

## Lecture: Leeuwenhoek

**Alive from:** 1632-1723

**Country of Origin:** Holland/Netherlands

**Education/Training:**

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**Employment:**

- his father was a shopkeeper and so that is what he did
- he was a draper ( ) also was a janitor!



**Contributions/Accomplishments:**

- 
- he is considered the “father of microbiology”
- 
- come up with his own technique for creating superior lenses; he refused to share his technique
- he created many simple microscopes that had greater magnification than the compound microscopes that had been created ~40 years prior to Leeuwenhoek’s work

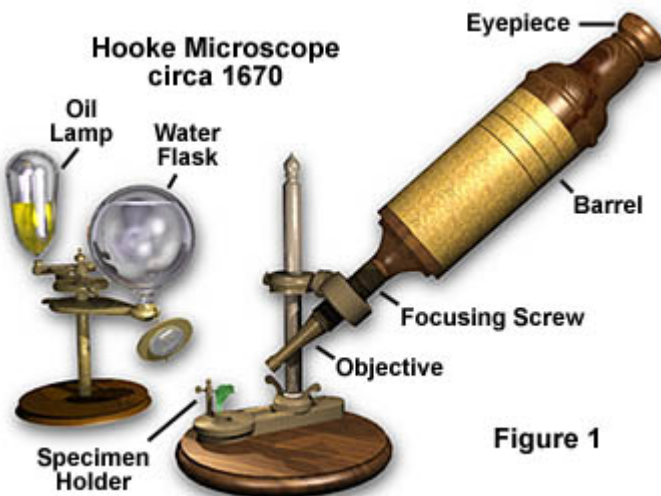
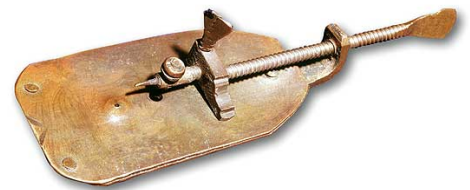


Figure 1

- Leeuwenhoek’s microscopes could magnify ~200-500X. The cruder compound microscopes only 20-30X.
- he observed protozoa ( ), bacteria from his teeth, sperm, muscle fibers, and blood and capillaries from fish tails

- he sent his observations to the Royal Society ( )
- they did not believe Leeuwenhoek so they sent representatives to look thru his microscopes and see for themselves.
- later Leeuwenhoek was granted admission to the Royal Society based on his work even though he has no science education
- Leeuwenhoek still refused to give the society one of his microscopes!
- he discovered that these little animals could be killed with heat; there were fewer bacteria on his front teeth compared to his back teeth when he drank hot coffee
- his view on teaching his techniques to others: "I've never taught one because if I taught one I'd have to teach others...I would give myself over to slavery, whereas I want to stay a free man."!

### **Reaction/Response/Controversy:**

- the existence of microorganisms was unknown prior to Leeuwenhoek
- Leeuwenhoek was a Christian and so believed that these animacules were created by God but not spontaneously!
- scientists from this time had to be very careful not to contradict the church or its teachings
- there existed the Invisible College who's mission was to "acquire knowledge through experimental investigation" also known as "science"
- at first they had to be very careful because they were questioning current accepted knowledge

### **Lecture: Pasteur (1)**

**Alive from:** 1822-1895

**Country of Origin:**

**Education/Training:**

- Pasteur was not the greatest college student but eventually earned degrees in chemistry

**Employment:**

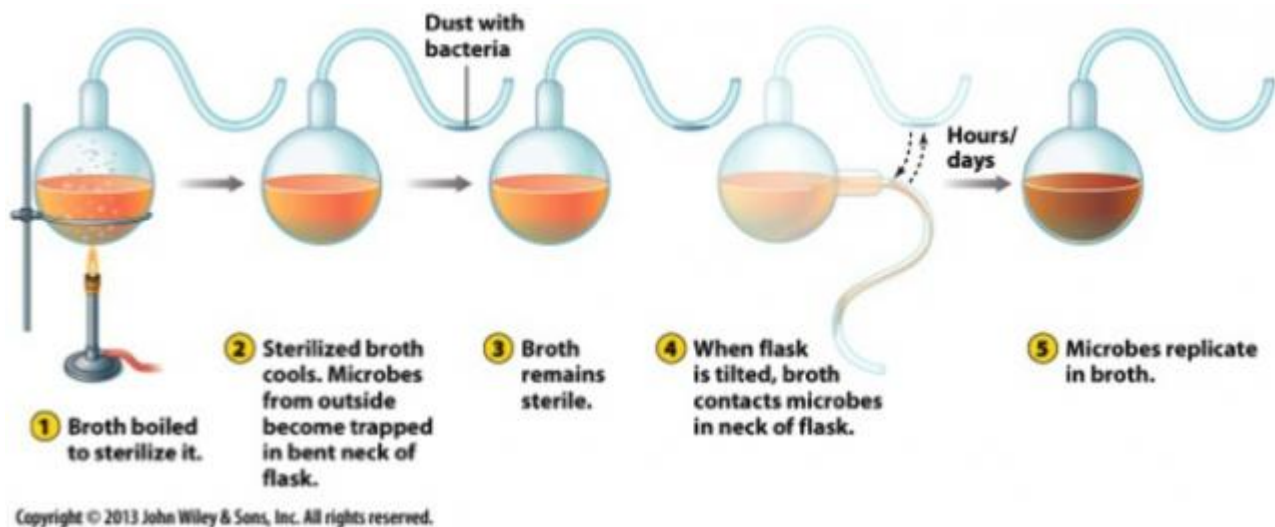
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**Contributions/Accomplishments:**

