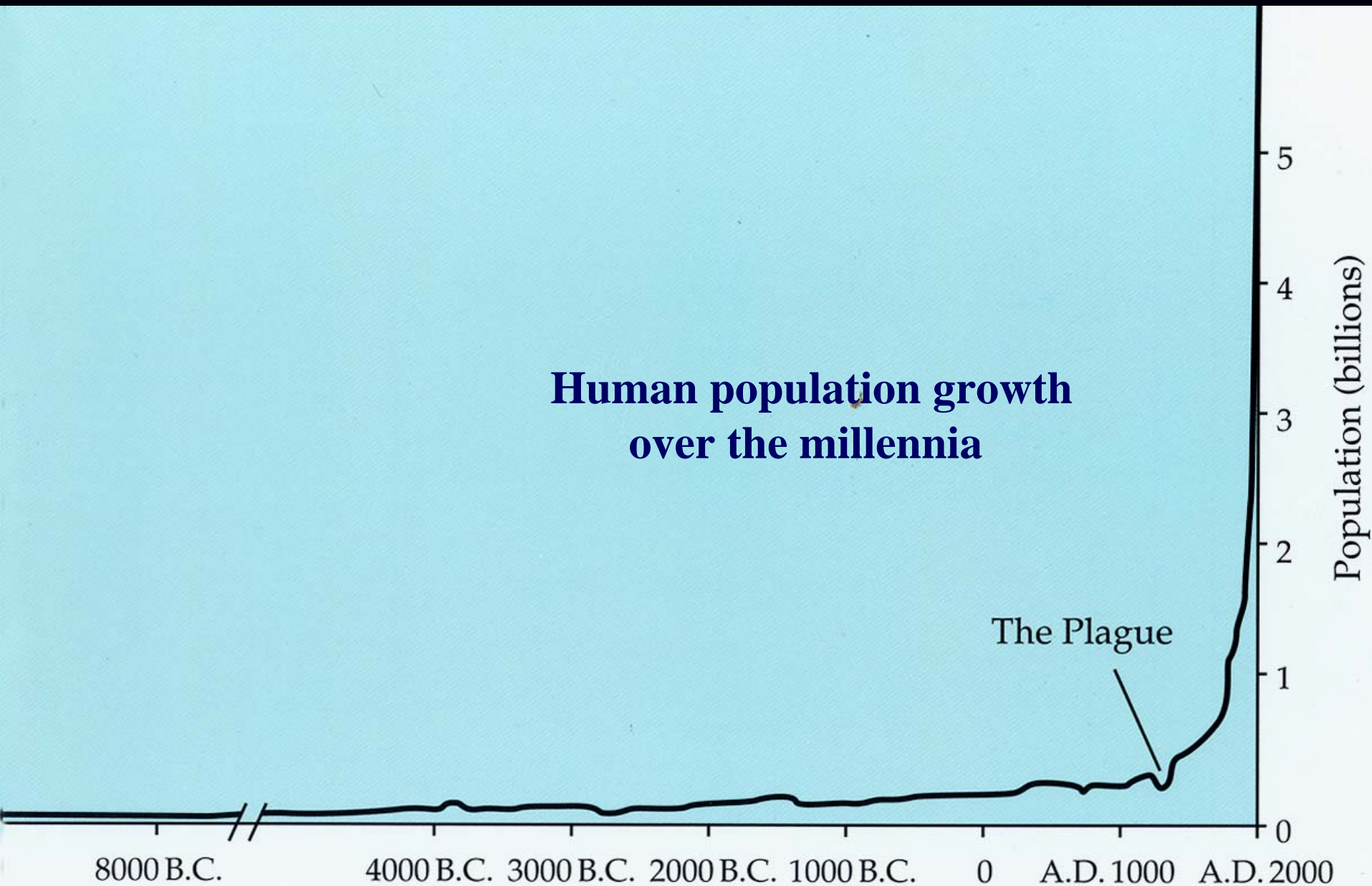


# Determinants of the Quality of Human Life

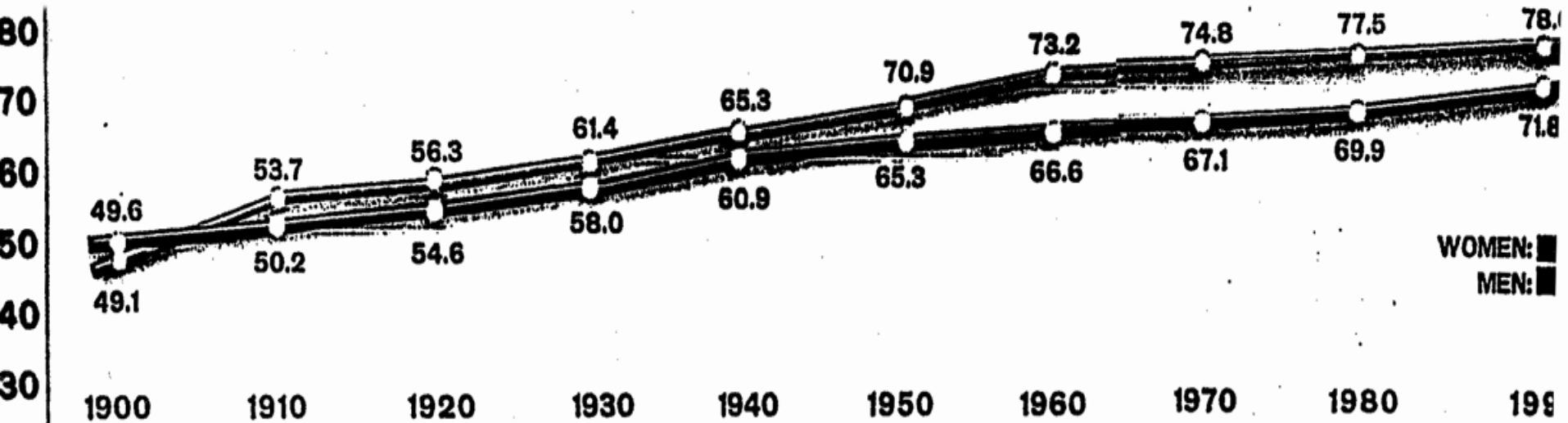
Humans have always been interested in infectious diseases even before they knew their cause. In this course we will examine the development of the **Germ Theory of Disease** and the impact that discovery has had on human health

## Human population growth over the millennia

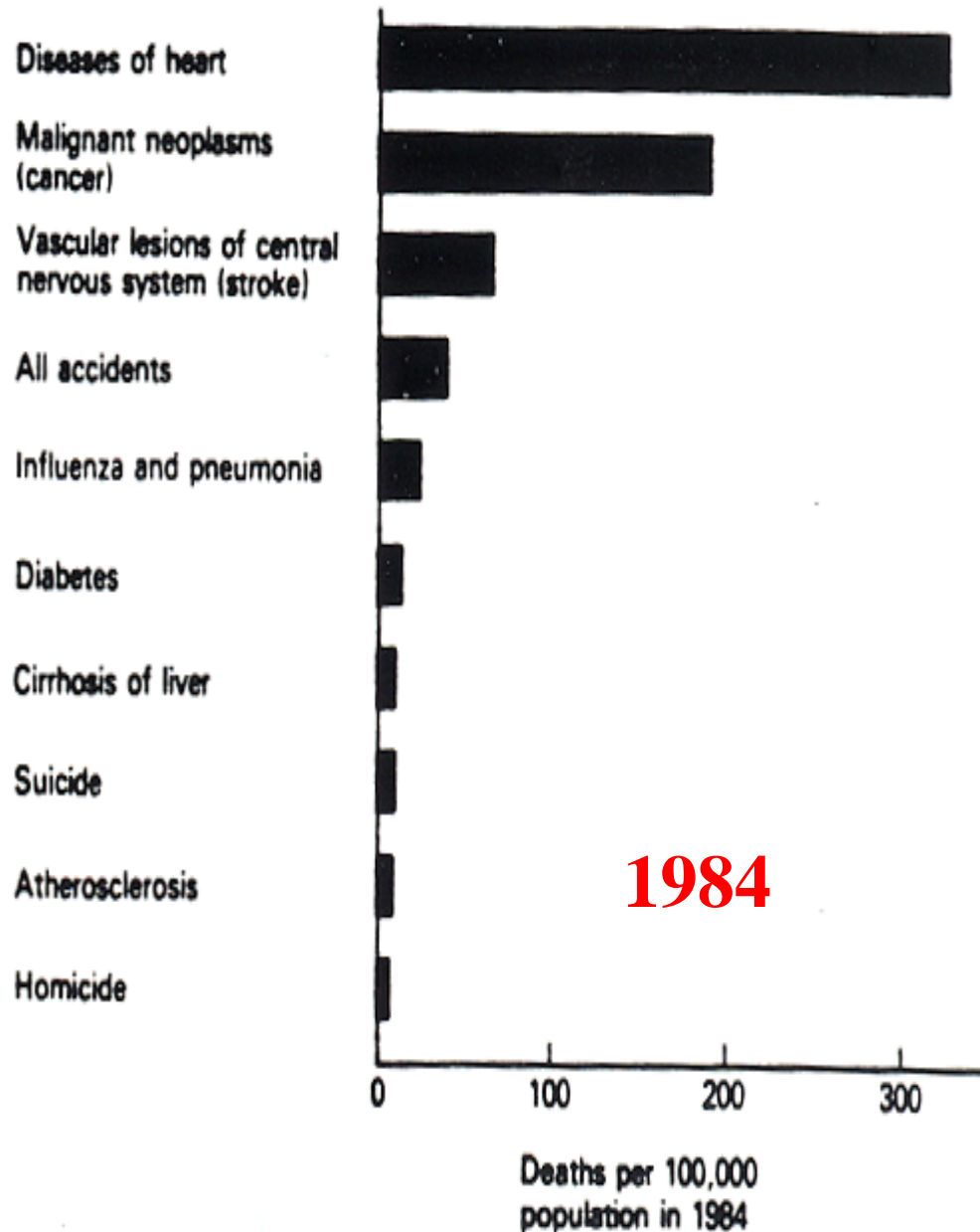
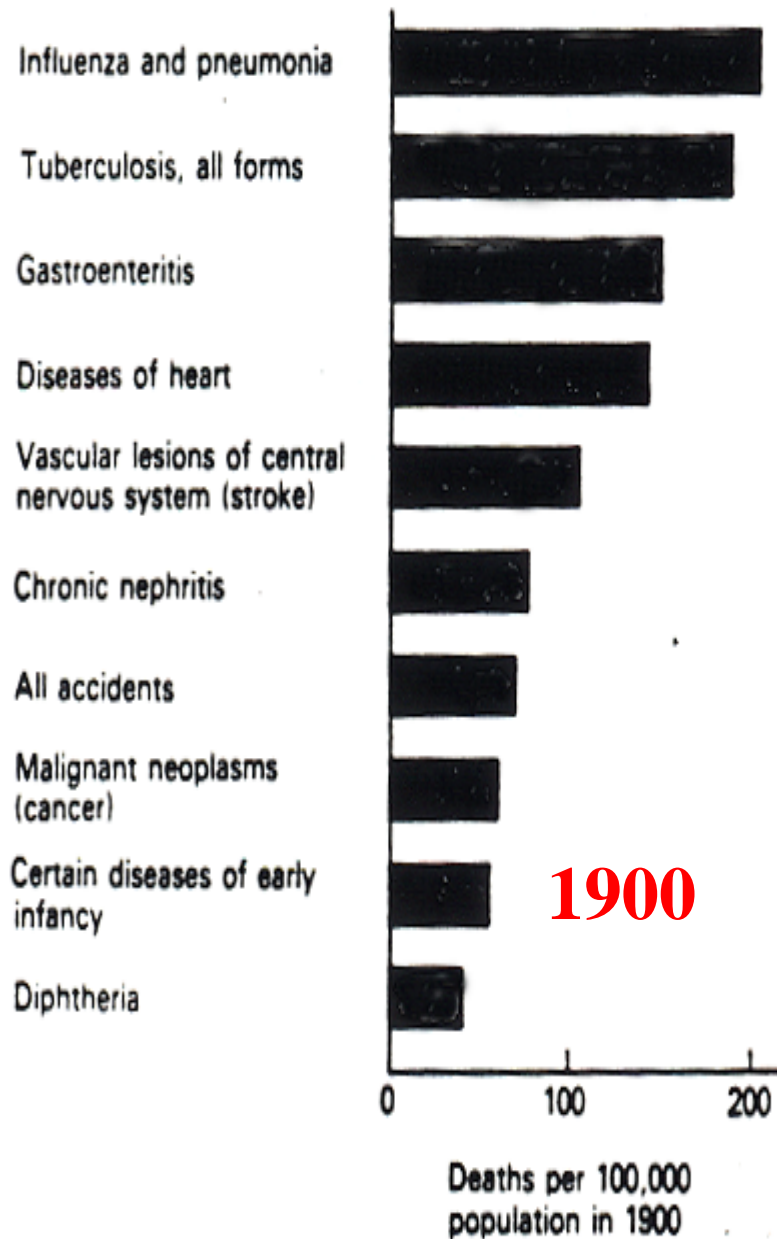


