

# Viruses vs. Superbugs

## A solution to the antibiotics crisis?

Thomas Häusler

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Translated by Karen Leube

**Macmillan**

London New York Melbourne Hong Kong

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First published 2006 by  
Macmillan

Houndmills, Basingstoke, Hampshire RG21 6XS and  
175 Fifth Avenue, New York, N.Y. 10010  
Companies and representatives throughout the world

ISBN-13: 978-1-4039-8764-8  
ISBN-10: 1-4039-8764-5

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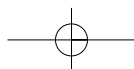
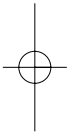
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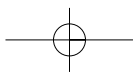
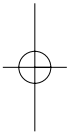
A catalog record for this book is available from the Library of Congress.

10 9 8 7 6 5 4 3 2 1  
15 14 13 12 11 10 09 08 07 06

Printed and bound in China

*For Susanne and Julia*





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## foreword

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Just imagine life without antibiotics. It would be like it was 100 years ago, when pneumonia and tuberculosis were the most frequent causes of death, and the risk of infection turned a simple appendectomy into a dangerous operation.

Luckily we do have antibiotics. However, they are becoming increasingly ineffective. Doctors are more and more frequently confronted with infections they can't do anything about because the bacteria have become resistant. This has dire consequences for patients. Many end up living with a chronic infection for years on end, some are forced to become amputees and yet others succumb to the infections.

The crisis affects people in both industrialized and developing countries. In the US and the UK, the bug *Staphylococcus aureus* is wreaking havoc. Forty to fifty per cent of infections that people contract in hospitals are resistant to more than one antibiotic. The developing countries are groaning under the burden of tuberculosis, which claims the lives of 2 million victims throughout the world every year. The increase in multi-resistant TB is especially alarming. Treating it costs 100 times more than treating the regular form, making a cure unaffordable for many people in impoverished countries. And these are only two examples.

Despite this, many pharmaceutical companies have stopped developing antibiotics. They see the financial risk as too big and potential profits too skimpy. This has led to very few new drugs for fighting bacterial infections being launched in recent

years. A survey of 11 large pharmaceutical companies revealed that of 400 substances they were developing, only 5 were anti-bacterial drugs.

What can be done about the resistance crisis? One thing is needed for sure: new drugs. One of them could be bacteriophages, viruses that attack bacteria without harming people. So-called bacteriophage therapy had its heyday from 1920 to 1940, before it was pushed aside by penicillin. The former Soviet Union is the only place it continues to be used today. Most Western doctors do not even know that this method exists.

However, there are some scientists who have resumed research on bacteriophage therapy, and that's a good thing. We need to pursue any and every approach that can contribute to solving the resistance crisis. Bacteriophage therapy may prove to be a particularly worthwhile area of research. Its long history provides a large stock of knowledge that is freely accessible. Determined researchers now need to use this as a starting point and work out how to turn bacteriophages into drugs that meet today's standards. This would be best carried out in cooperation with science departments at universities, along with private companies and non-profit foundations that support the projects. This is exactly the goal of the Foundation for Fatal Rare Diseases. The foundation supports the development of drugs for neglected infectious and pulmonary diseases and is especially committed to helping affected patients who have not been in the public eye, particularly those in Africa and India.

Thomas Häusler's remarkable book plays a central part in this scheme, because it acquaints the public, researchers and decision makers with a therapy that has the potential to someday heal many patients who cannot be helped at the moment. This is why the Foundation for Fatal Rare Diseases is supporting

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the realization of this English edition. The fact that the author writes about bacteriophage therapy in the form of such a gripping story makes reading it all the more exciting.

Vaduz, October 2005  
Vera Cavalli, Dorian Bevec and Fabio Cavalli  
Founders of the Foundation for Fatal Rare Diseases

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## preface

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Why should anyone be interested in an old cure that hasn't been used in the West for 50 years? It's a method that many doctors aren't even aware of today. The most telling answer to this question came when I received a call in my office from a man one Friday morning in January 2001. It was the day after my article on the Eliava Institute in Georgia had appeared in the German weekly newspaper *Die Zeit*. In the article I had described how this old remedy – phage therapy – had survived in the impoverished country.

Phages are viruses that attack and kill bacteria but not people. Since Stalin's days, doctors in Russia and Georgia have been using phages to cure bacterial infections. In the West this method was also once popular but, in contrast to the Soviet Union, the triumph of penicillin pushed phage therapy aside here after 1940. The Eliava Institute in Tbilisi, Georgia is a place where phage therapy survived even after the collapse of the Soviet Union. It looks back on a glorious 80-year history. However, because of Georgia's economically and politically precarious situation, it is experiencing a gloomy present. From the point of view of today's science, it is unclear how effective phages are in fighting infection. This is because the studies carried out by early pioneers and Soviet researchers do not meet today's standards. All this was in my article in *Die Zeit*.

