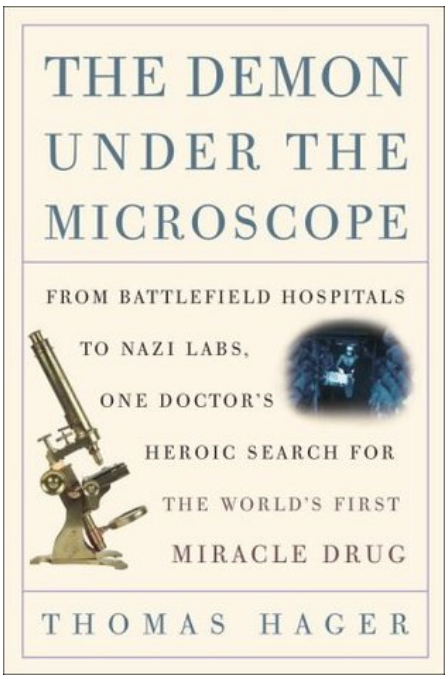

The Demon Under the Microscope: From Battlefield Hospitals to Nazi Labs, One Doctor's Heroic Search for the World's First Miracle Drug

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The Nazis discovered it. The Allies won the war with it. It conquered diseases, changed laws, and single-handedly launched the era of antibiotics. This incredible discovery was sulfa, the first antibiotic. In *The Demon Under the Microscope*, Thomas Hager chronicles the dramatic history of the drug that shaped modern medicine.

Sulfa saved millions of lives—among them those of Winston Churchill and Franklin Delano Roosevelt Jr.—but its real effects are even more far reaching. Sulfa changed the way new drugs were developed, approved, and sold; transformed the way doctors treated patients; and ushered in the era of modern medicine. The very concept that chemicals created in a lab could cure disease revolutionized medicine, taking it from the treatment of symptoms and discomfort to the eradication of the root cause of illness.

A strange and colorful story, *The Demon Under the Microscope* illuminates the vivid characters, corporate strategy, individual idealism, careful planning, lucky breaks, cynicism, heroism, greed, hard work, and the central (though mistaken) idea that brought sulfa to the world. This is a fascinating scientific tale with all the excitement and intrigue of a great suspense novel.

For thousands of years, humans had sought medicines with which they could defeat contagion, and they had slowly, painstakingly, won a few battles: some vaccines to ward off disease, a handful of antitoxins. A drug or two was available that could stop parasitic diseases once they hit, tropical maladies like malaria and sleeping sickness. But the great killers of Europe, North America, and most of Asia—pneumonia, plague, tuberculosis, diphtheria, cholera, meningitis—were caused not by parasites but by bacteria, much smaller, far different microorganisms. By 1931, nothing on earth could stop a bacterial infection once it started. . . .

But all that was about to change. . . . **—from *The Demon Under the Microscope***

The Demon Under the Microscope: From Battlefield Hospitals to Nazi Labs, One Doctor's Heroic Search for the World's First Miracle Drug Details

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From Reader Review The Demon Under the Microscope: From Battlefield Hospitals to Nazi Labs, One Doctor's Heroic Search for the World's First Miracle Drug for online ebook

Lori says

This is actually a goodread, even though it is basically a chronicle of an evolution of a drug, sulfa, its actually a whole lot more.
It goes through the history of its development, yes Nazis had a hand in it, but it saved millions of people including a one point Winston Churchill. It really took off in America when it saved the President’s son, FDR Jr.
Publicity spread about this wonder drug and to meet demands a company out of Tennessee, Massengill Co, made a liquid form in 1937. It was a concoction of Elixir Sulfanilamide adulterated with a lethal ingredient, diethylene glycol, that had the nasty side effect of killing people, more specifically killing kids then adults in Tulsa, Oklahoma. That lead to a massive hunt by the FDA to track down those who unwittingly were given the poisonous liquid. This catastrophe resulted in strengthening the FDA thru the passage of The Federal Food, Drug, and Cosmetics Act of 1938" From there on out drugs had to undergo testing before being unleashed on the public.
This is just one of Many interesting stories in this book.
The narrator, Stephen Hoye, of this 12hrs and 18 min audiobook is about as animated as a stuffed bear. This book would have greatly benefited from a livelier presentation.

