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Stephen Greenberg
Baylor College of Medicine

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Houston History of Medicine Society

Microbe Hunters Revisited – Paul de Kruif and the Beginning of Popular Science Writing

Date: March 7, 2012

Speaker: Stephen Greenberg, M.D., Dean of Medical Education, Baylor College of Medicine

Abstract: Paul de Kruif is credited with being one of the first popular science writers for the general public. He received his Ph.D. from the University of Michigan in 1916 and worked at the Rockefeller Institute under Simon Flexner. After being fired in 1922 for publishing a scathing article on medical research, de Kruif caught the attention of Sinclair Lewis, who used his scientific background to write his Pulitzer Prize winning novel, *Arrowsmith*. In 1926, de Kruif published *Microbe Hunters* which recounted the exploits and discoveries of 14 renowned microbiologists from von Leeuwenhoek to Pasteur, Ross, Paul Ehrlich and Walter Reed. *Microbe Hunters* became a best seller, was translated into 18 languages, and formed the basis of two Hollywood movies, "Yellow Jack" and "The Magic Bullet." Generations of young readers were captivated by the vivid portrayal of these men and their discoveries.

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INTRODUCTION ROBERT E. RAKEL MD

Today's speaker is Dr. Steve Greenberg, Dean of Medicine at Baylor College of Medicine. I think he's given a talk just about every year for the last five years. Steve, we really appreciate your support.

Today's title, as you can see on the board, is "*Microbe Hunters* Revisited." Dr. Greenberg did his undergraduate education at the University of Maryland, came to Baylor for infectious disease fellowship and has been here ever since, so I think he's called a native even though that's only 38 years now. But anyway, we appreciate your presentation today, Steve.

STEPHEN GREENBERG MD

Well, thank you. Thanks, Bob, for the introduction. It's always a pleasure to speak to this group and this is a topic that I've been interested in for a long time. Approximately 50 years ago, my father brought me a paperback copy of Paul de Kruif's book *Microbe Hunters*. Since I was recovering from a strep throat as a teenager at home, he thought I might like to read about scientists who had spent their lives learning about infectious diseases, one of which I was experiencing at the time.

As I read the first two paragraphs, I was immediately pulled into the book as the author began his story of Anton Leeuwenhoek, the discoverer of the microscope, and this is the way *Microbe Hunters* begins. "Two hundred and fifty years ago, an obscure man named Leeuwenhoek looked for the first time into a mysterious new world peopled with a thousand different kinds of tiny beings, many of them more important to mankind than any continent or archipelago."

Leeuwenhoek, unsung and scarce remembered, is now almost as unknown as his strange little animals and plants were at the time he discovered them. This is the story of Leeuwenhoek, first of the microbe hunters. It is the tale of the bold and persistent and curious explorers and fighters of death who came after him. It is the plain history of their tireless peerings into this new, fantastic world. They have tried to chart it, these microbe hunters and death fighters; so trying, they have groped and fumbled and made mistakes and roused vain hopes. Some of them who were too bold have died, done to death by the immensely small assassins they were studying and these have passed to an obscure, small glory.

We didn't have Transformers or X-Men and so forth. This was as good as it got in the 1950s. There were no TVs. Radio was still in existence then; you would listen to it at times. So for a teenager reading this was kind of exciting and sucked me into the rest of the book, which I devoured over the next week or two.

As I read all the stories of these remarkable microbiologists, I was caught up not only by the author's enthusiasm and respect for their accomplishments, but also by de Kruif's ability to portray them with all their flaws and foibles. In retrospect, this book, along with *Arrowsmith* by

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Sinclair Lewis were instrumental in my eventual decision to pursue medicine and infectious disease as a career.

Who was Paul de Kruif and how did he come to write *Microbe Hunters*? Much of what we know of Paul de Kruif's life we can glean from his memoir, *The Sweeping Wind*, published in 1962. The son of Dutch immigrants, he was born, grew up, and educated in Michigan. His Ph.D. thesis at the University of Michigan in 1960 was entitled *The Primary Toxicity of Normal Serum*. His mentor at the University of Michigan was Dr. Frederick Novy who had received additional training in the laboratories of Pasteur and Koch and Emile Roux.