# Life expectancy for males and females

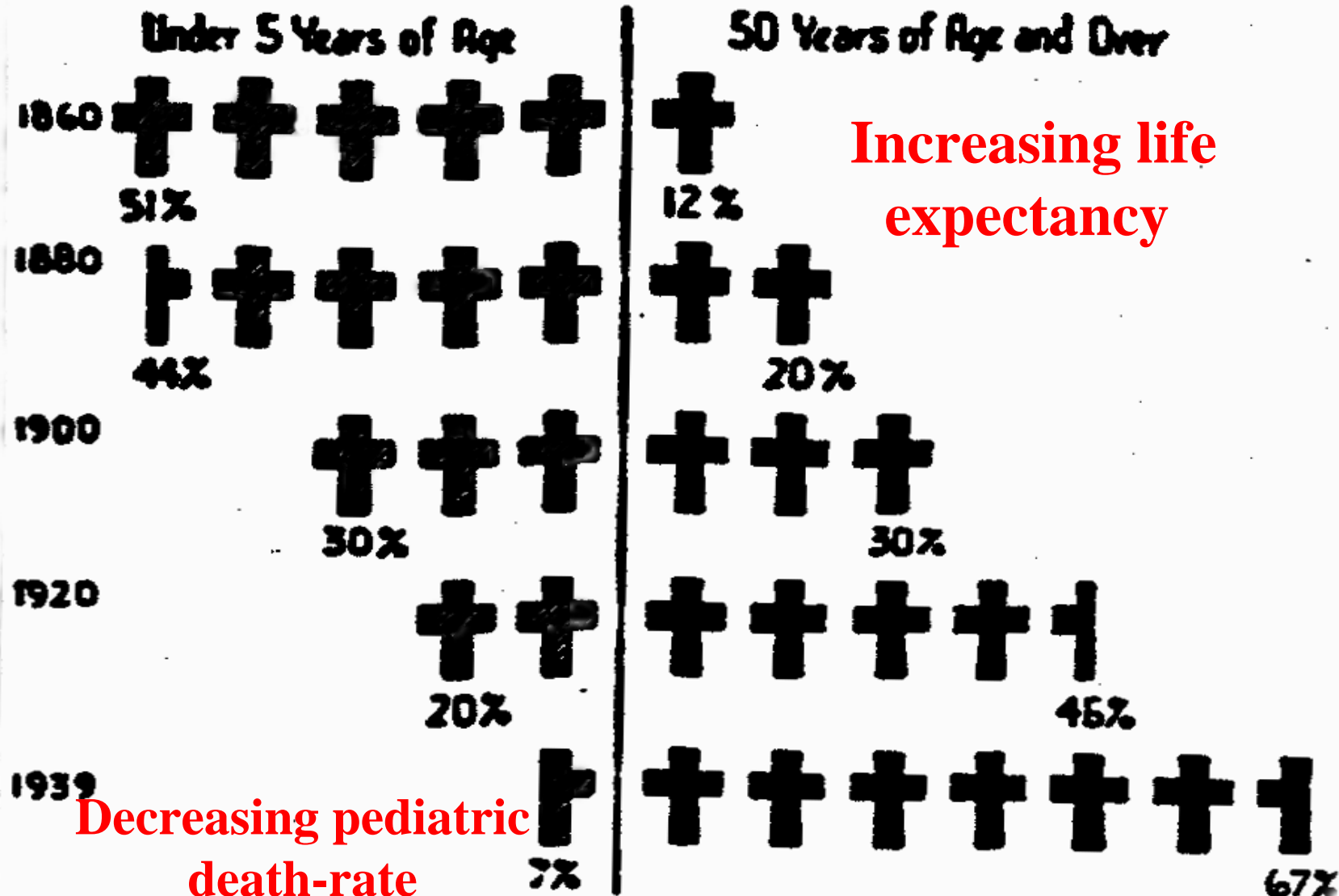
Life expectancy at birth for both sexes has increased dramatically in the last century, but since 1900—when, because of the high rate of deaths from childbirth, male life expectancy actually *exceeded* that of females—there has been an ever widening divergence, peaking in 1979 at 7.8 years.



# Causes of Death, 1900-1984



**A DECREASING PROPORTION OF DEATHS OCCUR AMONG THE VERY YOUNG  
 AN INCREASING PROPORTION AMONG OLDER PERSONS  
 ILLINOIS - 1860 TO 1939**