Christina Dudley says

A great read about the fascinating development of the world's first antibiotic, the sulfa drug Prontosil. If you ever wished to time travel and often picture yourself at Downton Abbey, let this cure you of such romanticism. Life before antibiotics was precarious! If President Calvin Coolidge's son could DIE of a blister on his toe that he got playing tennis, nobody was safe.

Developed by the German company Bayer, Prontosil's story intersects and overlaps with Nazi Germany and WWII.

Door-to-door a thrilling read. Highly recommend.

Mike (the Paladin) says

I tend to like medical thrillers, then to I like nonfiction about medical breakthroughs and medical advances. This book does lay out a story but it gets sidetracked from its given premise.

We are told we'll be looking at the development of Sulfa and it's effect on medicine and bacterial disease. We do but in a very round about way. The book turns into a series of short biographies. These don't actually hold up well (at least for me) as they to tended to wander a bit.

Just me of course but I didn't really get into this book at all. For me it was a put aside and forget book. I'd put off getting back to it. See what you think. Many readers liked it. I suppose it could be that it simply didn't catch my interest. Maybe try this one yourself.

Carly says

~4.5

Even as late as the 1930s, an infection was a likely death sentence. Even a small wound on a finger or toe could be deadly, for if it became septic, doctors could do nothing except hope that the patient could fight off the infection. Antibiotics were only a wistful dream of a universal panacea. After all, how could one create a medicine that would unerringly target the bacterial foe while leaving all of the diverse cells of the body intact?

Everything changed with the invention of sulfa. Sulfanilamide, or sulfa, which is still used today in familiar drugs such as Bactrim, was the first widely-known antibiotic, its effectiveness discovered by the German pathologist Gerhard Domagk. The story of sulfa--its invention, the race to production, the ironic twist in its usage, the growing tensions between Germany and the rest of the world--is all utterly fascinating and probably obscure to most of us. Because of that, I won't describe the best parts of the story--it's far better to reach the delicious ironies unaware.

Hager is a fantastic storyteller. He weaves together the story of sulfa from a series of related episodes, digressing into everything from Domagk's war experiences to the disastrous patent medicine incident in the United States to the French techniques of corporate espionage to the sulfa experiments on the women of Ravensbruck, yet somehow creating a harmonious whole. My only real complaint is that these digressions tend to make the book jump around a lot in time so that I had difficulty reconstructing the chronology.

Hager packs a tremendous amount of history into the story, and the impact of these practically forgotten figures is utterly startling. Many of these stories, such as the lab assistant who accidentally inoculated himself with "super strep" and was forced to experiment with his own treatments-- are so fantastic and so perfectly fitting that it is hard to believe they are fact rather than fiction. The stories of the characters' war experiences are so dramatic that I had to double-check them before I could believe the text. Oddly, one extraneous detail that really stuck with me was an offhanded comment about Hitler's vehement dislike of animal testing. How could a man who outlawed animal testing be so ready to substitute them with humans? I know Hitler was a monster and that much of what he did was even more illogical, but that bizarre inconsistency still somehow continues to trouble me. One of my favourites from the beginning of the book is the story of childbed fever, a.k.a. "The Doctor's Plague." First seen in the 1600s, it took centuries of dead women before people began to notice an odd pattern. While doctors' patients tended to die in droves, those treated by midwives, even in the same hospitals, had a good chance of never catching the disease. It took even longer for someone to discover the moral of the story: if you've just finished an autopsy of one victim of childbed fever, it might be nice to wash your hands before sticking them up another.

If you have even a mild interest in medical history, then I'd definitely recommend taking a look at *The Demon in the Microscope*. There's nothing quite as magical as a gifted storyteller with a fascinating story to tell.

Blake Charlton says

One of the best examples of clear, compelling scientific writing I've ever come across. Though I've studied organic chemistry and medical science for years, I never knew the amazing impact of sulfa--ranging from transformation of the medical profession, to the great influence it had on the way WWII was fought, to the creation of the FDA. Anyone interested in good science or historical writing really should pick this one up. For those interested in medicine, pharmacology, and infectious disease, this book is mandatory reading!

Trena says

I don't think it's an exaggeration to say that antibiotics changed the human condition. I had a vague idea about a penicillin eureka moment with moldy bread, but had never heard any of the story of the actual first commercially available antibiotics: sulfa drugs.