Dr. Novy was made professor of bacteriology and head of the department in 1902 and served in that capacity until 1936. He, along with de Kruif were the first to demonstrate anaphylatoxins. He also described one of the two organisms that cause gas gangrene. Novy would serve as a model for the character of Dr. Max Gottlieb in Sinclair Lewis's *Arrowsmith*.

After obtaining his Ph.D. degree, de Kruif left Michigan to serve with the U.S. government in the expedition forces to fight Poncho Villa in Mexico and then he served in the Sanitary Corps of the U.S. Army in World War I in France, and it's during that time in World War I that he worked on antitoxin for gas gangrene and also met many scientists at the Pasteur Institute as well as Hans Zinsser, Emile Roux and Marcel Nichol. This is sort of the scientific bloodlines of Paul deKruif. Novy, from Michigan, was trained by Emile Roux and Robert Koch and Novy trained Paul de Kruif.

So he returned to the University of Michigan and worked with Dr. Novy on anaphylatoxin, or what would come to be known as the alternative complement system components. He fell in love with a lab technician, Rhea Barbarin, and divorced his first wife and left his two kids in 1920. He was asked to join the Rockefeller Institute in New York City and work in the laboratory of Simon Flexner. He joined the research program that was beginning to study respiratory infections in rabbits.

During his stay at the Rockefeller Institute, de Kruif's experiment led to our understanding of the concept of microbic dissociation, which opened up the whole area of genetic mutation in bacteria. While working at the Rockefeller Institute, de Kruif was asked to write a short, anonymous essay on physicians and their misuse of drugs, which was published. He was also asked to write a chapter for a book called *Civilization* in which he just chastised medicine for not embracing basic science as the method for advancing new discoveries and criticized the paucity of appropriate controls in medical research. In this chapter, de Kruif coined the term "medical ga-gaism"—I don't think Lady Gaga picked it up from that, though—in which he described the current state of American medicine. His boss, Simon Flexner, interpreted these articles as an attack on the Rockefeller Institute and asked de Kruif to resign, which he did in 1922.

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In his memoirs, de Kruif describes his anger with Flexner over their different views of the Rockefeller staff and the goals for the Institute. De Kruif felt that having a central harmonious research family would be the death knell of any creative endeavor. He states, "All creating including science is a war against precedent. Science, to be vital, must grow out of competition between individual brains, foils one to the other, each man mad for his own idea."

De Kruif had been encouraged in his non-scientific writings by H. L. Mencken, who he had met previously. Mencken gave de Kruif advice on writing and through him; he was introduced to Morris Fishbein, the associate editor of JAMA. Fishbein introduced him to Sinclair Lewis in late 1922, and from that time forward, Sinclair Lewis and de Kruif became fast friends and drinking buddies.

Lewis had wanted to write a great novel on American medicine. Over the next two years, they worked out the plot and ideas for *Arrowsmith*. De Kruif developed the scientific material and character outlines based on scientists and physicians he had known. De Kruif was to receive 25 percent of the royalties and a byline on the cover. In the end, he received a brief word of thanks in the acknowledgements for, "technical assistance." Lewis turned down the Pulitzer Prize for *Arrowsmith* and de Kruif was forced to turn it down as well. It is difficult to measure how much de Kruif learned from Sinclair Lewis and the writing of this commercially successful novel, but he definitely learned dialogue, suspense, and the importance of character development.

The important and pivotal character in *Arrowsmith*, Dr. Max Gottlieb, is thought to be an amalgamation of Dr. Novy and Jacques Loeb, who advised de Kruif at the Rockefeller Institute. Both men believed in controlled scientific experiments.

While de Kruif had been working on *Arrowsmith*, he had been developing his ideas for a series of reviews of major scientists and how they had worked to find their discoveries. At the Rockefeller, Jules Bordet is reported by de Kruif to have told him to do a "roman des microbes." I can see he is reported to have said, "You feel you are as much roman as science." Donald Brace of Harcourt, Brace & Company approved the writing of the book. De Kruif meets with Clifford Dobell, Bullock, Emile Roux, Theobald Smith and David Bruce to discuss the research and ask about other bacteriologists that they had worked with and completed the book in 1925. He published *Microbe Hunters* in 1926 and it was an immediate success, within the first year selling 100,000 copies and was the outstanding scientific nonfiction book of the 1920s.