**Increasing life expectancy**

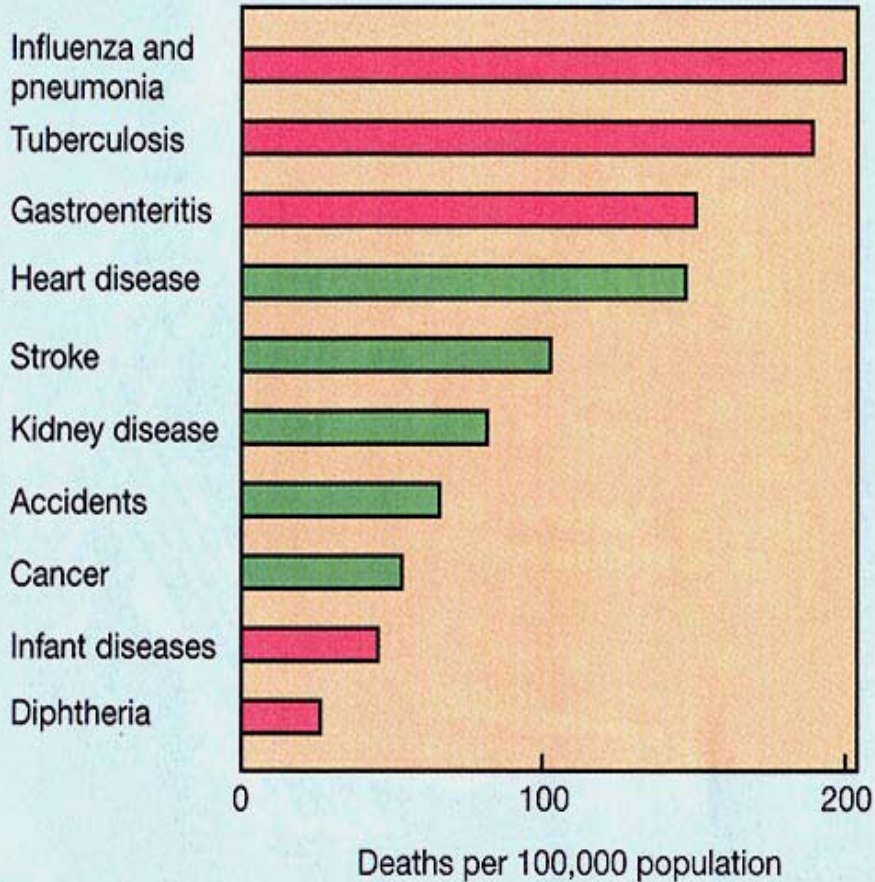
**Decreasing pediatric death-rate**

*Each Symbol represents 10% of the Deaths occurring at all ages*

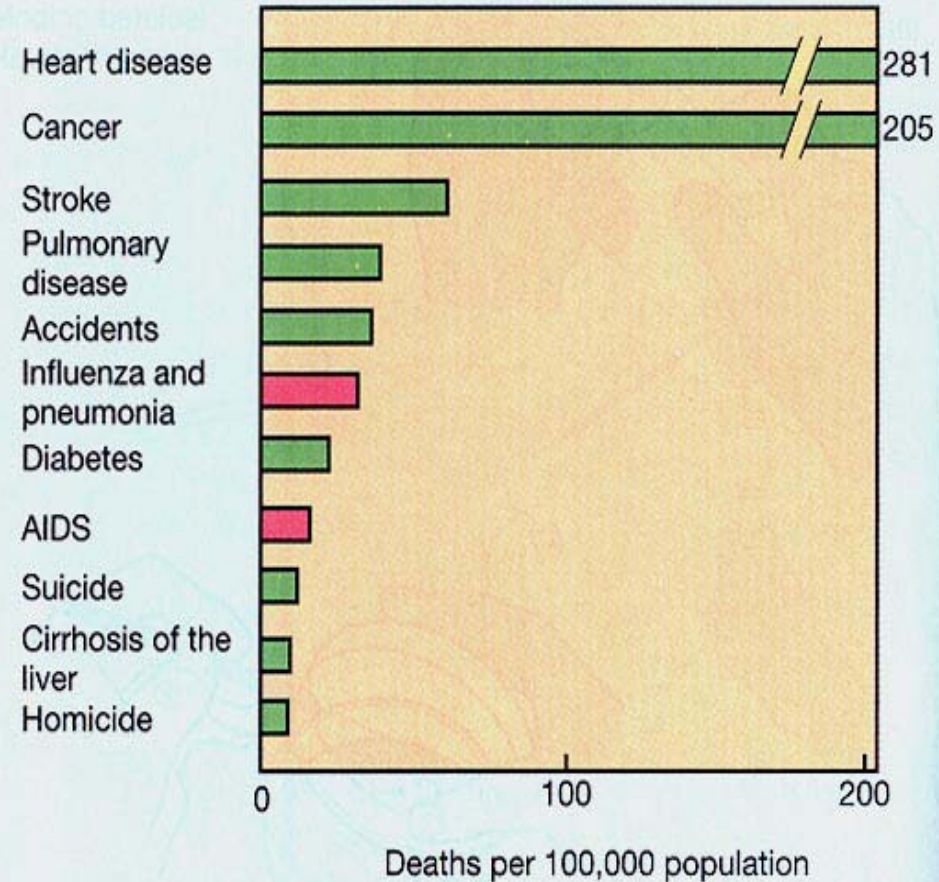


# Again, more data comparing 1900 with 2000

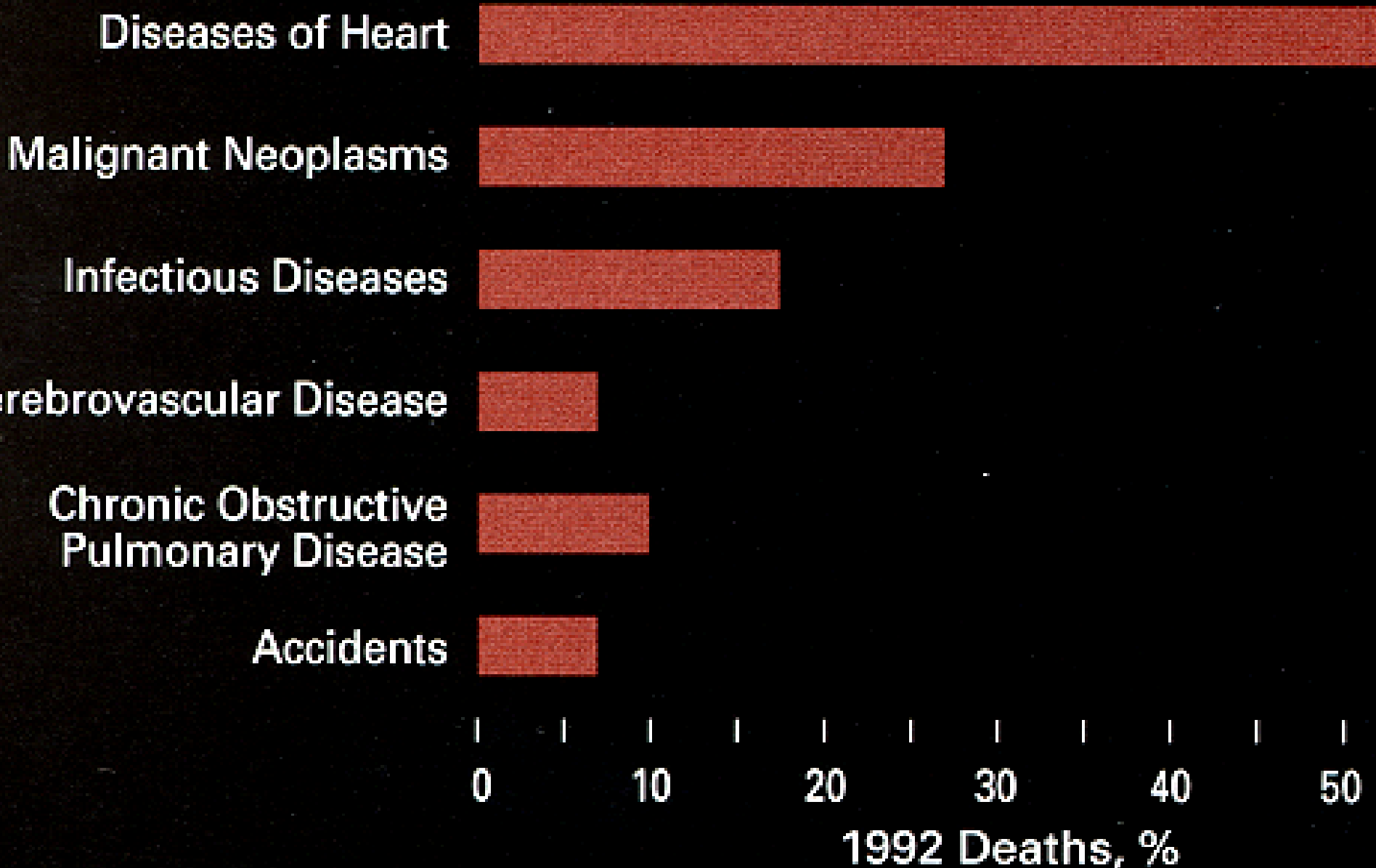
1900

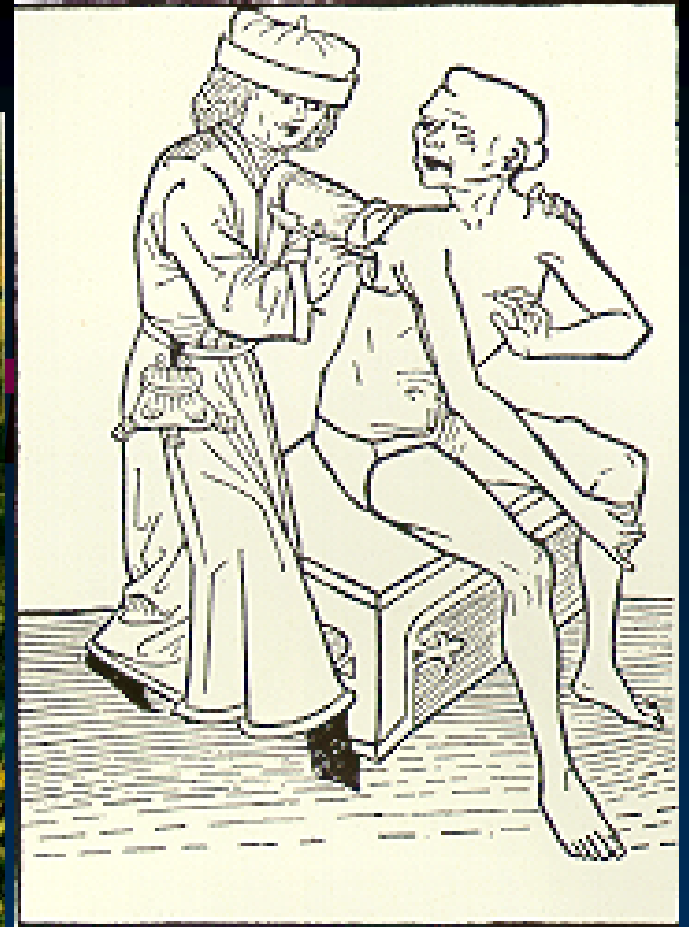


2000



# United States Causes of Death





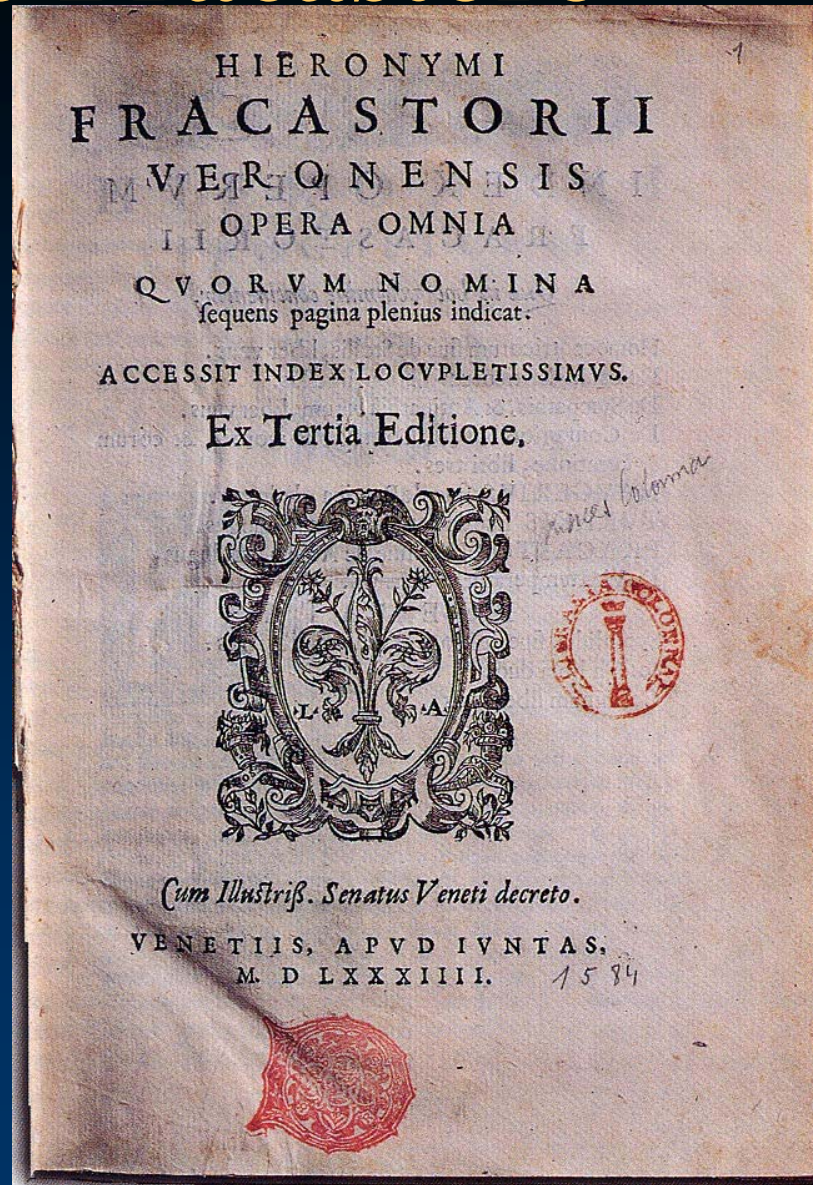
**“The Triumph of Death”;  
Depictions of plague or  
‘The Black Death’ from  
the mid-sixteenth century.**