The caller explained that he had read the article. He was calling directly from the hospital and appeared to be under a great deal of pressure. Not mincing words, he explained that he had been suffering from an infection in his foot for two

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years. Doctors couldn't get it under control because the bacteria were resistant to all antibiotics. He was scheduled to have his foot operated on a fourth time the next day. Could I put him in touch with someone in Georgia? He was afraid that before long he would lose his foot.

More than any research I have done, his call hit me between the eyes. Never before had I been so aware of the power that bacteria continue to wield over us. We have grown up with the certainty that every bacterial infection can be cured by antibiotics. Most of us have no idea of the destruction that bacteria are capable of rendering, because our doctors prescribe drugs at the slightest symptom.

One year after I received this call, I accompanied an expedition of botanists and fragrance researchers to a rain forest in Madagascar. One night, as I slept in my hammock, I woke up, and my right foot was hot, red and swollen. The next morning I could hardly walk. Bacteria must have entered places where my sandals had rubbed against my skin while we were hiking. The doctor accompanying the expedition gave me some antibiotics that he found in his first-aid kit. The effect was hit or miss – more miss than hit, in fact. Four days later, I arrived home – with my foot still swollen. My GP prescribed some other antibiotics and luckily they worked. He cut to the chase: 'That could have been the end of you.'

At that point, however, I no longer needed that kind of graphic demonstration of the power of bacteria, since I had already started doing research for this book. The 80-year-old history of the tiny phages and their potential role in reining in the antibiotic resistance crisis were constantly on my mind.

The fascination produced by phage therapy is particularly striking as I write these lines. In Southeast Asia, veterinarians and doctors are combating bird flu. A pandemic is in the making. This was only just averted in the case of SARS, a new

atypical kind of pneumonia. These health crises show viruses in their familiar role – as lethal villains. Phage therapy takes this image and turns it upside down, turning the bad guys into unexpected allies.

This book is not a health manual whose purpose is to testify to the efficacy of phages. First, it's too early to reach a clear conclusion about their effectiveness. Researchers are still working on this. Second, I found the detective work on the origins of the captivating idea that bacteria can be fought with their natural enemies at least as interesting as the analysis of phages' curative powers. I hope that this has led to a book that sheds some light on the sometimes winding paths of medical research and in turn provides some insight into an area of our society that is becoming increasingly significant. Never has so much medical research been undertaken as at the present time, nor has so much money ever been spent to cure us of diseases.

This English edition came about some three years after the German edition was published. I have taken great pains to update the material in the book. As I did so, I saw that some companies had been confronted with scientific or financial obstacles, leading them to abandon their projects altogether. On the other hand, other companies and university researchers have joined the ranks of phage therapy research, contributing good ideas. What they require is support from public and private sponsors in order to produce drugs from phages. They are desperately needed.

I could not have written this book without the help of many researchers, doctors, patients, librarians and helpers. They provided me with information, books and photos, gave me accommodation, told me about their lives, interpreted or handed out advice. I extend my gratitude to all of them.

I would specifically like to thank Elizabeth Kutter, Hans-Wolfgang Ackermann and Harald Brüssow for sharing their

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expertise. Zemphira Alavidze, Nino Chanishvili, Liana Gachechiladze, David Gamrekeli and Mzia Kutateladze not only provided me with exhaustive information, but made my research in Georgia possible in the first place. I will never forget their hospitality.

Reto Schneider, Elizabeth Kutter and my wife Susanne read the entire manuscript. I thank them for their countless suggestions for improvement in style and content. I also express my thanks to my translator Karen Leube, my editors Sara Abdulla (Macmillan) and Wolfgang Gartmann (Piper), and the team at Aardvark Editorial. Without the support of Tamedia AG, the publisher of *Facts* news magazine, this book would not have been possible. *Facts*, my employer, continued my salary while I worked on this book, and Tamedia's media forum paid for the research expenses. I would like to thank my colleagues at *Facts*, Odette Frey, Beate Kittl and Rainer Klose, for their willingness to put up with the additional work and reorganization brought about by my absence. The English translation was generously funded by the Foundation for Fatal Rare Diseases. Thomas Fritschi and Rich Weber drew the graphics for Figures 3.4 and 3.5. I thank Susanne and Julia for putting up with a husband and father who was more of a phantom for a year and, at times, an overworked, nervous one at that.

Thomas Häusler