The 13 investigators in the book included Antonie Leeuwenhoek, Louis Pasteur, Walter Reed, Theobald Smith, Emile Roux, Ilya Mechnikov and Paul Ehrlich. Several journal reviews of the book were positive, but thought the work "highly dramatic" or "sometimes unrestrained and occasionally rather theatrical."

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Julian Huxley wrote in *The Yale Review* that the book should be read by everyone. Hans Zinsser, writing in *The Saturday Review of Literature* thought it an unusually good one, although de Kruif's style was not entirely pleasing. His friend and mentor H. L. Mencken wrote in *The Nation* that the book was immensely interesting.

However, scientists disagreed about the accuracy of several of de Kruif's statements. The greatest detractor of the book was Sir Ronald Ross, who was still alive at the time and keenly aware of the ongoing battle with Battista Grassi over who had defined the transmission of malaria from mosquitoes to man. Ross was so offended by de Kruif's depiction of him in the book, he threatened to sue the publishing company in England if the chapter on malaria were not removed from the British edition of the book. When *Microbe Hunters* was published in England, the book had the chapters on David Bruce and Sir Ronald Ross deleted. De Kruif is said to have agreed to the removal of these chapters. No lawsuit was ever filed.

Ronald Ross is an interesting character; born in India, joined the Indian Medical Service and was interested in studying malaria in birds and described the osis of the malaria parasite in the walls of the stomach of the birds. He also made the association between certain mosquitoes and the possible transmission of malaria. For this work, he won the Nobel Prize in 1902. This is some of the pictures where he first described the pigmented malarial parasites in mosquitoes in his notebook.

While this was going on, Giovanni Battista Grassi in Italy, who was a zoologist, was studying malarian birds in Catania and in 1890, around the same time, published on the malarial cycle in different species of birds. He knew of the work of Ross and he was impelled to do some research of his own in terms of the mosquitoes transmission. He ended up not winning the Nobel Prize.

So on the basis of the epidemiology of malaria and the distribution of mosquitoes present in the malarial zones, Battista Grassi focused his investigations on three species suspected of malarial transmission and he communicated this result to the academy in 1898. He announced—and along with his two colleagues—had infected a volunteer by exposing the volunteer to a bite of these three mosquito species and a formal note was sent to the academy and read in the academic session in December of 1898 where it was announced that a healthy man in a non-malarial area had contracted tertian malaria after being bitten by an experimentally infected Anopheles claviger mosquito and the experimental phase ended in December with a communication to the academy that described the entire development cycle of a plasmodium in the body of Anopheles and say that it corresponded to what Ross had described in the culex pipians in the malarial cycle of birds.

Well, now enter another person who enters into this, and that's Clifford Dobell. He was a highly respected researcher working at the National Institute of Medical Research and had written on

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protozoan men and he was fascinated by the work of von Leeuwenhoek and had made notes on von Leeuwenhoek and made those available to de Kruif for publishing the *Microbe Hunters*.

But Dobell was also interested in the work of Ross and Manson and Grassi, and this is what Dobell writes in a letter to de Kruif: "In one evening, I could tell you more about Ross, Manson, and Grassi and everything else than you could dig out for yourself in one year in New York and I can tell it to you accurately and fully from my own completely biased standpoint so that you would only have to go home and type it all out, ready for press. But if you won't come, I must send you some references," and he gives him a series of letters and papers of Grassi's on what he had described.

This is from Dobell's letter to de Kruif: "This is a most complicated story, but the facts, very briefly, are as follows. Ross instigated by Manson in England, helped at every time by him, tried to discover how malaria is transmitted from man to man in India and failed utterly. Ross then, again egged on by Manson, tried to discover the mode of transmission of bird malaria and succeeded. Ross and Manson were unable to apply the knowledge gained from birds to the study of human malaria because they knew next to nothing about zoology. Consequently, they couldn't do anything more; only guess."