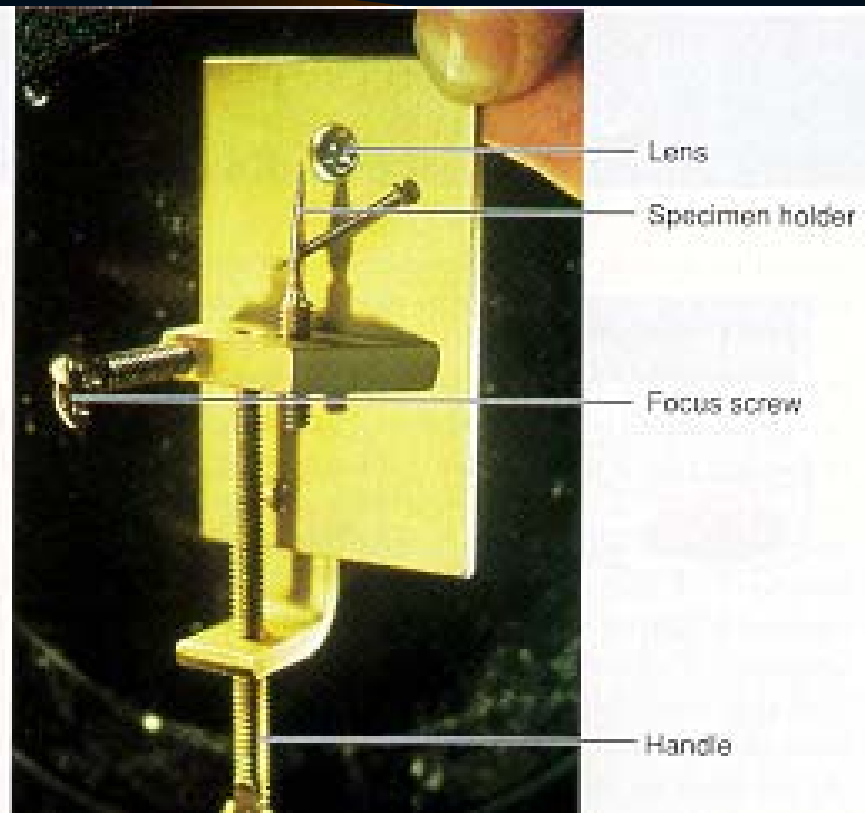


# Girolamo Fracastoro

- Fracastoro, a careful observer of disease transmission
  - obvious that some diseases were the same regardless of patient
  - specific diseases passed person to person had same symptoms
- “On Contagion”, 1546
  - mentions “seminaria” or seeds of disease.
  - before microbial world
- Three general patterns:
  - **Direct contact only**
  - **Fomes (fomites)**
  - **At a distance**



Fracastoro's “Incurable Wound” on rabies, humans not the only ones, but they always die



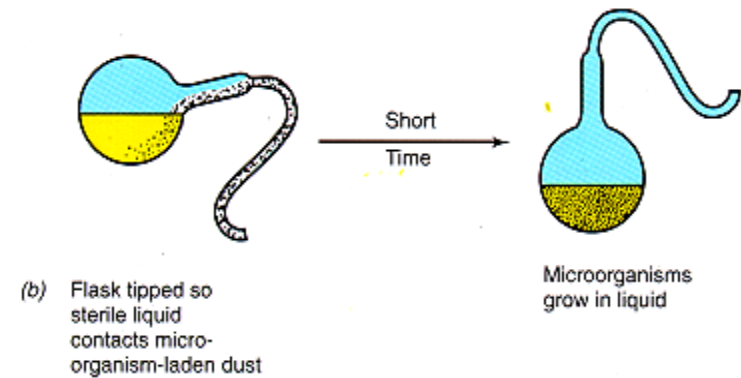
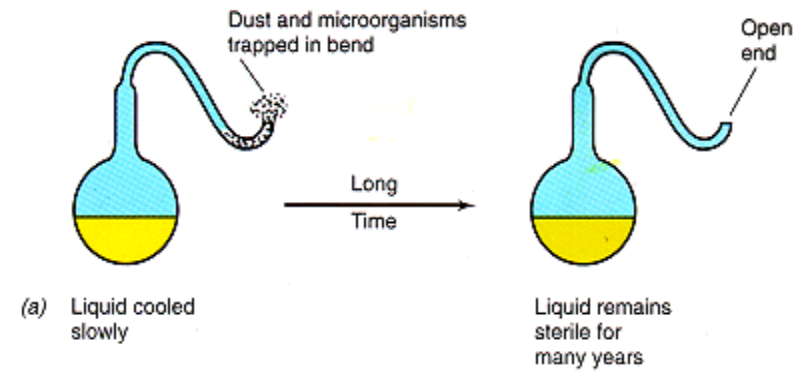
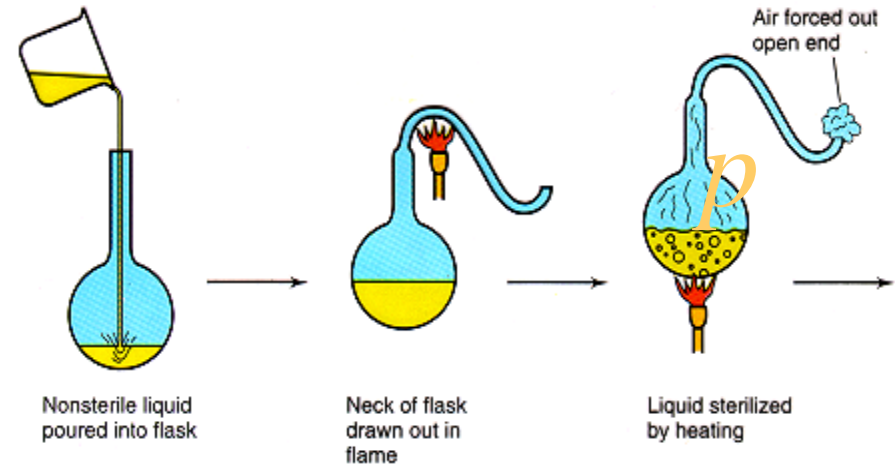
**Anton van Leeuwenhoek and his microscope  
(1632-1723)**

*Recipe for making mice*  
*J.B. van Helmont ~ 1620 AD*

“If a dirty undergarment is squeezed into the mouth of a vessel containing wheat, within a few days (say 21) a ferment drained from the garments and transformed by the smell of the grain, encrusts the wheat itself with its own skin and turns it into mice. And what is more remarkable, the mice from the grain and undergarments are neither weanlings or sucklings nor premature but they jump out fully formed.”



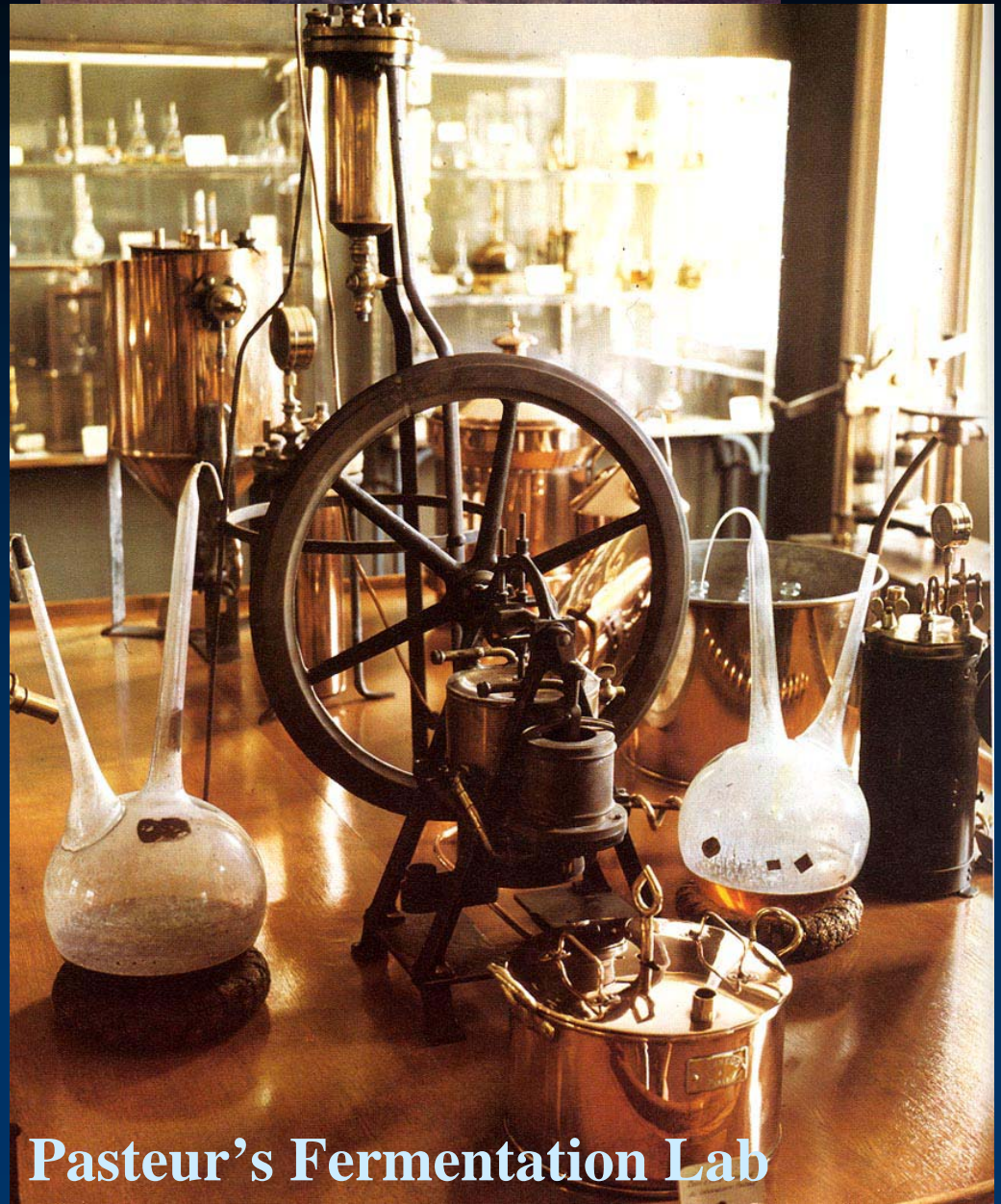
## 6. Pasteur's Experiment with the Swan-necked Flask