In inter-war Germany, Bayer gave nearly unlimited budget and time to a team that painstakingly tested hundreds of synthesized chemicals--each patiently constructed a molecule different than the last--against a virulent form of strep developed specifically for the tests. When they finally found one that worked, the rest of the world was highly skeptical, until doctor after doctor found themselves in a last ditch situation with deathly ill patients and managed to wheedle some Prontosil out of Bayer's labs with literally miraculous results.

I enjoyed the book's balance between the personalities and the science, and the story really is riveting. It's well-written and moves quickly, ranging from Bayer's labs to a horrifying patent medicine episode in American that killed dozens and led to the evolution of the modern FDA. Great read!

Meg says

Let me start by saying the title of this book is incredibly misleading. This is not one doctor's discovery of sulfa drugs, the first antibiotic, it is the story of the discovery of sulfa drugs and their effectiveness which took years and many people in labs throughout several countries. The focus for much of the book is on Gerhard Domagk, but there were dozens instrumental to its discovery, development, and marketing; not to mention those who paved the way for the research.

The book covers the development, use, and eventual disuse of sulfa drugs from 1931 to 1950, covering WWI and WWII and the horrific battlefield wounds found there. I learned so many things from this book, I'll just touch upon a few subjects.

First would be the sheer destructive power of what we consider minor ailments today. An infected cut, especially a battlefield injury full of shrapnel and manure rich soil, would almost inevitably kill, often in horrible ways such as gas gangrene. Strep throat and ear infections were much the same, all families and doctors could really do was make them comfortable and hope.

There is a history of understanding bacteria and diseases. Without an understanding of what caused them, doctors would often spread infections and disease to otherwise healthy patients. This is illustrated with childbed fever, doctors would attend autopsies and immediately after examine living patients with no break

for washing. One doctor was even known to carry interesting specimens from autopsies in his pocket.

Interestingly, once sulfa was proved to work it was immediately over-prescribed and over ingested for everything from colds and fevers (which it was ineffective against) to meningitis and infections (which it was very effective against). Everyone wanted sulfa and it was eaten like candy. This overuse helped create the first strains of antibiotic resistant bacteria, a problem which is huge today. Not to mention all the patent medicines that misused it and ended up poisoning people which lead to the creation of the FDA and gave it the power to enforce drug testing.

I was also fascinated to discover that Hitler was extremely against animal testing but, after the death of one of his favorites, endorsed human testing on women imprisoned at Ravensbruck. These women were infected with various forms of strep bacteria and given various levels of sulfa to see how effective it was. (This was after sulfa was conclusively proven to fight strep bacteria in Germany, France, England, the United States, and several other countries)

Overall I have been given a new sense of gratitude to live in an era of antibiotics. This is a gripping history of the development of medicines and they changed medical practice, research, and even livestock.

Barbara (The Bibliophage) says

Fascinating look into the development of the first antibiotics, with scenes from WWI battlefields, Nazi experiments, Nobel ceremonies, and lots of moments over microscopes. Surprise appearance by the early FDA, explaining how they started drug testing protocols. Must enjoy science and medicine, although it's written in layman's language. I loved it!

Full review on my blog TheBibliophage.com.

Catherine says

Tells the story of the life-altering research and development of sulfa drugs. The book is well paced for the most part, and the backdrop of early Nazi Germany adds additional interest. The book begins with the story of Gerhard Domagk, a German who survived injuries sustained in World War I to become the first doctor and researcher to achieve some success in developing an antibiotic. Coverage of the initial research dragged a little (possibly because none of the German or French researchers would listen when I repeatedly hissed, “It’s not the azo dyes!”). It picked up when Daniel Bovet, a Swiss scientist employed by the Pasteur Institute in France, found he had four extra mice to experiment with. By the time Dr. Long of Johns-Hopkins received what he initially believed to be a prank call from a colleague impersonating Eleanor Roosevelt, both the story and the use of sulfa were moving like a wildfire.

I was struck by the fact that only 75 years ago there was no awareness of the importance of hygiene in medical procedures. It was also fascinating to read about problems resulting from nonexistent standards for drug oversight, and how an errant sulfa compound finally changed this.

The book goes on to cover further uses and abuses of sulfa variants, politics, and peer competition, particularly as World War II came to an end, and the satisfaction when Domagk was finally allowed to

accept his Nobel prize 8 years after it was awarded. By that time penicillin was proving to be more useful than sulfa, but as the epilogue points out (somewhat repetitively), the evolution of the first antibiotic had a profound impact on medical protocol and the health of the world population.

