed during the period after the anthrax attacks in October 2001, when we and some of our colleagues spent hours talking to postal workers, university staff members, and undergraduates in introductory classes. They wanted to know more than the answer to the question, what options do I have? They wanted to know what bacteria are, how antibiotics work, and why government and media workers were getting one antibiotic while postal workers were getting another. These questions did not end once the anthrax panic had subsided. They had already shown up in concerns about the safety of genetically modified plants, which contain bacterial antibiotic resistance genes, or, more recently, about the consequences of the use of antibiotics in agriculture. Granted, those who were most immediately affected by the anthrax attack or by the debate over the agricultural use of antibiotics had a strong vested interest in paying attention. But the interest went beyond that. People want to know what is going on with their health and with the health of the community.

Something we relearned, because in a way we already knew it, is that a book about antibiotics and antibiotic resistance has to go beyond the scientific facts and try to deal with the social, economic, and political aspects of the topic. Scientists like us are not used to writing about such things. It’s a little like explaining to your grandmother, who has asked about condoms, how condoms give partial protection against sexually transmitted diseases. You feel a little embarrassed, not just because of the intimate nature of the topic but because you are not sure you are competent to convey all the subtleties of the topic. Scientists are not trained formally to speak about such things as social, economic, and political aspects of scientific advances. We received this training in a different milieu. In a sense, we both have earned second Ph.D.s in dealing with
these subjects in the school of hard knocks: teaching, testifying before regulatory agencies, talking to reporters, and talking to community groups. Of course we didn’t get it right every time, but we didn’t flunk either.

A different kind of challenge we faced with this book was to decide who the audience was. Every other book on antibiotics and antibiotic resistance that has stressed the scientific aspects of the topic has had scientists with advanced degrees as its audience. We wanted to reach a wider audience, but we didn’t want to exclude scientists, especially those who work in areas in which information about antibiotics might not have been part of their training.

Accordingly, we made some compromises. For example, we decided that we wanted to show the chemical structures of antibiotics because some people would be interested in seeing them. However, they tended to break up the narrative flow of the text and are somewhat off-putting to those who are not used to seeing them, so we did what all scholarly types do when faced with such a dilemma: we put them in an appendix. We also decided not to list references to scientific papers at the ends of the chapters. We put those in an appendix too. Do you begin to detect a pattern here? We are so pathetically predictable.

We also did something else that is usually not seen in books like this one. We end each chapter with some questions labeled “issues to ponder.” Normally, we are only too happy to ram our opinions down the throats of those who can’t run faster than we can. (Fortunately, our advancing age has made this less of a threat than it once was.) However, we wanted to convey the very important message that people, whether they have scientific credentials or not, should be able to have and express opinions about controversies in the areas covered in the different chapters. We realize that this device labels us as a couple of unreconstructed fusty old pedants, but it was the best thing we could come up with.

Finally, we did not want to follow the example of others who have written about this issue and forecast gloom and doom or spread blame and pain, because we want readers to enjoy this book. Admittedly, it is a book about a serious subject, but there are light as well as dark sides to the subjects it covers. There are three things we hope readers will take away from this book. First, there is plenty of hope. There is still time to avert what is constantly being portrayed as the impending disaster of a return to the preantibiotic world. Second, everyone should and can have a say in what is done about saving the antibiotics we already have and
battling antibiotic-resistant bacteria. However, to be part of the solution, you need to have information. We hope this book provides this information in a relatively painless way. Third (and this is probably a wildly unrealistic expectation), we hope that this book leaves people who have not thought much about bacteria with an appreciation for these indomitable little critters. This may sound like an odd goal, attached as it is to a book about the damage bacteria can do, but the important message we hope this book brings is that these tiny parasites are not consciously malevolent. They were here long before we appeared, and in a very real sense, they gave us the possibility of life. When they cause us problems, remember that they’re just trying to make a living. And they’re not even making minimum wage.

Abigail Salyers
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