# Fermentation

- Sugar metabolism:
  - with  $O_2 = CO_2 + \text{water}$
  - W/O  $O_2 = \text{organic acids or alcohol}$
  - was considered a chemical process due to unstable molecules
  - The “ferment”
  - Schwann, yeast = Etoh
  - L. Pasteur took up the work
    - fermentation, a living process
    - Saved the French wine industry
    - “Pasteurization “



Pasteur's Fermentation Lab



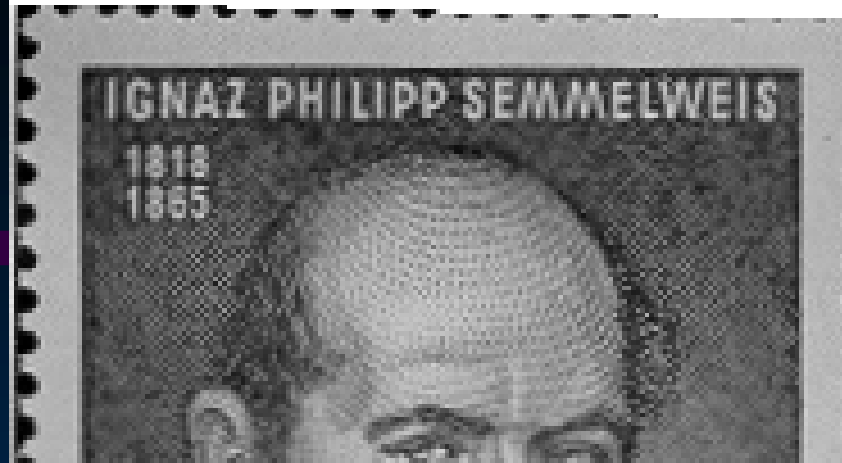
# Henle's Views



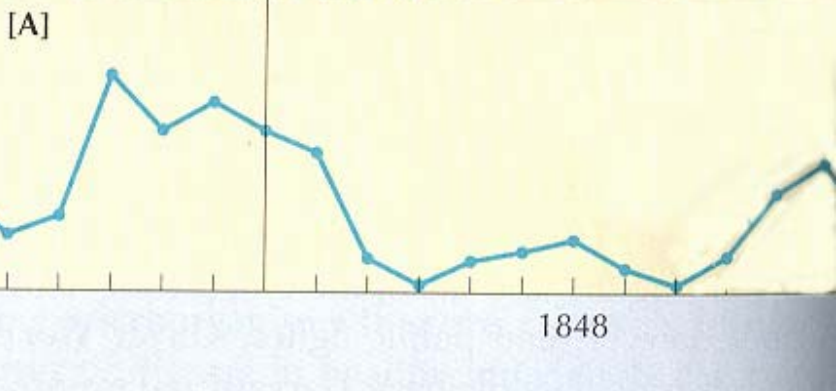
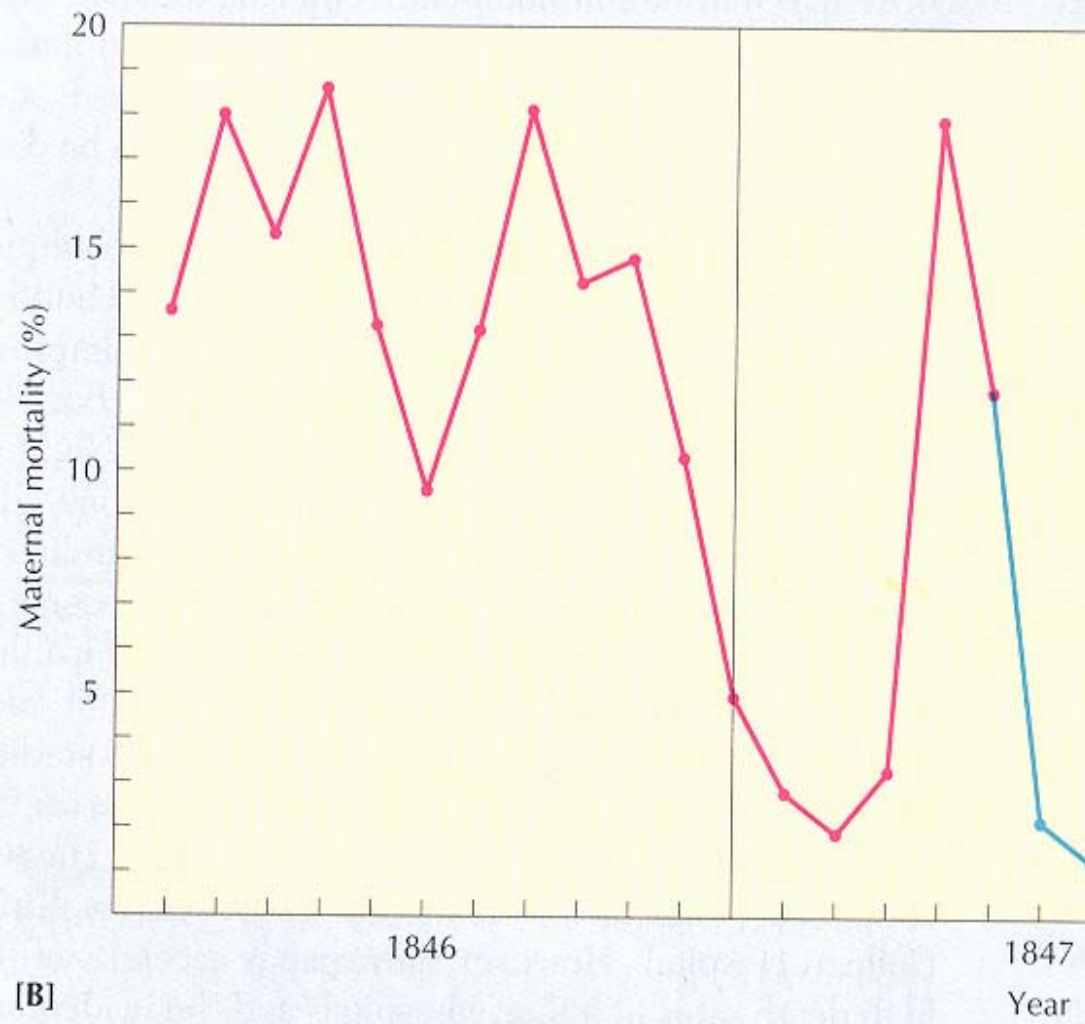
- If diseased wines were due to living organisms, then...what about disease in humans? (referring to Pasteur's work)
- The cause of disease must be the seed of the disease or the "germ" (disease germinator, from the idea of biogenesis)
- Needed to isolate into pure culture the seeds or germs of disease--but he stated that he did not know how this could be done

# Ignaz Semmelweis, 1850

- Hospital administrator in Vienna
  - Problem of Puerperal Fever, child-bed fever
  - Used hospital records
  - two obstetric clinics
  - one for MDs, the other a midwife clinic
  - 4X as many deaths in the Drs clinic
  - role of dissection and teaching in Drs clinic
  - Washing with chloride of lime
    - major drop in deaths
    - the fallout!!



**Dr. , Wash your hands!**



**Decreases in child-bed fever mortality**

# Putrefaction and Microorganisms

- The link between the growth of microorganisms and decay was known, but the work of Semmelweis underscored the relationship with regard to child-bed fever, but not until much later
- If micro-organisms caused putrefaction and putrefaction caused child-bed fever---
  - now we know that hemolytic *Streptococcus* sp cause puerperal fever, can still be a problem
  - the key was fermentation and putrefaction were caused by living organisms