Ross says

Interesting review of the history of man's knowledge (and lack thereof) of bacterial infections leading up to the discovery of the sulfa drugs in Germany in the '30s and their enormous importance in WWII. I was not aware of the essentially complete lack of regulation of drug sales in the U.S. prior to the enactment of some regulation by the FDA. You could sell anything you liked and make any claim you liked about why it was good for you!! Hard to believe in this century but true.

Tyler says

The story of sulfa drugs makes for good reading, but the author's fascination with the scientist behind their discovery turns this book into an un-asked-for defense of the German people's conduct during the Nazi era. The author's story is uneven, so I'll go from the bad to the good.

Hager's book could have been thirty or forty pages shorter. He takes too long describing the experiments leading to the isolation of a sulfa drug by Dr. Gerhard Domagk, who one day would win a Nobel prize for it. He lingers too much over the Great War and wastes too many pages on the rollout of the new drug. The author explains away a shocking scandal in which Domagk's employer sat on his discovery for two years, and he depicts the Pasteur Institute as a dump whose nihilistic reasearchers were out to destroy the profitability of the German discovery just for the fun of it.

Because Hager identifies so much with Dr. Domagk the full story of sulfa loses its way. Dr. Domagk was a German scientist working for a German conglomerate in the runup to World War II, so the author feels it necessary to defend the actions of the German people and even individual Nazis to save his hero from accusations nobody ever made. Hager thus drags out the old *tu quoque* about the awful things the Americans and Russians did, ruining even that by deploring how invading American troops simply ruined Dr. Domagk's formal dinner jacket. Are you kidding me? When Domagk's involvement with sulfa ends, so does Hager's story. The author, in short, doesn't say enough about the right things.

Still, scientific discoveries are natural stories for human curiosity. Would you like to guess the main causes of hospital deaths in 1930? If you were born after that time, you probably have no idea. Hager does a good job framing the state of medical science which drove the search for chemical antibiotics. A skillful juxtaposition of the lives of the sons of two American presidents illustrates two separate worlds, a world of terror at the prospect of infections of any kind, followed by a glorious new world brought about by sulfa in which any illness seemed curable. It's here that Hager does his best work, helping to remind us of a time sulfa allowed us to forget about in the astonishing space of a single year.

I rated this book just an "okay" read because the weaknesses outweigh the strengths and the final chapter is a cut-and-paste job with no value for readers. But the story of sulfa is fascinating, and if you're interested (and you should be) you may well find it worthwhile to plow through the annoying parts of the story for the sake

of the better ones.

Yune says

I got sick while in the middle of this book, and it's a testament to the content that I kept reading despite the descriptions of people dying in various agonizing ways while my own health was questionable. It's not that graphic, but for anyone born after a certain time, after antibiotics became both commonplace and safe, it's sobering to realize how many people used to die due to secondary infections.

Gerhard Domagk, a German soldier-turned-medical-assistant in the First World War, was frustrated by seeing how many men survived surgery, only to succumb to gangrene days later. The conditions were horrid, but he did his best; "He was smart, young, and strong, he followed orders and worked hard. He earned a reputation as a reliable, steady man. And he was unusually observant." I felt like that last line was equivalent to "And the spider bit Peter" or something, the sign of a superhero's emergence. (I will note that his uncanny ability to spot four-leaf clovers, which Hager attributes to Domagk's combined observation skills and luck, is something my mom shares, so maybe she has a pending great scientific discovery!)

Despite the title, though, this is not just Domagk's story. While he goes on to become a physician, we learn about the rise of the German chemical dye industry, which eventually turns its eye toward pharmaceuticals. The connection's not as tenuous as it may seem; chemists are involved in both, and a man named Paul Ehrlich figures that in the same way some dyes hold fast to some materials better than others, it might be possible to design a chemical that would target specific bacteria.

This isn't simple or easy work; consider that "Number 418" is one of the first promising chemicals, and that's hundreds of chemicals, each painstakingly tested. Hager also does a fantastic job illustrating how a profit-motivated company has the resources and mixed motivations to discover a working drug. And with their industrial dye origins, the first solution is bound to a dye, and mysteriously only works in live animals, not in test tubes; this mystery is satisfactorily explained. In the end, sulfa, an unpatentable substance, was pinpointed as the acting agent.

