Kwame Nkrumah University of Science & Technology, Kumasi, Ghana

# BIOL 251: BASIC MICROBIOLOGY 2020/2021

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## History of Microbiology – How it all started



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## Discovery of Cells

Robert Hooke (mid-1600s) - **1660s**
- Observed sliver of cork
- Saw "row of empty boxes"
- Coined the term cell



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## Description of microbes

**1670s - Antonie van Leeuwenhoek, 'The father of Microbiology'**



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## First real Microbiology Studies

van Leeuwenhoek was a true scientist and chronicled his observations:

- Microbes in wine and beer
- Impact of pepper on microbes
- Asked Hooke to confirm findings (review)
- Microbes in rainwater



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## Louis Pasteur (1822-1895)

In the 1800s the French were wondering why their wines were turning sour. Fermentation????

Prevailing theory: **fermentation was purely a chemical process with no input by living organisms.**



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Pasteur used **experimentation** to provide evidence against this...

- Pasteur showed that **tiny organisms** were found in the wine.
- Sour wines contained populations of the microorganisms described by van Leeuwenhoek.
- When the organisms were killed through heating, **no fermentation would take place**.
- When the organisms were added back, **fermentation would again occur**.



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## Are microbes in the air responsible for spoilage?

- Louis Pasteur's grape juice went sour on standing for sometime
- Heated & Bottled, tightly closed, it remained the same
- However left ajar went sour
- Certain microbes in the air responsible for the spoilage.
- Breakthroughs in microbiology was the development of the Koch's postulates (1881).



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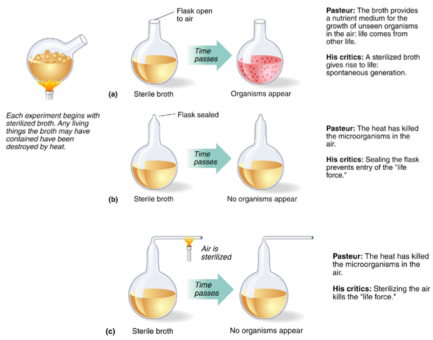
## Louis Pasteur's Experiment



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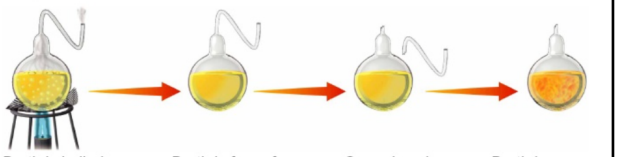
## Louis Pasteur's modification – swan-necked flasks



Broth is boiled. | Broth is free of microorganisms for a year. | Curved neck is removed. | Broth is teeming with microorganisms.

**Real question……Could microorganisms play a role in human health?**



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- Reasoning: Microbes could be transmitted to humans. This led him to propose the **germ theory of disease,** which states that ***microorganisms play significant roles in the development of infectious disease***.

- Diseased tissues often yield more than one microbes
- Consequently, not always obvious which microbe is the cause of disease
- Big problem in medical science in the 19th century
- Robert Koch Rules-of-proof of causality



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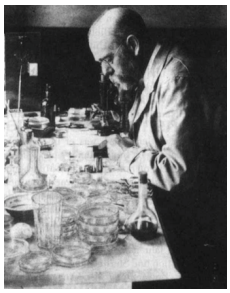
## Nature of Infectious Disease
## Robert Koch – 1843-1910





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## Koch's Postulates

- The organism in question must always be found associated with a particular disease
- The organism must be isolated and grown in pure culture.
- The organism grown in pure culture must be inoculated into a healthy host under favourable conditions and induce a characteristic disease.
- The organism must be re-isolated from the second host and compared with the first culture
- Both the diseased condition produced by inoculation and the organisms recovered from the inoculated host must correspond to the original diseased condition and to the first organisms isolated, respectively.