# Setting the stage

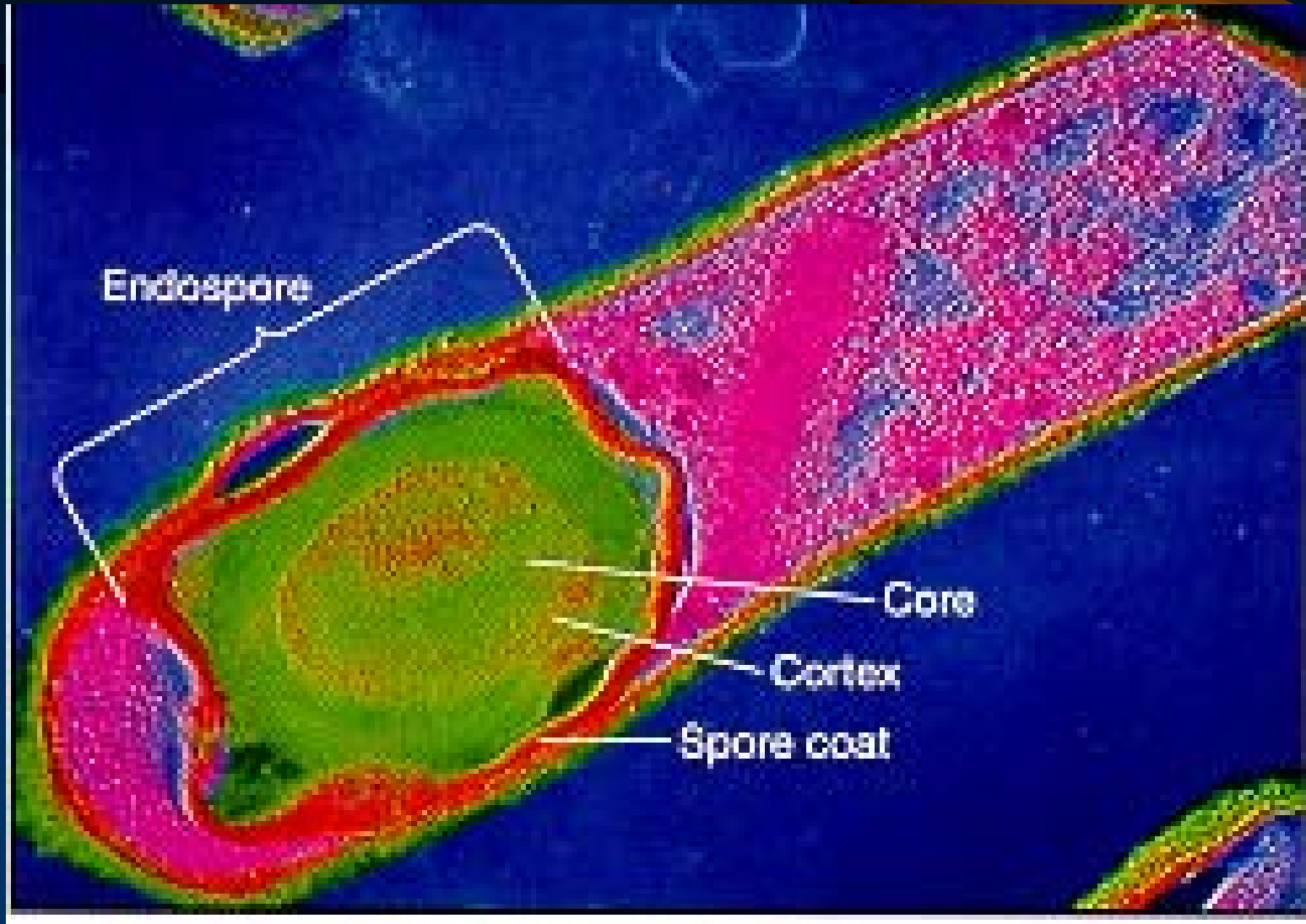


- Davaine's work on Anthrax
- Ferdinand Cohn's work on Endospores



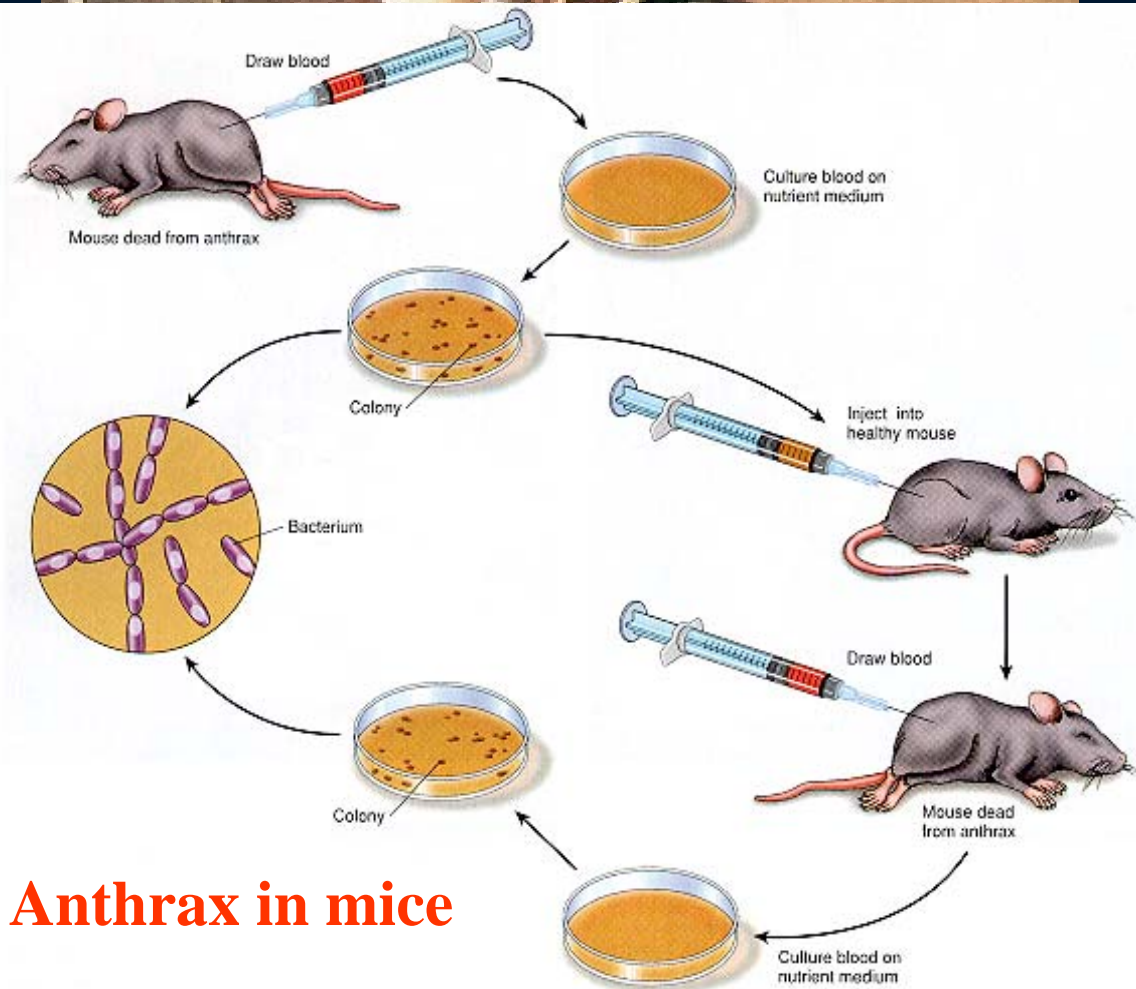
# Other discoveries:

## The Bacillus endospore



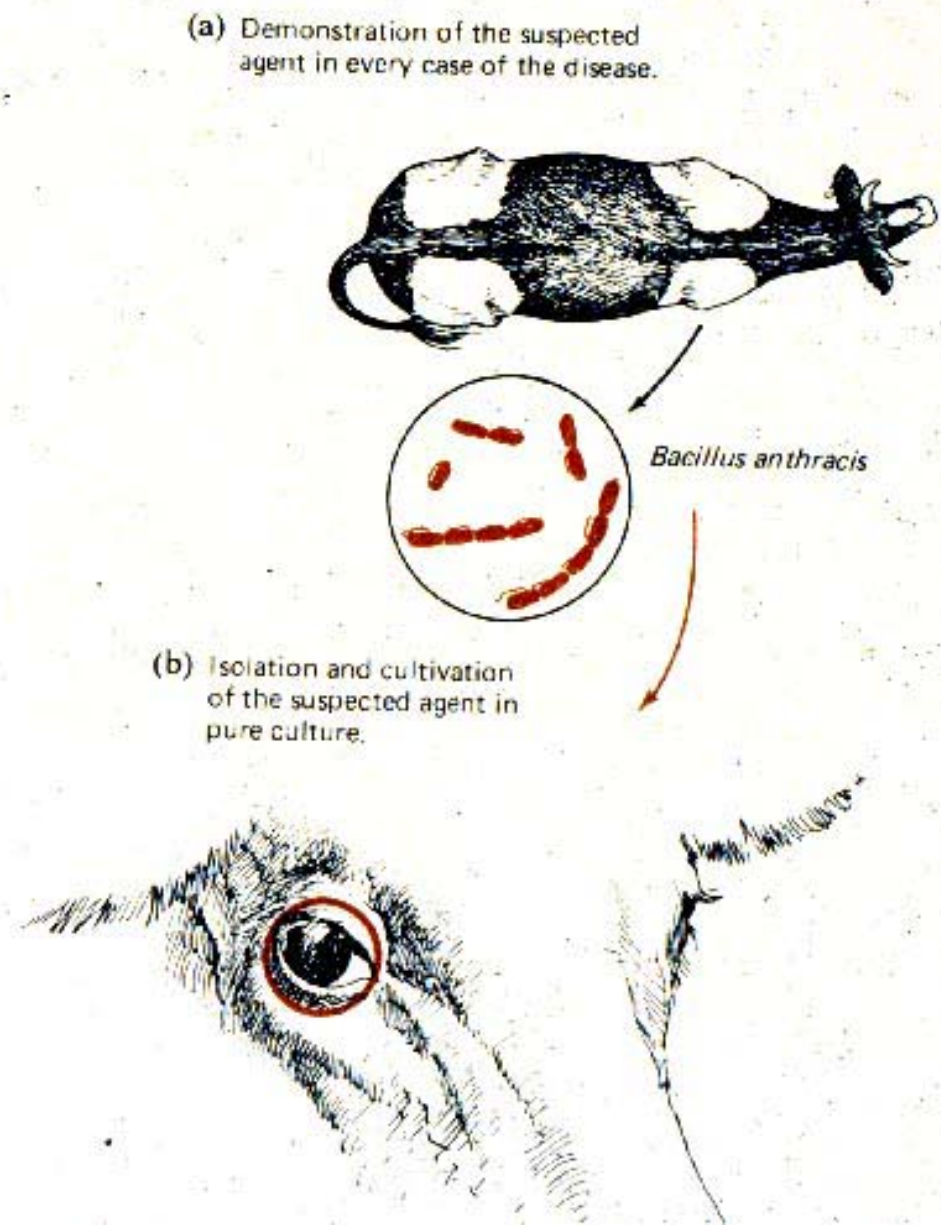
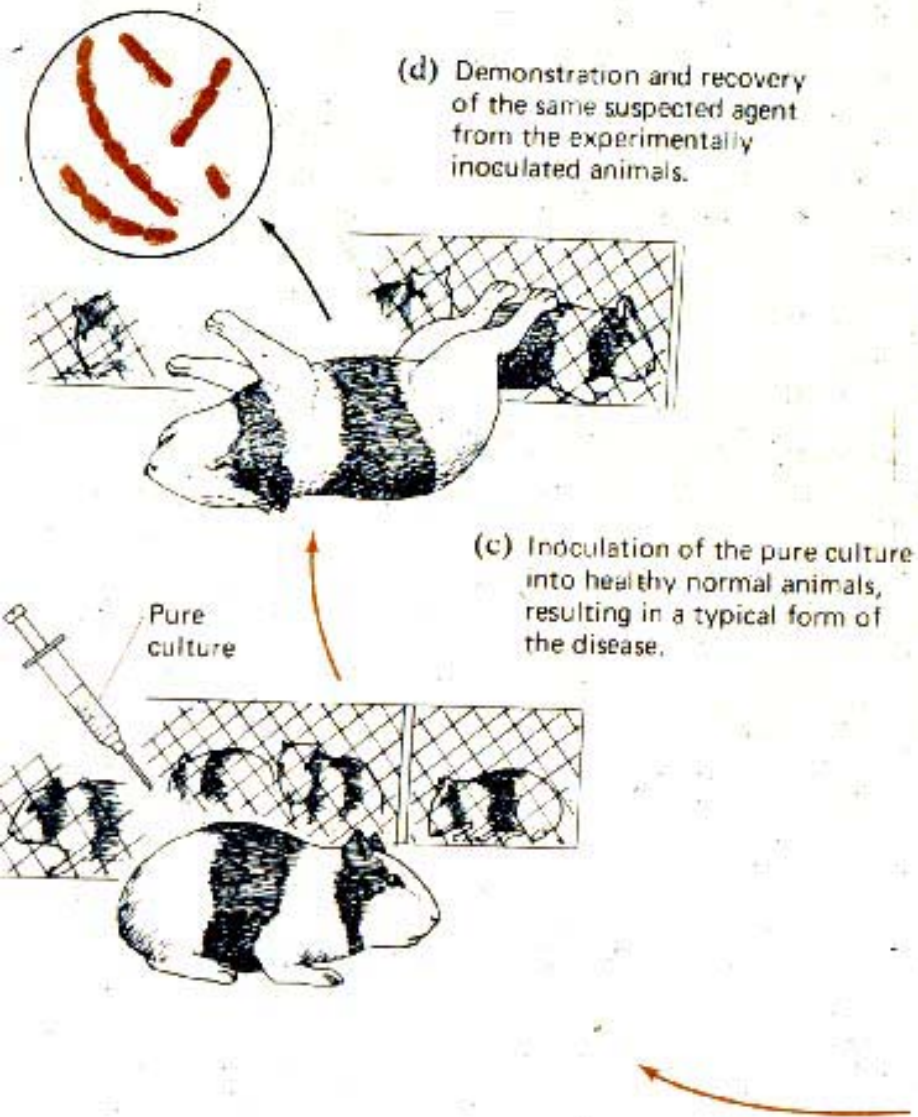
# Robert Koch, 1881