And Hager doesn't stop there. The following sulfa craze leads to patentable variants, and one of them includes a solvent that, when ingested, leads to kidney failure. As deaths pile up, the FDA springs into action. It doesn't have much clout at this time -- it has to seize the toxic elixir under a technicality of mislabeling rather than because it's actually dangerous. Pharmaceutical companies have gutted any legislation that would back up governmental regulation, until the elixir panic finally pushes through a law with some bite.

There's a bit of back-and-forth through different times and places to provide proper context: the emergence of germ theory, the classification of different types of strep by an American lab assistant, the conflict between chemists and researchers and who gets the credit, childbed fever, FDR's son's illness, the hellish Nazi experiments on exactly how effective sulfa could be (you can imagine how they went about this), Hitler's refusal to allow any Germans to accept Nobel Prizes... It's actually rather coherent and added to my interest, but I can see some people getting frustrated with the side details (and I've left out a bunch).

This is not a medical thriller or a heart-quickening route to discovery, but it rewards patience and paints an eye-opening picture of not only how much things have changed in medicine, but how, and how it also could -- and did -- go wrong. I see Hager has other books; they're going on my to-read list.

Nathaniel says

So, for most of my life I read almost exclusively sci-fi. For the past few years, I've been branching out a lot. I'm reading and enjoying more kinds of fiction but also--for the first time in my love--quite a lot of nonfiction. I've read enough historical nonfiction now to sort of understand that the basic task of an author in this genre is to assemble a compelling story from the historical facts. There are basically two approaches.

First, they can take a well-known historical story (say, the Fall of Rome) and then offer their own spin. They will tell it from a fresh perspective, or they will offer a contrarian view, or--in rare cases--they will offer the definitive account. (The bigger the event, the harder it is to do that, because so many historians have already done it.)

Second, they can take a relatively lesser-known story (say, an American rowing crew preparing for the 1936 Olympics) and in that case they have the advantage of being the only person to tell the story, but the disadvantage of needing to explain why we should care. After all, if the story were really important, wouldn't we have heard it already? When this is done well, it's fantastic. That's why everyone loved The Boys in the Boat: Nine Americans and Their Epic Quest for Gold at the 1936 Berlin Olympics. When this is not done well, it's often because the author fails to find a way to make their historical event interesting, which is why I gave up on reading The Greatest Game Ever Played. It had promise--especially uncovering the class history of pro vs. amateur competition--but in the end the author just didn't give me any reason to care about golf. In contrast, "Boys in the Boat" included enough detail to understand rowing and also enough rowing philosophy--how it relates to fundamental concepts like belonging in a group--that everyone could understand why it mattered.

In his book, Hager fell between these two polls.

The big, unstated obstacle for his story is that we've all heard of penicillin, but virtually no one has heard of think the "One Doctor" is Gerhard Domagk, but I'm not sure, and that's a problem. In fact, a major plot point (even historical books have plots) is the conflict between Domagk (who discovered that sulfa worked) and his chemists (who actually created the first iterations of the wonder drug) and a second is the fact that it was French researches (Domagk and his chemists were working for the German company Bayer) who actually discovered that it was sulfa (and not some other part of the molecule) that actually did the healing work.

So the book just isn't framed quite correctly. We start with Domagk and his World War I experiences that provide the psychological underpinning of his desire to cure bacterial infections and we end with him belatedly receiving his Nobel Prize after Germany loses World War II, but in between the thread of the tale is lost under an avalanche of other doctors and scientists--some just as compelling--who contributed as well. We even have long asides into the competitive landscape in which Bayer and other German congolmerates were situated, both nationally and internationally. There are some interesting allegations that Bayer intentionally suppressed part of their discovery (because their initial drug could be patented, but sulfa as a category of drugs could not), but Hager doesn't make any definitive points on that score and so what could be a fascinating historical conspiracy theory becomes just one more loose end cluttering up the landscape.

On the other hand, some of the tangents were really interesting. For one thing, Hager talks about a mass poisoning that took place after the advent of sulfa drugs in the US when a patent drug manufacturer (independent and essentially unregulated) used an industrial solvent to dissolve sulfa and shipped the

resulting concoction--which was quite lethal--across the country. The resulting deaths and widespread outrage led to the formation of the modern FDA. (The FDA already existed, but not with the kinds of powers it has today.) This is all interesting stuff, but what does it have to do with Gerhard Domagk? Not a thing, really. And even here, the story is told with frequent use of flashbacks that are kind of confusing as you read them.