Grassi and his collaborators in Italy in the meantime go out on the track of the true story regarding human malaria. They had already made some progress when they had heard of Ross's results with birds and as Grassi was a good zoologist, he at once saw their significance and went ahead and solved the problem.

Ross now claims that his work on birds solved the problem of human malaria, but it didn't, because even after he had finished the work on bird malaria, he was hopelessly in the dark himself regarding the transmission of human malaria. So was Manson, and his ideas throughout were nearly all wrong. It was Grassi who discovered that malaria in man isn't transmitted by Anopheles and had worked the complete development of the human parasite in this mosquito.

"Ross is a very dirty dog. He told that he intended to live on the discoveries for the rest of his life. He has done so. Grassi is dirty, but not a dirty dog. He is a great zoologist, but savage or almost rabid when roused. I believe he is honest and after spending a long time corresponding with him and testing his statements in every way I can, he has always played the game with me and I admire him as a worker, though not as an individual human being, whatever that means."

I show you all of this to show you what de Kruif went through to gather his data. He knew this at the time he wrote *Microbe Hunters*. He had all of this correspondence and the chapter which is entitled "Ross versus Grassi" in *Microbe Hunters* depicts this whole story of who really discovered the chain, and Ross reads it and says, "Wait a minute. You're misreading history. I was the one who really did it." And as I say, Grassi did not win. It was actually put up to Koch in

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the Nobel Committee as to who should get the Nobel Prize and Koch voted for Ross over Grassi. The British won over the Italians.

So if you think about Ross versus Grassi, Ross was an intuitive and empirical researcher. He wins the Nobel Prize. Grassi's experimental, systematic, and comparative; he doesn't win the Nobel Prize. Dobell hears the whole story. He tells Paul de Kruif. Paul de Kruif writes *Microbe Hunters* and Ross threatens a lawsuit which doesn't go anywhere.

After *Microbe Hunters*, de Kruif would go on to write 12 more books on such topics as agriculture, hunger in America, the Iron Range in Minnesota, the new Kaiser Permanente healthcare plan as well as newer treatments for insanity. These books span 30 years of writing but none of them have the impact and success of *Microbe Hunters*.

Paul de Kruif was a medical reporter and activist. He reported on medical discoveries and by doing so, he visited their labs. He exposed malnutrition among the U.S. poor in the 1930s. He campaigned against tuberculosis through screening techniques in Detroit. This was all in the 1930s and early '40s. He developed a program for screening through blood testing for syphilis in Chicago and was instrumental in trying to raise money for polio myelitis.

Even though Morris Fishbein had started out to be his friend, they ended up being enemies and he fought with Morris Fishbein over his support of the AMA and over the last 10 to 15 years of his life, Paul de Kruif just chastised the AMA for its lack of vision for the health of the community and for the United States. He was an apostle of the Kaiser healthcare plan that went into existence in the 1940s and wrote about it in a book, but then later on in the 1950s and '60s, came to attack it and his attack was not over the concept of having a unified healthcare plan, but he didn't think—he thought that when it was first set up, they were going to use a certain percentage of the proceeds to put it back into R&D, to put back into research on how you improve care, how you improve disease management. And it turns out he didn't think they were doing enough of that, so he ended up saying it was a good idea, but they were squandering their chance to improve care.

He also got very involved with Alcoholics Anonymous and there's a streak in him that isn't quite clear as to the religiosity of the 12-point program and putting yourself up to a higher authority to get through Alcoholics Anonymous. It wasn't clear how important the religious aspects of Alcoholics Anonymous were. He wasn't a churchgoing individual by any means, but he liked that part of it as well.

He wrote over 200 additional articles for the popular magazines of the day: *Country Gentleman*, *Ladies' Home Journal* and *Reader's Digest*. He co-authored a Broadway play entitled *Yellow Jack*, having to do with Walter Reed and the studies on yellow fever. He authored a movie based on the life of Paul Ehrlich called *The Magic Bullet*.

