**The War on Bacteria (back cover blurb)**

Across the world, 700,000 people die as a result of being infected with antibiotic-resistant bacteria each year.[[1]](#footnote-1) In the US, resistant bacteria claim three times as many human lives as HIV/AIDS. This is the biggest health crisis of our time – and yet it seems to be a subject that is hardly discussed.

The World Health Organisation (WHO) has issued the following warning: without antibiotics, medical science will be set back by 100 years. Not only will we be powerless in the face of infections, but without antibiotics even simple operations will become impossible. Heart transplants, liver transplants, cancer treatments and prostheses – all of these may come to an end. Without antibiotics, every operation could result in a deadly infection. By 2050, ten million people may be at risk of dying as a result of resistant bacteria each year. [[2]](#footnote-2) The biggest health catastrophe the world has ever seen is right on our doorstep.

But how did we end up here? *The War on Bacteria* takes you behind the scenes at our hospitals and tells the story that pharmaceutical industry CEOs, hospital managers and the meat industry don’t want you to know. It is the shocking story of how the pursuit of profit has driven Big Pharma to hand out antibiotics as if they were vitamins. And it is the story of how the meat industry has systematically undermined information that could have stopped the spread of these super bacteria.

But this is also the story of a battle that is older than humankind. It is the story of how, over hundreds of thousands of years, animals and bacteria have developed in a delicate balance – and how our uninhibited use of antibiotics is about to throw this balance completely off kilter.

Is there no cure? In the shadow of antibiotics, another miracle medicine has been completely forgotten. This is the story of how an old cure, preserved by a group of dedicated doctors and nurses in Georgia, is in the process of being rediscovered – and how this cure may change medical history forever.

**SYNOPSIS**

**BACKGROUND**

The book starts with the gripping story of how the author himself may have died had it not been for antibiotics. At four years old, he was admitted to hospital with a serious lung infection. Just three days later, he had recovered – antibiotics had saved him.

\*\* One hundred years ago, one in ten children died before the age of five. When antibiotics became available, they revolutionised medical science.

\*\* In the introduction, the author takes a look at our current major health crisis, and outlines what it means for us. He also takes a broad look at the relationship between humans, bacteria, animals and ecology.

\*\* Penicillin is no longer effective, and even new antibiotics fail to provide adequate treatment. Across the world, thousands of patients are admitted to hospital every day. There is no longer a single hospital in Europe that has not experienced an outbreak of antibiotic-resistant bacteria.

**Part 1: THE CRISIS**

\*\* Part 1 takes you right to the heart of the dramatic health crisis caused by antibiotic-resistant bacteria. Sofia Miçoogullari has just given birth to a son. Just hours after the birth, she receives shocking news: her baby is infected with deadly multidrug-resistant Staphylococcus aureus (MRSA). We follow the family and their dramatic fight to save their son. From here, the author travels to the University Hospital of North Norway in Tromsø, which is experiencing a deadly outbreak of multiresistant klebsiella. The author speaks with the doctors and nurses fighting to contain the outbreak. Will they manage to stop the infection from spreading, and how did the resistant bacteria reach this city north of the Arctic Circle?

\*\* After diving straight into the heart of the crisis, the author zooms out to take a broader view. In order to understand what’s actually going on, he scrutinises the available statistics. He discovers a health policy scandal – it turns out that patient deaths caused by antibiotic-resistant bacteria are not registered as such. The book therefore uncovers a fundamental failure of the European health services, and one reason why the crisis caused by resistant bacteria is so difficult to quantify.

\*\* The author meets several patients and hospital employees who tell of the stigma, fear and isolation they encounter.

\*\* Curious about the place of bacteria in nature, the author travels to Trøndelag to meet Tor Grenne, a prominent geologist who has made an astounding discovery. Deep within the Norwegian mountains, Grenne literally hacks his way to one of the keys to the origins of life. Here, the author finds the first traces of the relationship between humans and microbes.

**Part 2. THE HISTORY**

\*\* After taking a deep dive into the contemporary situation, the author wants to understand more about its history, and so travels to London to meet osteologist Don Walker and his team of archaeologists. Beneath Liverpool Street, they have uncovered forty-two corpses from the Great Plague that hit London in 1663. Walker provides information about the tiny bacterium *yersinia pestis*, and how this finding in London proves that this bacterium triggered three great pandemics in human history. Deep within the Museum of London Archaeology, the author is able to view the remains of a man who died during the Great Plague in London. So begins the revelation of the story of humankind’s long war on bacteria.

