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# *Microbe Hunters*

*Paul de Kruif*

## **Synopsis**

*Microbe Hunters* describes the discovery and early research of microscopic organisms. The survey begins in the 1600s with Leeuwenhoek's discovery of microbes under the first "microscope," which was a simple series of magnifying lenses. The narrative progresses through the events and research developments made by scientists up until the early 1900s.

Around the world, working independently—sometimes racing against one another—scientists began making exciting discoveries into this microscopic world that cannot be seen by the naked eye. Leeuwenhoek was not a scientist but a cloth merchant by trade. When he first detected the tiny creatures that he called animalcules, he had no idea that they held a key to the health of people and animals. Leeuwenhoek invented the microscope as a tool to help inspect the quality of cloth. It was Lazzaro Spallanzani who developed experiments and equipment to delve further into the power and purpose of microscopic organisms. Louis Pasteur began his scientific career exploring the effect of microbes on grapes. What he learned about microbes and fermentation set the stage for all scientists to begin learning about the relationship between microscopic organisms and disease.

By the time de Kruif published his dramatic story in 1926, scientists had developed cures, vaccinations, and preventive methods for previously deadly diseases caused by microscopic organisms. They had established the means for hunting microbes and were already gaining ground against contagion and infection.

## **Student Focus**

As you follow de Kruif's lively narrative, you should appreciate his literary use of description and detail. In addition, you should pay close attention to the experiments with microorganisms. What is the development, purpose, and benefit of each research technique? How do the research styles of the scientists compare?

## **Correlation to Subject Matter**

Viruses, Bacteria, Disease, and Immunology

## ***Analyzing the Book***

## Identifying Facts

1. List five of the microbe hunters and at least one scientific discovery that each one made.

2. What specimens did Leeuwenhoek first observe through his microscope? Where did he find microbes? Why did Leeuwenhoek's lack of formal education aid in his study of microbes?

3. What steps did Spallanzani take to disprove the Vegetative Force? What steps did he take to prove that microbes reproduce by fission?

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**Microbe Hunters**

4. What experiment did Pasteur use to prove that microbes do not come from the air alone? How did he prove that microbes come from outside of grapes?

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5. Describe the method Koch used to prove that a specific bacillus caused anthrax.

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6. How did Pasteur discover immunity in animals? What did Pasteur do to the hydrophobia virus in order to create a vaccine that would make humans immune to rabies?

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**Microbe Hunters**

7. Once Behring discovered an antitoxin serum, what difficulty did he encounter? When Roux further developed the antitoxin, what difficulty did he encounter?

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8. What part of the immune system did Metchnikoff identify and name? What was his theory about natural immunity and the failure of immunity?

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9. What crucial information about Texas fever did Theobald Smith gain from local cattlemen? What did he do with this information?

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10. What geographical information did David Bruce use in his search for the cause of nagana, or sleeping sickness? Why did this information help him determine the cause of sleeping sickness?

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11. What method did Ross use to find a solution to the problem of malaria? What process did Grassi use to determine how malaria traveled from sick people to healthy people?

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**Microbe Hunters**

12. List the qualifications that Walter Reed brought to his task of answering the questions relating to the cause and prevention of yellow fever.

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13. What did Paul Erlich achieve with his discovery of 606 that was new to the field of microbe hunting? What was the unforeseen aspect of a "magic bullet"?

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14. From the time that Leeuwenhoek first saw microbes to the time Erlich discovered the cure for a disease caused by a microbe, information was steadily gained. Summarize what the microbe hunters discovered.

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**Microbe Hunters**

**Interpreting  
Meanings**

15. How did the microbe hunters use information from former and fellow scientists to help in their individual searches?

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16. Although he did little to analyze his findings, Leeuwenhoek's discoveries under the microscope ~~were the beginning of a new branch of science~~. Why?

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17. How did the beliefs and ideas of Leeuwenhoek and Spallanzani's day affect their microbe hunting?