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He also became an advisor to Franklin Delano Roosevelt in the March of Dimes campaign against infantile paralysis, or polio myelitis. And actually, he became the secretary and treasurer of the National Foundation for Infantile Paralysis. At the beginning of World War II, in his autobiography and memoirs, he describes a luncheon he has with FDR where he's come with a proposal to really redo the healthcare system for the United States and it's a three-hour luncheon in which Roosevelt just talks for three hours. He won't give him a word edgewise. He never gets to prepare or present his plan and he walks out of there feeling beaten by this brilliant politician who knew that if he'd stopped talking, he was going to be asked to give something and he was right. So he never did get to present the plan that he wanted to do with Roosevelt even though he was a great admirer of him.

Toward the last part of his writing, he started looking at the challenge of aging. He got enamored of testosterone as a way to decrease the aging process in men. He got interested in the newer treatments for psychiatric disorders and followed one particular psychiatrist who was doing electro compulsive therapy in a book called *A Man Against Insanity*. He also had a love/hate relationship with doctors, research, industrialists, and politicians throughout his whole life, but in many was—especially in the latter part of his life, the medical conscious of America.

The Michigan State Senate and House of Representatives, after he passed, awarded his widow and third wife, Eleanor, a framed resolution, which I'll read to you. "Paul de Kruif became a stormy petrol to part of the medical hierarchy but was the open sesame to millions of readers in medical and other sciences' interpretation. Although not a follower of formalized religion, his work breathes his inmost conviction of God's supremacy. Dr. Paul de Kruif's influence upon his times and in his field was of that of a genius. His unique talents yielded a rich heritage for the ages. Now therefore, be it resolved that by these presents, the highest tribute of the State of Michigan, is accorded as a memorial."

His alma mater, the University of Michigan, recognized his importance and established a Paul de Kruif chair and academic pathology as well as a Paul de Kruif Award for pre-clinical students for the best essay on bioethical issues or medical humanities. Likewise, some private donors in Holland, Michigan have installed a modest de Kruif writing prize for Hope College—which is there—biology students who write the best research paper of the year. He is buried in his hometown of Zeeland, Michigan.

His writing is now thought to be too dramatic and dialogue often made up. In his case, the story often took precedence over the facts, but I can assure you I've gone back and reread *Microbe Hunters* and it's not that far off. Nevertheless, he forged a path for writers of popular science to follow, whether it's Laurie Garrett, Louis Thomas, Sherwin Nuland, all worthy successors. They owe a debt of gratitude to Paul de Kruif and what he called his "jazz style of making science fun for laymen and scientists alike."

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There have been updated books. *Microbe Hunters Then and Now* is an updated version of newer microbe hunters along the way and what they've done.

Since beginning my academic career in infectious diseases in the 1970s, there have been more than 35 microbes identified, including legionella, HIV, SARS, helicobacter pylori, Borrelia burgdorferi, (s/l priange), just to name a few. Although I have not been one to describe a new microbe, I have loved watching and fathering the next generation of microbe hunters. The first author is my son, David Greenberg, and I'm happy to report that this next generation of microbe hunters is still working enthusiastically to find those pesky microbes living among us. I hope Paul de Kruif would be proud. I know this father is. Thank you.

QUESTION 1 (DR. RAKEL)
Arrowsmith is one of my favorites as well. Is there any possible explanation why Sinclair Lewis turned down the Pulitzer Prize and was it Sinclair Lewis or the publisher who took de Kruif off?

STEPHEN GREENBERG MD
Sinclair Lewis thought he wasn't worthy of it. He ended up winning the Nobel Prize in Literature. He was the first American to win a Nobel—Sinclair Lewis. He didn't turn that one down, but he did turn down the Pulitzer Prize because he didn't think he was worthy of it. And because he turned it down, de Kruif thought he couldn't do it.

The story on the loss of authorship, as you read it in de Kruif's biography and also in the biography of Sinclair Lewis, is that the publishing company went to Lewis and said, "If you put de Kruif's name on the front cover, it'll diminish you as the author of this book." No one knows Paul de Kruif. They all know he was a writer and then there will be confusion as to whether who should get the credit for really writing it, so we'll just give it an acknowledgement and that'll be enough. And he ended up swallowing his pride and not making an issue out of it and there's correspondence back and forth with Sinclair Lewis in which he always feels bad about it, but not enough to keep his name on the front cover and so towards the end, they sort of split apart over obviously this issue. So the Pulitzer Prize, since he wasn't even on the front cover at that time, it was really up to Sinclair. He wasn't about to say, "Well, wait a minute. Give me the money. Give me the award. I'll take it." He couldn't do it so that's I think the story of how that got to be.