- Pasteur was responsible for many accomplishments



- he discovered that yeasts fermented to make good wine ( ) and bacteria fermented to ruin the wine ( )
- “It is living things, sub-visible living things, that are the real cause of fermentation.”
- Justus von Liebig ( ) did not believe that yeasts caused fermentation; it was the albumen ( ) present in mixture that broke down to form alcohol
- Pasteur hated Germans after France lost the Franco-Prussian War
- Pasteur developed culture media for growing the contaminating bacteria and for growing yeasts
  - for bacteria – boiled dry yeast ( ), sugar, and calcium carbonate (buffer)
  - for yeasts – ammonium tartrate ( ) and sugar
- the yeasts produced alcohol without any albumen so Pasteur was correct!
- where did the yeasts and other microbes come from? Did they have parents? ( ) Or did they arise from dead matter ( )?
- Pasteur demonstrated that microbes come from preexisting microbes using his S-shaped or swan-necked flask



- he saved the French silk industry by showing that the disease “pebrine” which killed silkworms ( ) was caused by a microbe and that by eliminating infected worms and eggs, the silk industry could greatly reduce the occurrence of pebrine.

### Reaction/Response/Controversy:

- there was much controversy as to whether or not microbes did anything – good or bad
- there were many supporters of spontaneous generation that Pasteur tirelessly disproved

## Lecture: Pasteur (2)

**Alive from:**

**Country of Origin:**

**Education/Training:**

- Pasteur was not the greatest college student but eventually earned degrees in chemistry

**Employment:**

- professor of physics and chemistry

**Contributions/Accomplishments:**

- Pasteur contributed to the Germ Theory of Disease ( )

**Vaccines ( )**

**“In this case I have demonstrated a thing that Jenner never could do in smallpox--and that is, that the microbe that kills is the same one that guards the animal from death!”**

- if you make the animal a little bit sick with the pathogen, then it is protected from a massive inoculation of the pathogen
- he created chicken cholera vaccine using aged cholera bacteria ( )
- he mistakenly thought that this vaccine would protect against other pathogens like anthrax
- later he created a mostly effective vaccine against anthrax using the same idea of aged bacteria
- then he tried to make a vaccine against rabies ( ) which is a virus that could not be seen or cultured (keep in mind Pasteur died before viruses were discovered)
- he bravely and dangerously removed saliva from rabid dogs
- the best way to infect the dogs was to drill a hole in the skull and infect the brain directly (originally Pasteur was opposed because the dogs would be harmed by the drilling)
- Dr. Emile Roux, a colleague, was the actual creator of the vaccine using dried infected spinal cords. They used spinal cords dried from 1-14 days. The vaccination started with the 14 day old virus and each day thereafter the next oldest. This created an immune response that protected animals and people from developing rabies after being infected.
- the first human trial was a 9 yo boy, Joseph Meister, who was bitten by a rabid dog – he survived and never developed rabies

- next 19 Russian peasants who were attacked by a rabid wolf 19 days earlier came to Pasteur, remarkably 16 were saved by the rabies vaccine ( )

### **Reaction/Response/Controversy:**

- Pasteur had a tendency to be arrogant and fought with many of his contemporaries. He was sometimes jealous of them and they were sometimes jealous of him.
- He may not have always reported his results accurately.
- Pasteur's treatment of 9 year old Joseph Meister for rabies was illegal. Pasteur was not a physician (no medical license) and the vaccine had only been tested on dogs. The actual creator of the vaccine, Dr. Emile Roux refused to participate because it was unethical.
- technically the first anthrax vaccine was actually created by Jean Joseph Henri Toussaint but Pasteur received the official credit
- Pasteur's anthrax vaccine was not always successful. Many farmers still lost their sheep.

### **Study Objectives**

- 1. Know where Leeuwenhoek and Pasteur were born.**
- 2. Describe the scientific training, if any, possessed by Leeuwenhoek and Pasteur.**
- 3. Why is Leeuwenhoek considered the "father of microbiology" and not Pasteur? Explain.**
- 4. Were Leeuwenhoek's discoveries controversial? Explain why or why not.**
- 5. Explain how Pasteur proved that yeasts ferment to make good wine and bacteria ferment to make bad wine.**
- 6. Explain how Pasteur's S-shaped flask experiment conclusively demonstrated that microbes come from preexisting microbes (biogenesis).**
- 7. Pasteur's cholera, anthrax, and rabies vaccines all have what in common?**
- 8. Explain the following statement: "the microbe that kills is the same one that guards the animal from death".**
- 9. Explain the 14-day rabies vaccine.**
- 10. Why was treating Joseph Meister controversial?**