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18. How did Pasteur's high-spirited personality aid his microbe research? How did it hinder it?

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19. What affect did the discovery of phagocytes and the understanding of immunity have upon microbe research?

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20. Why was Koch's discovery of how to stop the spread of anthrax a milestone? Why was his inability to stop tuberculosis such a failure?

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21. How might a less systematic approach have affected the outcome of Smith's research?

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22. Why did Reed use two houses to test whether clothing transmitted yellow fever?

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23. Why was chemistry important to Ehrlich's development of 606? Why was 606 called a magic bullet?

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24. What were some of the techniques developed and used in the course of experimenting with the microbe?

## Applying Meanings

25. Explain how a vaccine makes an animal or person immune to a disease.

## Writing About the Book

On a separate sheet of paper, write the answers to each of the following.

### Extending the Story

1. Paul de Kruif's historical account of microbe hunters ends in 1926, when the book was first published. The hunt for microbes that cause disease continued. For many diseases, a vaccine, an antitoxin, or a preventive measure has been discovered. Choose and research a scientist who worked to discover the microbe that caused a particular disease. Write a description of the scientist and his or her research. Include the motivation for the microbe hunt.

### Thinking About Assumptions

2. After determining that tsetse flies carried sleeping sickness between humans, David Bruce set out to rid Uganda of the disease. He made a mistake in assuming that trypanosomes only live in human blood. Later he regretted that it was not possible for him to experiment with injecting the nagana trypanosomes into one thousand human beings. Would such an experiment have proved Bruce's assumption that the new form of sleeping sickness was the same as nagana? Why, or why not?

### Responding to a Review

3. In writing about *Microbe Hunters*, F. Gonzalez-Crussi, M.D. praises the book for continuing to engage hearts and minds today, especially since he states that it "deals with facts and personalities whose description has been reiterated ad nauseam." Write an essay in which you react to this opinion. Do you think de Kruif's book is still timely and interesting? Why, or why not?

### Evaluating Characters

4. Louis Pasteur and Robert Koch approached science quite differently, yet they had similar goals. Compare and contrast the two scientists. Which man do you think achieved more? Why?

### Writing a Journal Entry

5. Imagine that you are working as an assistant to one of the scientists who is searching for a specific microbe. It is your responsibility to keep a written record of each day's experiments and discussions. Write the entry which describes a major discovery in the search.

### Analyzing Scientific Methods

6. If you were a microbe hunter, which scientist would you use as a role model? Describe the scientific methodology used by the microbe hunter, as described in the book, and explain why you think it produced the best results. How has this methodology withstood the test of time in taming the diseases caused by microbes? What would you do differently? Why?

## Testing on the Book

On a separate sheet of paper, write the answers to each of the following.

### Critical Thinking and Writing

1. How did Leeuwenhoek's personality and individual interests affect the use of his invention? Cite incidents and statements that illustrate his effectiveness as the first of the ~~microbe~~ hunters.
2. People all around the world were anxious for cures and preventions for the deadly diseases ~~that~~ ravaged them. How did the public's reaction to the vaccination for rabies affect Pasteur's decision on how to proceed with his work? How did the public's reaction to fighting diphtheria affect Behring's development of the antitoxin?
3. Koch's systematic research methods became known as Koch's postulates. They are a set of steps to determine the causative agent of a disease. They are the following: 1) isolate the organism from the patient, 2) infect a healthy animal to recreate the disease, and 3) isolate the organism from the newly sickened animal and compare it to the organism originally isolated. Describe how one of the ~~microbe~~ hunters strayed from or adhered to Koch's postulates.
4. At times the scientists' hypotheses and testing methods seemed farfetched. Consider the ~~current scientific information~~ to which they did not have access. Select a microbe search described in the book. Write a description of how the search would have differed with modern information and technology.
5. Some of the scientists described by Paul de Kruif were more inclined to theorize and hypothesize. Some were more inclined to test and re-test a single hypothesis. What did all of these men have in common?