QUESTION 2 (David Sears)
Did Paul de Kruif have a Ph.D.?

STEPHEN GREENBERG MD
Yes. He got his Ph.D. from Michigan in 1960 with Novy and it was on this business of the serum.

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QUESTION 2 (David)
Did he publish microbiology papers?

STEPHEN GREENBERG MD
Yes, and actually, he was a very good scientist and he would have had—he was an interesting character. When he gets to Rockefeller, he is really enamored of some of the scientists that are there, but not most of them. And he's definitely not enamored of Flexner, who he thinks is just a scientific bureaucrat and isn't getting—he was one of those guys who believed you should be in the lab and doing it, so he was really—became very cynical about how they were doing it. And actually, if you read *Arrowsmith*, there are a couple of key characters in *Arrowsmith* who people have attributed to being de Kruif. Science for science's sake. *Arrowsmith* goes off at the end to the back woods to build a lab with his buddy and they're going to just do pure science.

That's what de Kruif thought it would be and what happened was he started selling these articles and *Microbe Hunters* made him a success overnight. And actually, it's interesting. In the 1930s—so he had all this—*Microbe Hunters*—all these new books that started to come out about hunger and so forth, the late 1920s, early '30s, right at the beginning of The Depression, there are people who were writing him and saying, "Listen, stop writing about the *Microbe Hunters*. There's trouble going on in this country," and he shifts. He definitely goes out and he starts looking at it. He does his homework. He's a good journalist and he goes out and he sees there's poverty and there's problems in the country and he shifts his whole—for the last 30 years, all his books are about what's wrong with the healthcare system in the United States, basically, and he becomes the conscience of the United States.

As I got interested in Paul de Kruif, one of the things I noticed was that no one had written a biography of him. There is no biography of Paul de Kruif, so I thought maybe this would be a future project for me and I was storming through all the different sites and I came across this researcher in the Netherlands named Verhave and he had written an article. Actually, some of the data I got on Dobell's interaction with Ross comes from an article by Verhave, so I emailed Verhave and I said, "Listen, I read your paper. Do you know of anybody who's working on a biography of him?" He says, "Yes. Me." And so he's working on a biography of Paul de Kruif and we've gone back and forth and I think it's going to be a great book. He's a very complicated character in a lot of ways and has basically two separate careers: a scientific career and then much more of a public writer career. And you've got to realize, this was a new form of journalism. People weren't writing about science. He popularized science of the 1930s where people couldn't stop reading all this stuff. They loved it.

QUESTION 3
How old was he when he got fired from Rockefeller?

STEPHEN GREENBERG MD
So wait a minute…1922. He was 32.

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QUESTION 3
Did he ever go back to the laboratory?

STEPHEN GREENBERG MD
No. Never went back to the laboratory.

QUESTION 3
His whole scientific career?

STEPHEN GREENBERG MD
That was it. So before tenure—he left before he got tenure. Yeah.

STEPHEN GREENBERG MD
It's part of that. He did. And in fact, Mencken loved his style because he was always zinging and so he was sort of an alter-ego to de Kruif's writing style. There's no question in terms of—he talks about in his memoirs, they were drinking buddies and his wife and one of the interesting parts that I can't put together is that he married his childhood sweetheart and they had two kids. She, actually, I know very little about, but she was well-educated herself and then he met this lab technician and basically lightning strikes and he divorces and he never looks back. He never sees his kids again and just leaves. It's like they're just gone. And he talks a little bit about it in his memoirs, but not much.

The other thing about Mencken, I don't think Mencken was a big believer in the style. If you read just a couple of these chapters, every chapter has at least 60 to 70 exclamation points at the end of sentences. He loved exclamation points. Everything was an exclamation point. But it was the equivalent of something on the screen blowing up or something. "And Pasteur discovered…!!!" And it goes like that. So that style, I don't think was H. L. Mencken, but he was always zinging people. He did a lot of homework for his stuff.