The problem in this case is not that there's not enough to tell a story, but that there's *too much* and instead of picking and choosing Hager throws it all in there. This works out better than it should, because so many of the parts are interesting. I really liked the analysis of how the meaning and role of a physician's work changed dramatically from a humble comforter (before anti-biotics doctors were basically powerless once an infection took hold) to an arrogant technician (today doctors have a huge number of powerful drugs at their disposal which can have great impact) and the possible negative ramifications for society (we've abandoned a lot of the public health campaigns that, in 1890 - 1930 when germ theory was understood but antibiotics didn't exist yet) were the backbone of public health strategy. In short: the ability to fight infections diverted our attention away from preventing them, and--if prevention is more cost-effective--this might be a bad idea in the long run.

So, I definitely recommend the book. It was interesting and I also happened to get lots of ideas for my own writing from it, but it was also a flawed story.

Which is understandable. The thing about history is that you are--we all assume and hope--constrained by the facts as they really happened. Hager couldn't just relocate the American patent medicine scare to Germany to make Domagk a central character in that episode. So I've got nothing but respect for his research and his analysis, but in the end the result is still a little too diffuse to be truly gripping.

Becky says

It is interesting that I read this book concurrently with Joan Didion’s A Year of Magical Thinking, wherein her daughter nearly succumbs to sepsis created by the flu. I remember reading through those chapters and thinking, “my god this still happens!” I know *factually* that people still die from sepsis from bacteria and viruses; my childhood hero, Jim Henson passed in that same manner with pneumonia. I even know, logically, that this CAN happen to people in their prime- recently a local police officer passed from the flu. These things happen, all over the place, and all the time, but now it’s rare enough its reported. I know these things logically, but I do not know them emotionally because this type of loss has been incredibly rare for everyone born after the “discovery/invention” of sulfa medicines and the rebirth of medicine that it spawned. People used to understand that a simple disease could suddenly take control of your body. A measly eighty years ago no one was untouched by that sort of death.

My own father has a scar on his neck where the doctors had to cut in to treat a severe staph infection he received in the nursery at the hospital. Years later, another baby, born the same day as him, died from a staph infection kept in the same nursery he had been. He said it always gave him the chills to think about. Yet childbirth was one of the first near death experiences that almost everyone faced. It’s a wonder that Freud never looked into that (or maybe he did), we came into the world potentially blinded from gonorrhea, weakened and defenseless against strep, staph, childbed fever, a simple cold, tuberculosis. Name it. Every baby born in a hospital before sulfa and semi-modern hygiene practices was nearly born one foot in the grave. Labor wards resembled morgues more than today’s thriving delivery wards.

This book really makes you appreciate that. It makes you appreciate the staggering amount of human suffering despite doctor's best (and not always misguided) efforts from medieval times to the early 1900's. It also makes you appreciate the up-hill battle to understand what was happening in our bodies when we were infected and how to stop it. It makes you appreciate **what you have now** .

I thought that the author did a fantastic job of weaving interesting side-stories into the narrative. The horrors of WWI that set Domagk on a path to end the curse of infection, made you understand what could drive a man to fail for years, all the while believing that there was something out there that would act as a panacea. There were stories that strengthened the reader's understanding of the importance of sulfa- it saved Churchill's life in the middle of the war, it saved thousands and thousands of soldier's lives during the war, soldiers that had this been WWI, would have just died. He really let you see the world wide impact that it had- it helped form the FDA, it saved hundreds maybe thousands of Africans and Islanders. He brought the humanity back into medicine and let the reader see how the world became so transformed its nearly unrecognizable from then to now. Sure the doctors were catty, and maybe purposely obtuse. The evil of the Nazi's cannot be overstated. Neither can the fear that many non-Nazi Germans felt within their own country at the time. America's FDA had a rocky start, and hundreds needed to die before anything managed to get changed because of lobbyists. But it was a good story. And an important one. I definitely recommend it, though be prepared for it to slow down at times.

John says

Interesting read on a history I knew very little about, detailing the rise of antibiotics, the pharmaceutical industry, and the FDA all in the backdrop of WW2. It also blows my mind reading about how common and quickly what we consider as minor bacterial infections like strep throat would kill people. We take a lot for granted.