\*\* After the plague slowly withdraws from Europe, a new health threat arises: smallpox. During the 1700s and 1800s, millions of people die of this disease. In Europe there is no cure, but in Constantinople doctors practice a cure known as variolation. When a British lady takes the method to London’s establishment, and even Queen Victoria herself, she simultaneously challenges the doctors and paradigm of the age – the miasma theory, which held that diseases were spread through bad air. She thereby lays the foundations for the first vaccine.

\*\*After Edward Jenner develops a smallpox vaccine, London becomes a world metropolis. People live in cramped conditions, and in the slums of Soho a new disease develops – cholera is unlike anything the Europeans have ever seen before. Anaesthetist John Snow is the first person to understand that cholera is spread through water, not the air. Snow uses modern statistics in an attempt to reveal that it is microbes that make people ill, not bad air, thereby casting a historic light on today’s insufficient keeping of statistics.

\*\* In the mid-1800s in France, bacteriologist Louis Pasteur establishes a connection between a microorganism and a disease that kills silkworms. Scottish surgeon Joseph Lister understands that Pasteur must be right, and deduces that bacteria must be the cause of gangrene and infections. He then goes on to develop antiseptics. German Robert Koch is the first to discover that *Bacillus anthracis* is the cause of anthrax.

\*\* Back in London, the author visits St Marys Hospital and the British Library. Here, he finds traces of medical history’s greatest discovery. When Alexander Fleming first developed antibiotics, he did so by chance. And had it not been for the outbreak of the Second World War, and the fact that a new research team was tasked with hunting down the bacterial killers, Fleming may never have become famous. While the London Blitz is at its worst, a patient is treated with antibiotics for the first time. The penicillin works, but it is in the US that the British research team finds the money and equipment they need to mass-produce the medicine. In an old ice factory in Brooklyn, Pfizer produces millions of doses, which are given to the American soldiers who will invade Normandy. **The age of antibiotics has begun**.

\*\* After the discovery of penicillin, a series of discoveries starts, revolutionising modern medicine. The author reveals how aureomycin, streptomycin and cephalosporin are discovered in the most unlikely places. Surgery reaches new heights, and antibiotics become incredibly popular.

**Part 3: THE FALL**

\*\* Thirty years after Fleming discovered penicillin, another troubling discovery is made at the Public Health Laboratory in Colindale, north-west London. Here, the young Patricia Jevons is the first person to discover multiresistant staphylococcus (MRSA). This is the first time that the existence of MRSA is established, but it creates no big headlines. This is the same bacterium that almost took the life of the little boy in the first chapter.

\*\* The author takes a deep dive into modern research. He finds that bacteria such as MRSA are able to develop even without the use of broad-spectrum antibiotics. This happens through so-called horizontal gene transfer. Research indicates that MRSA has obtained its antibiotic resistance from bacteria that live on animals, and the author begins to unravel the story of how antibiotics came to be used in the production of meat.

\*\* On the farm of British pig farmer Richard Lister, the author is able to see with his own eyes how large amounts of antibiotics are mixed into the pigs’ feed and drinking water as a preventative medicine. He talks with researchers, who explain how MRSA has spread throughout pig farms across Europe, and meets a Norwegian pig farmer who has to slaughter all his livestock following the discovery of the presence of this terrifying bacteria. In Denmark, pigs and humans infect each other – a majority of the pig farmers are carriers of MRSA. The author learns that eighty per cent of all antibiotics are used in the production of meat.

\*\* At a hospital in Norway, a patient is admitted with a new, serious bacterial infection – ESBL. The author speaks with the doctors and the patient’s close family, and must put on protective clothing in order to visit the isolated patient.

\*\* A Swedish researcher explains how ESBL has spread from European hens to humans. Shocked by these findings, the author examines the poultry industry’s statistics. He finds that bacteria with ESBL properties are now found everywhere in nature. British researcher Elizabeth Wellington finds them in the Thames, and warns of the risks of a post-antibiotic society.

\*\* The author travels to Brussels to speak with politicians there, and investigates what is being done to stop the spread of resistant bacteria.

\*\* In Madagascar, an outbreak of resistant plague causes panic. The author visits the Pasteur Institute in Paris, where scientists are working to develop a vaccine.

**Part 4: SOLUTIONS**

\*\* Resistant bacteria seem unstoppable. Tuberculosis, scarlet fever and other diseases from our forgotten past are back. Is there no cure?