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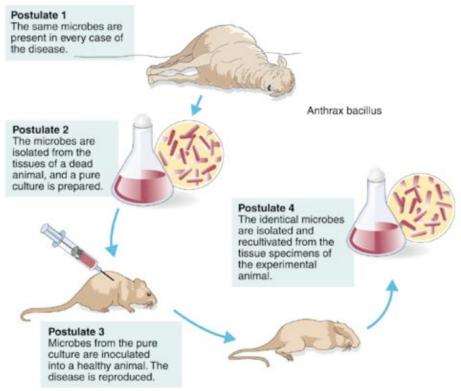




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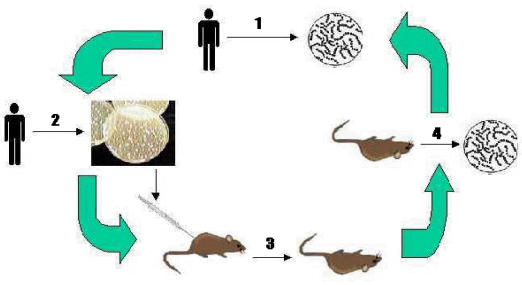
## A schematic diagram of Koch's postulate



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## NATURE AND KINDS OF MICROBES



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## NATURE AND KINDS OF MICROBES

- Prokaryotic cells (bacteria)
- Eukaryotic cells (plant and animal)

Prokaryotes differ from eukaryotes cells in several ways



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## PROKARYOTIC DIVERSITY

- Bacteria are differentiated mainly by their different **morphological**, **physiological** and **behavioral** characteristics.
  - Morphology (Shape)
  - Chemical composition (staining reactions)
  - Nutritional requirements
  - Biochemical activities and some source of energy (sunlight and chemicals)



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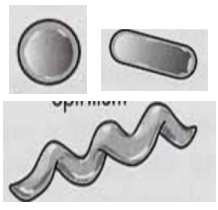
## Prokaryotic Diversity – Morphological Diversity

Three major forms of bacteria



- **Spherical or round forms**
  - Coccus (Plural- Cocci)
- **Rod-shaped forms**
  - Bacillus (Plural-Bacilli)
- **Spiral forms** or Spirillum/twisted - like corkscrew



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## Arrangements after cell division (Cocci)



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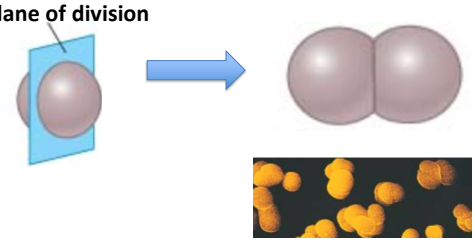
Plane of division



Cocci that divide and **remain in pairs** after dividing are

***Diplococcus/Diplococci***

*Neisseria gonorrhoeae*



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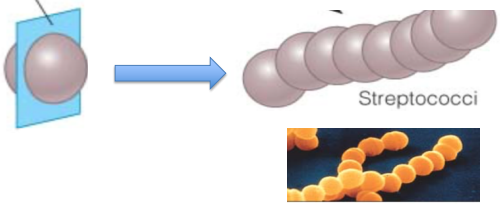
Plane of division




Divide and **remain attached in chainlike** patterns are

***Streptococcus/Streptococci***

*Streptococcus pyogenes*



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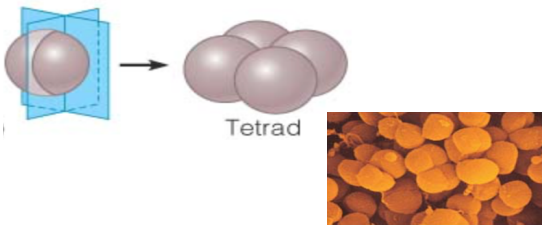
Plane of division




Those that divide in **two planes** and remain in **groups of four** are **Tetrads**

*Micrococcus species*



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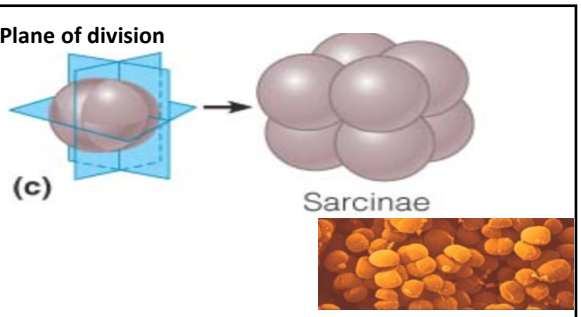
Plane of division




Cocci that divide in **three planes** and remain attached in **cube-like groups of eight** are called **Sarcina**

*Sarcina ventriculi*



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**Cocci that divide in multiple planes and form grape like clusters or sheets are called Staphylococci**

*Staphylococcus aureus*

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