I'm teaching a course right now at Rice on *Microbe Hunters* and we're sort of using the book and I started going back and reread it again and tied it what I'm now going back to. He's not way off. He obviously makes up conversations, but if I wanted to learn about Pasteur and Koch and get a feel for them, I'm not sure this is way off. I've written—I've read the biographies of Pasteur and Koch. He captures the flavor and he captures the essence. If I were a kid in high school and I wanted to know about this stuff, I'd say read it. It wouldn't be way off.

QUESTION 4
What was the nature in infectious diseases that this new microbe and what are they concentrating on and what is the (inaudible)? I'm just curious about a typical week in your practice. What kind of infectious diseases do you cover?

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ROBERT E. RAKEL MD
Can you repeat the question?

STEPHEN GREENBERG MD
So those are two different questions. So what are the tool kids that modern microbe hunters are using? It's interesting you should say that. If you looked at what my son did in terms of discovery, he was in a unique situation at NIH where a patient came in and they isolated in a specialized lab an organism that they had never isolated before and being NIH and having the money, they sequenced the organism. This is first time—sequenced the organism—and then they couldn't attach it to anything known and basically they came up with a new designation for this new bacterial species. And then he developed an animal model and he fulfilled Koch's postulates, which is part of the discussion in the book, what are Koch's postulates—as to how do you tie a particular organism to a particular infection? So they had an animal model for his particular infection, showed that it reproduced it, got it back out to culture. All of the things that you would do.

Nowadays, one of the screening tools is to use genetic material of the bacteria or the virus and there are different gene sequences that are common that you can start looking for. So that in the past 10 or 15 years, there's probably been 200 new strains and species of bacteria and fungi found through this new molecular capability. It's estimated that we can only, with our routine laboratory capabilities, isolate 50 percent or less of all the organisms that are out there. We don't know at least 50 percent of all the organisms in the soil that are out there, maybe even infecting us, but because of the nature of how we screen for growth, they're not going to be picked up. That particular organism which has become Granulibacter bethesdensis because it was isolated at NIH took weeks to grow out and their lab was geared to do that. Most microlabs keep it for three to five days and if it doesn't grow out, they throw the plates away. So people are going back to look at it and to see what are these new organisms that we haven't cultured before.

Now, in terms of my personal day, I don't have an infectious disease practice so as chief of medicine at Ben Taub, I'm rounding on general medicine patients who often have infectious diseases but they may have other things as well. The infectious disease practice on the inpatient side of most hospitals now is geared towards things that you pick up in the hospital. Hospital-acquired infections. Many patients who come in with infections have pneumonia, HIV, things of that sort. But as an example, at Ben Taub, we see five to ten cases of malaria a year when people come in with malaria from other parts of the world. We pick up amoebic liver apsis. We pick up a lot of things that are infectious diseases that these microbe hunters would definitely understand.

QUESTION 5
What about MRSA?

STEPHEN GREENBERG MD

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800.982.3378
www.adeptwordmanagement.com

We have plenty of MRSA— Methicillin-resistant Staph aureus—which started out as a hospital-acquired organism and then was moved out into the community and it's just an epidemic. Same with Clostridium difficile which is a GI pathogen but was not nearly as much of a problem in the past now has spread in hospitals and it too has gone out to the outside world as well, so the interchange of organisms is spreading as we intersect people in hospitals in the outpatient arenas.

My estimate is that there's at least one or two more legionella, HIV, helicobacter pylori equivalents that we haven't identified. When I teach the concept of disease, I whittle down all disease to one formula, right or wrong. It's the Greenberg Formula. It's disease equals genetics plus or minus infectious diseases.

QUESTION 6
I heard that de Kruif might have had an alcohol problem. Is that true?

STEPHEN GREENBERG MD
Yes. He was alcoholic. He had a problem with it. He loved alcohol. He thought he could drink with the best of them and he talks about all his escapades with Sinclair Lewis and with Mencken. Mencken was a big drinker. But he never went for rehab. He never felt that it affected him.

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