- Work on Anthrax
  - experiments with mice
  - 20 different mice
  - all died the same way
  - natural history of anthrax
  - “in a cow’s eye”
  - potatoes and pure cultures
  - the definitive proof, anthrax was caused by *Bacillus anthracis*



**Anthrax in mice**

# The basics of Koch's work



# Formally, these are the four postulates:

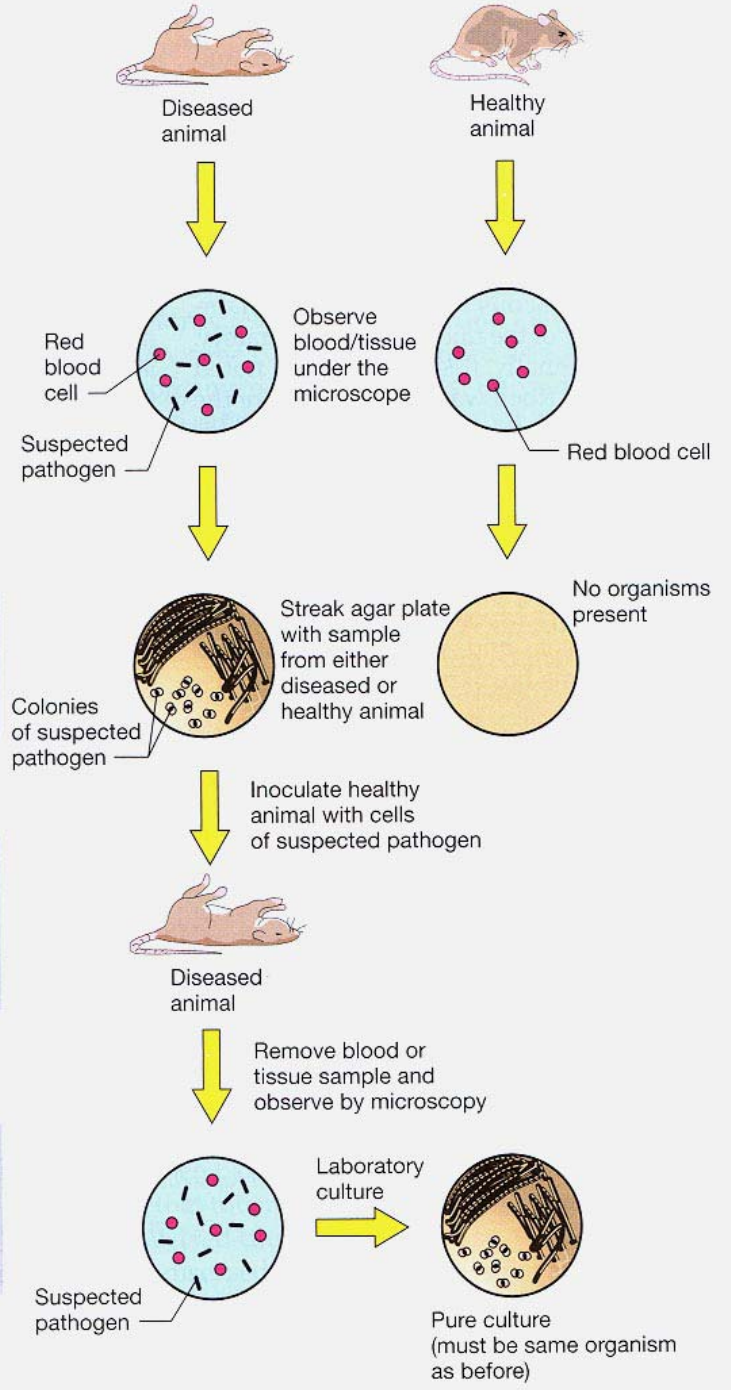
Within 20 years the agents of all major bacterial diseases were discovered

**Postulate 1**  
The suspected pathogenic organism should be present in *all* cases of the disease and absent from healthy animals.

**Postulate 2**  
The suspected organism should be grown in pure culture.

**Postulate 3**  
Cells from a pure culture of the suspected organism should cause disease in a healthy animal.

**Postulate 4**  
The organism should be reisolated and shown to be the same as the original.





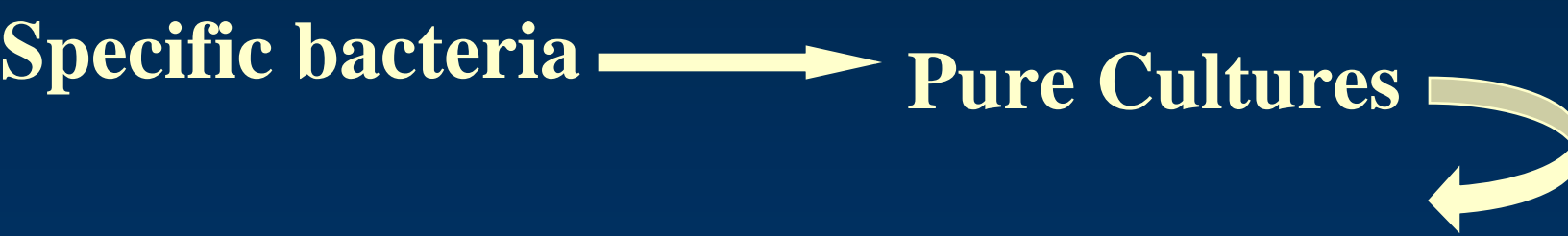
**Contagion** → **Microbes** → **Biogenesis**