\*\* The author travels to Georgia, and visits the George Eliava Institute in Tbilisi. Here, he finds a forgotten cure for bacterial diseases, which may prove effective against resistant bacteria. He finds out about bacteriophages – viruses that kill bacteria. In Tbilisi, he meets patients who have been treated using bacteriophages, and the doctors who have treated them. The author takes a look at the history of this forgotten cure – discovered by the French bacteriologist Felix d’Herelle at the Pasteur Institute as far back as 1919, and taken to the Soviet Union. The KGB kills one of the individuals who tries to develop the medicine.

\*\* After D-Day in 1945, penicillin becomes enormously popular in the West. But behind the Iron Curtain in the Soviet Union, bacteriophages are being developed as a treatment for bacterial infections. In the 1960s and 1970s, a large production facility is established in Tbilisi, and this facility supplies the entire Soviet Union with medicine. But when the Soviet Union dissolves, the George Eliava Institute loses its entire supply and distribution network. As civil war rages in Georgia, and armed men run through the streets, a group of dedicated researchers manage to save a bank of bacteriophages by taking them home for safekeeping.

\*\* Are bacteriophages really a cure? In Wrocław in Poland the author meets Timo, a Finnish patient being treated for chronic prostatitis with the help of bacteriophages. The doctors at the Ludwik Hirszfeld Institute must follow EU legislation when they distribute and report on the use of this old cure. The author speaks to several patients who believe that bacteriophages work. Researchers and bacteriologists in Wrocław tell stories of a cure that works, but also of regulations and an industry that pose barriers to quickly rolling out this treatment.

\*\* In the US, the presence of antibiotic-resistant bacteria has reached new heights. At Yale University, the author meets Dr Ben Chen, a researcher who, together with a group of doctors at John Hopkins University, is treating patients using bacteriophages. But there is a disadvantage to this treatment – because the bacteriophages are not certified as a medicine, only patients on the brink of death are permitted to use the medicine. Many lives have been saved using bacteriophages.

\*\* Chen and other researchers speak about a pharmaceutical regime set up for chemical pharmacology, and which is not adapted for bacteriophages. The author meets Dr Carl R. Merril, who has founded *Adaptive Phage Therapeutics*. He believes bacteriophages are here to stay, and that bacteriophages will make their breakthrough. It costs over a billion kroner to licence a new antibiotic. Swedish researcher Anders Nilsson explains a new licensing method which is now being tested in the EU. Through so-called adaptive licensing, the hope is to make it easier to use new medicines when they are needed.

\*\* After having seen how bacteriophages kill disease-causing bacteria, the author finds new research that seems to indicate that antibiotics do not have as few side effects as first thought. So-called autoimmune diseases such as asthma and ME attack the body’s immune system. The author explores the background to the so-called hygiene hypothesis, which looks at how the war on bacteria has also eradicated the bacteria we need to keep us healthy. He hears about how autoimmune diseases are hardly found among the Amish in the USA – a people who live a simple life. British professor Graham Rock points out that bacteria help to sharpen and educate our immune system. A bacteria-free life destroys the immune system, and paves the way for disease-causing bacteria. The author finds out that important bacteria in the gut help us to produce important fats that the body needs, and that the extensive use of antibiotics can kill these important bacteria, which Graham Rook refers to as ‘old friends’.

\*\* The author travels to the University of East Anglia (UEA), and meets Professor Matt Hutchings. He has discovered a completely new type of antibiotic, which is cultivated on the backs of small African ants. Hutchings explains the obstacles to bringing new antibiotics into use, and the author puts into place the last pieces of the puzzle that explain why the health crisis we are facing is so difficult to solve. Hutchings shows us how a new generation of antibiotics might replace some of the old antibiotics – if we use them more carefully. In Sweden, all-out efforts are being made to reduce the use of antibiotics.

\*\* In the final chapter, the author rounds up the story of the connection between bacteria and humans. We cannot live without them, but nor can we survive them should they attack us. The use of antibiotics in agriculture must be dramatically reduced, and doctors must stop prescribing antibiotics for simple airway infections. We must take care of the antibiotics we still have, regarding them as the great treasure that they are. At the same time, we must create regulations that make it possible to quickly roll out the use of bacteriophages in medicine.

1. The Guardian, 08.10.2017. [↑](#footnote-ref-1)
2. O’Neil, Jim et al. (2016). [↑](#footnote-ref-2)