**Fermentation** → **Putrefaction**



**Specific bacteria** → **Pure Cultures**

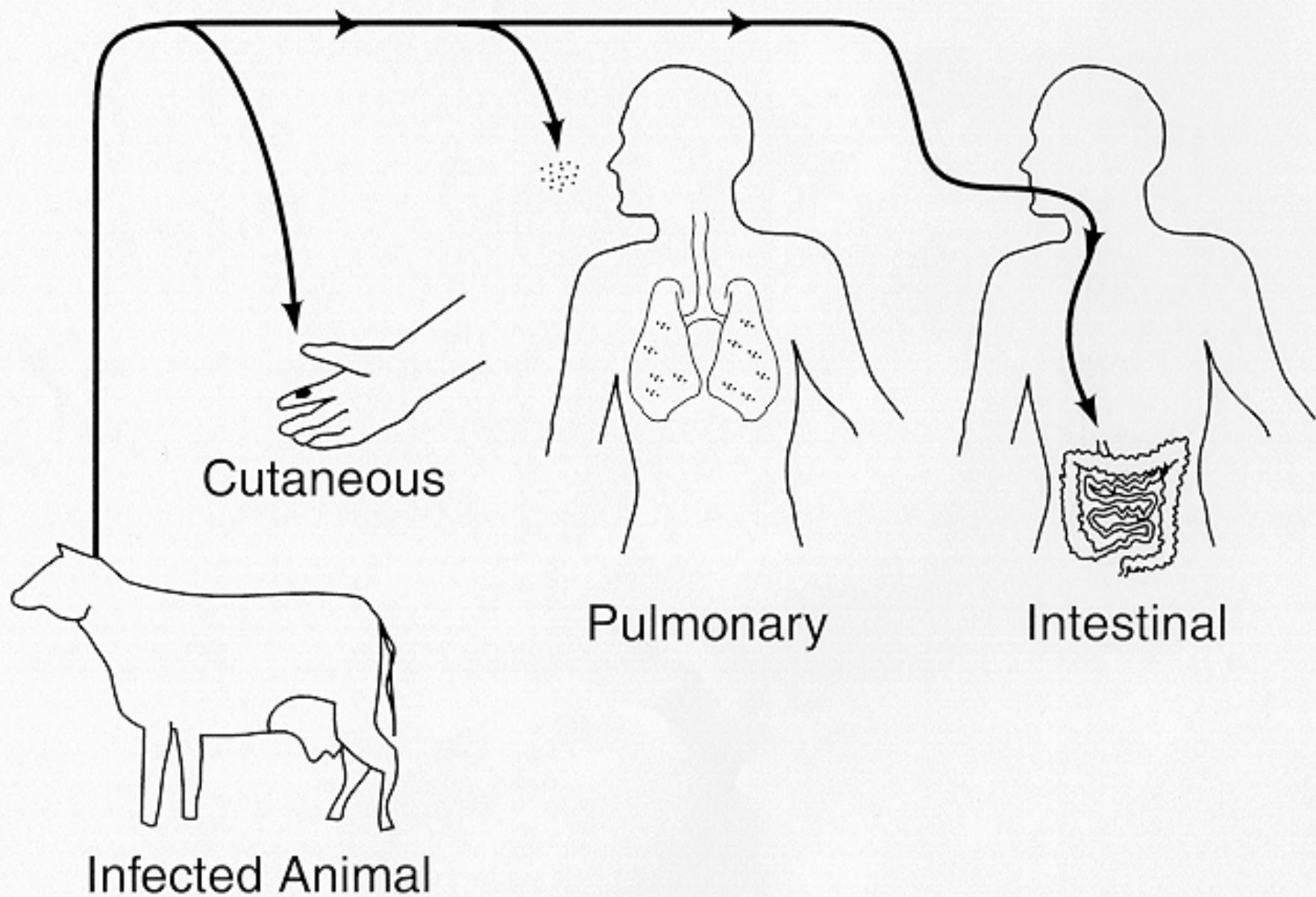


**Koch's Postulates** → **Germ Theory of Disease**





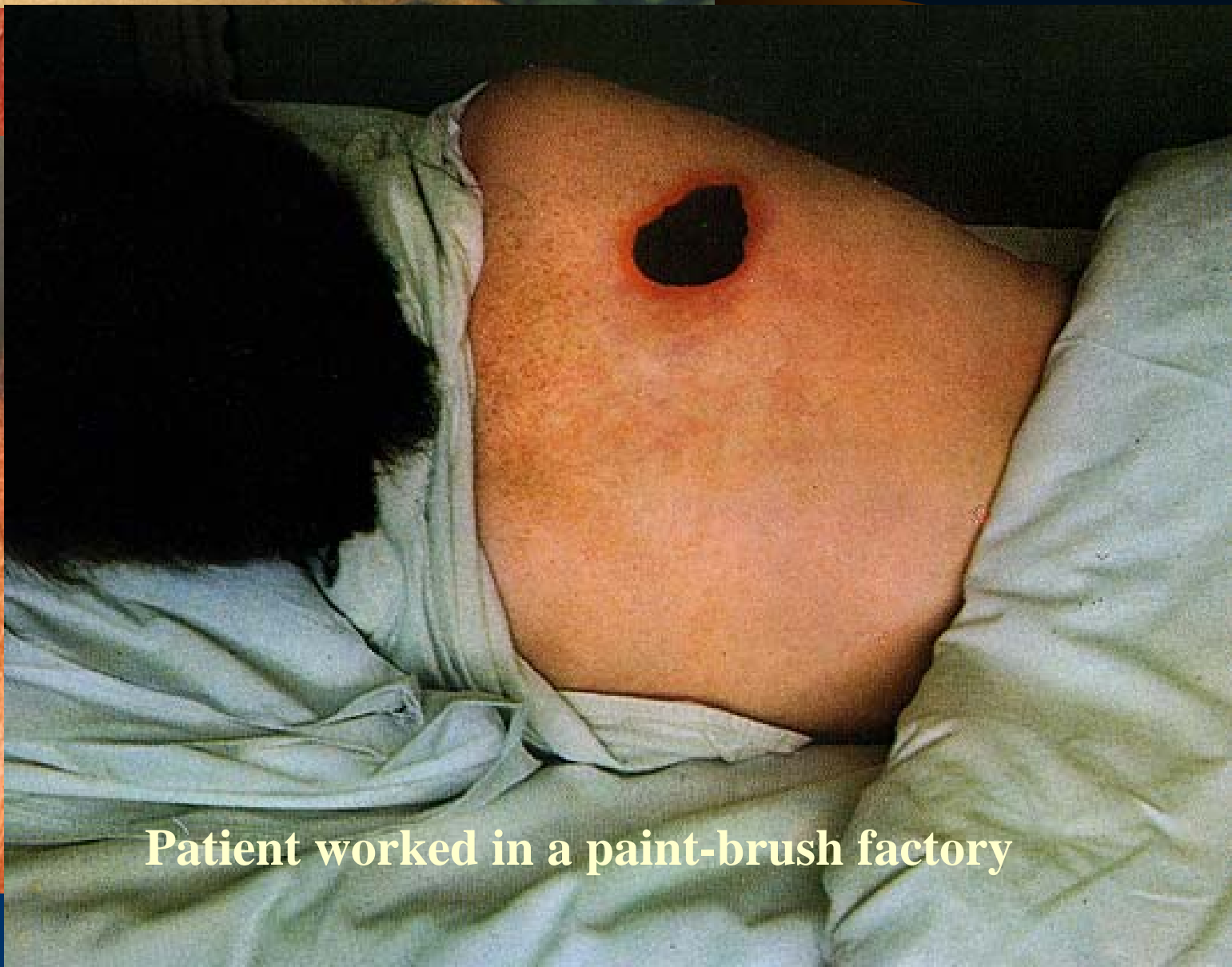
Figure 19-8 Three forms of anthrax that might be contracted by exposure to infected animal products.



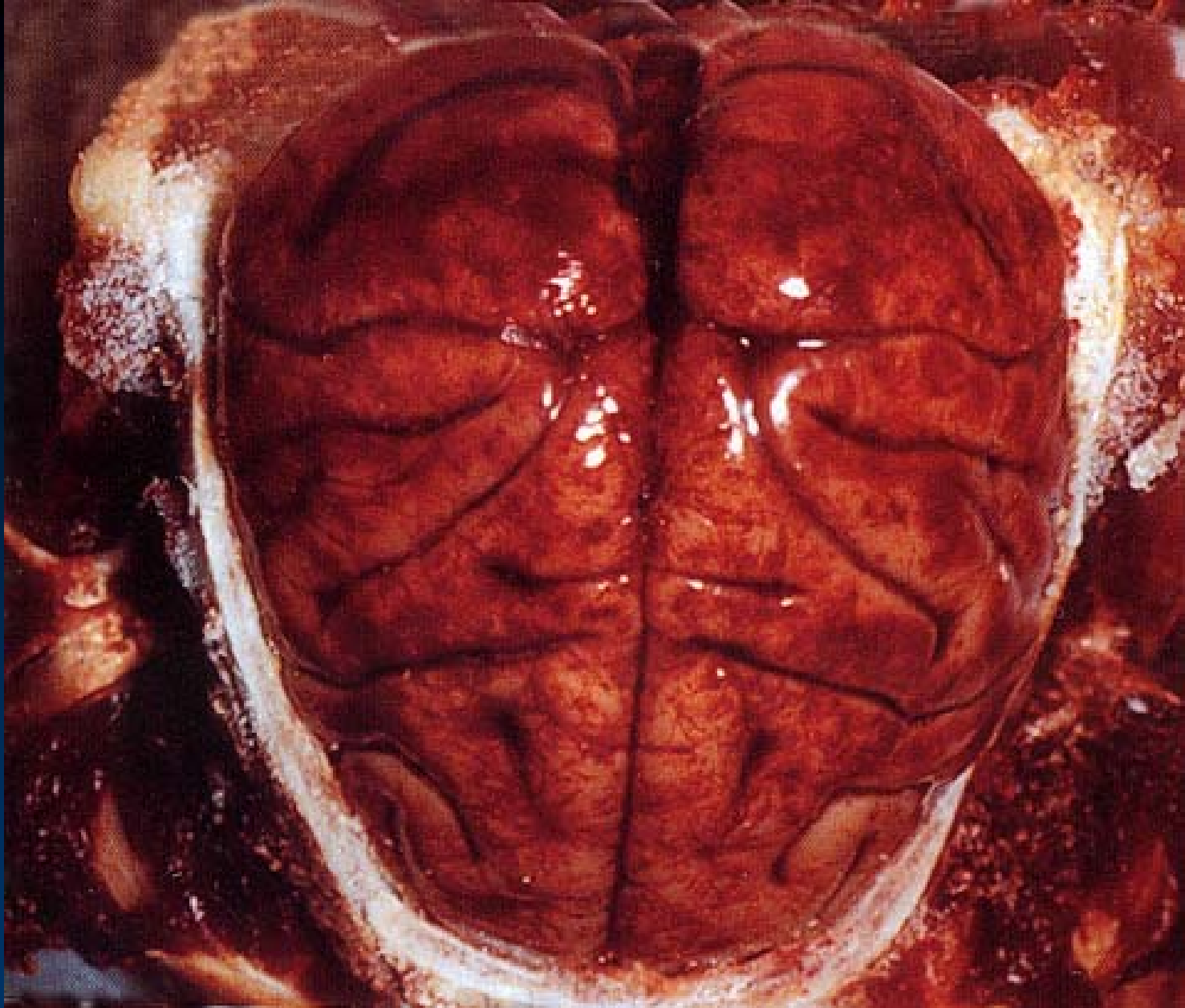
# Cutaneous Anthrax lesions



Early



Patient worked in a paint-brush factory



**Hemorrhagic monkey brain after experimental inhalation of anthrax spores**