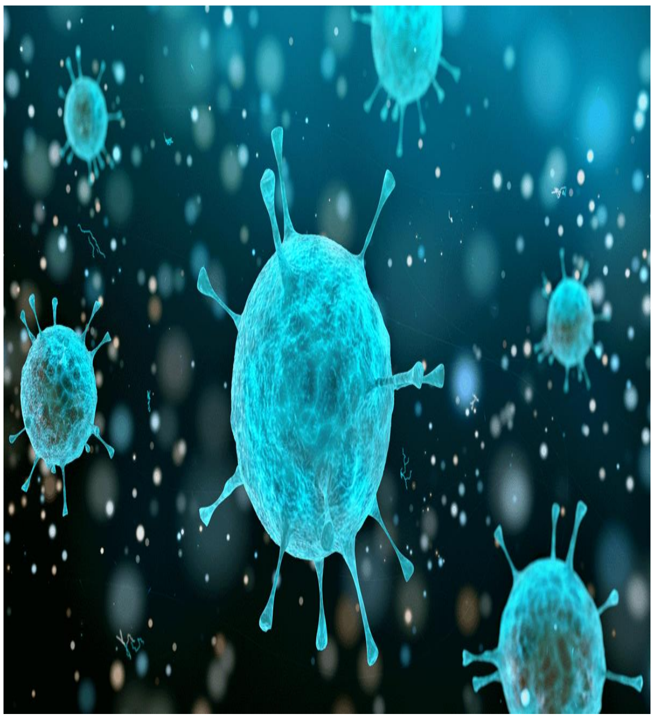
Lecture 1

Second Year

Passion Batch



MICROBIOLOGY

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Microbiology in the biological world

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Microbiology is the study of microbes which can be observed only with the use of various types of microscopes with only rare exceptions

33% of diseases are originated from infectious diseases

Microbiology

- Microorganisms share their small sizes; although they are simple they can be extraordinarily complex.

indigenous are in or on the body

- Superficially, bacteria appear to be relatively simple forms of life; in fact, they are sophisticated and highly adaptable.

there is three relationships between microbes and host:mutualism,parasitis,neutralism

Why Study Microbiology?

- Indigenous microbiota.

- Opportunistic pathogens

  fungus is the main decomposer of death organisms

- Microbes produce oxygen (algae and cyanobacteria a group of photosynthetic bacteria that produce oxygen)

- Microbes are involved in the decomposition of dead organisms and the waste products of living organisms

- Microbes are capable of decomposing industrial wastes (oil spills).
- Many microbes are involved in elemental cycles, e.g: nitrogencycle
- Algae and bacteria serve as food for tiny animals.
- Microbes produce substances that are of value to the host e.g: E. coli produce vitamins K and B1

vit B1 also called thiamine

lactobacillus is found in activia(dairy product

E.coli is the most studied model of bacteria

- Many microbes are essential in various food and beverage industries

beverage:كحولية

- Some bacteria and fungi produce antibiotics that are used to treat patients with infectious diseases

- Microbes are essential in the field of genetic engineering.

- Microbes have been used as "cell models. *E. coli is one of the most studied of all microbes.*

- These organisms are studied for many reasons; one important reason is that they cause deadly diseases.

- Pathogens cause two major types of diseases: infectious diseases and microbial intoxications.

microbial intoxications:التلوث الناتج عن سموم البكتيريا مثل في بقايا الطعام

3% of known microbes are capable of causing disease and said to be pathogenic

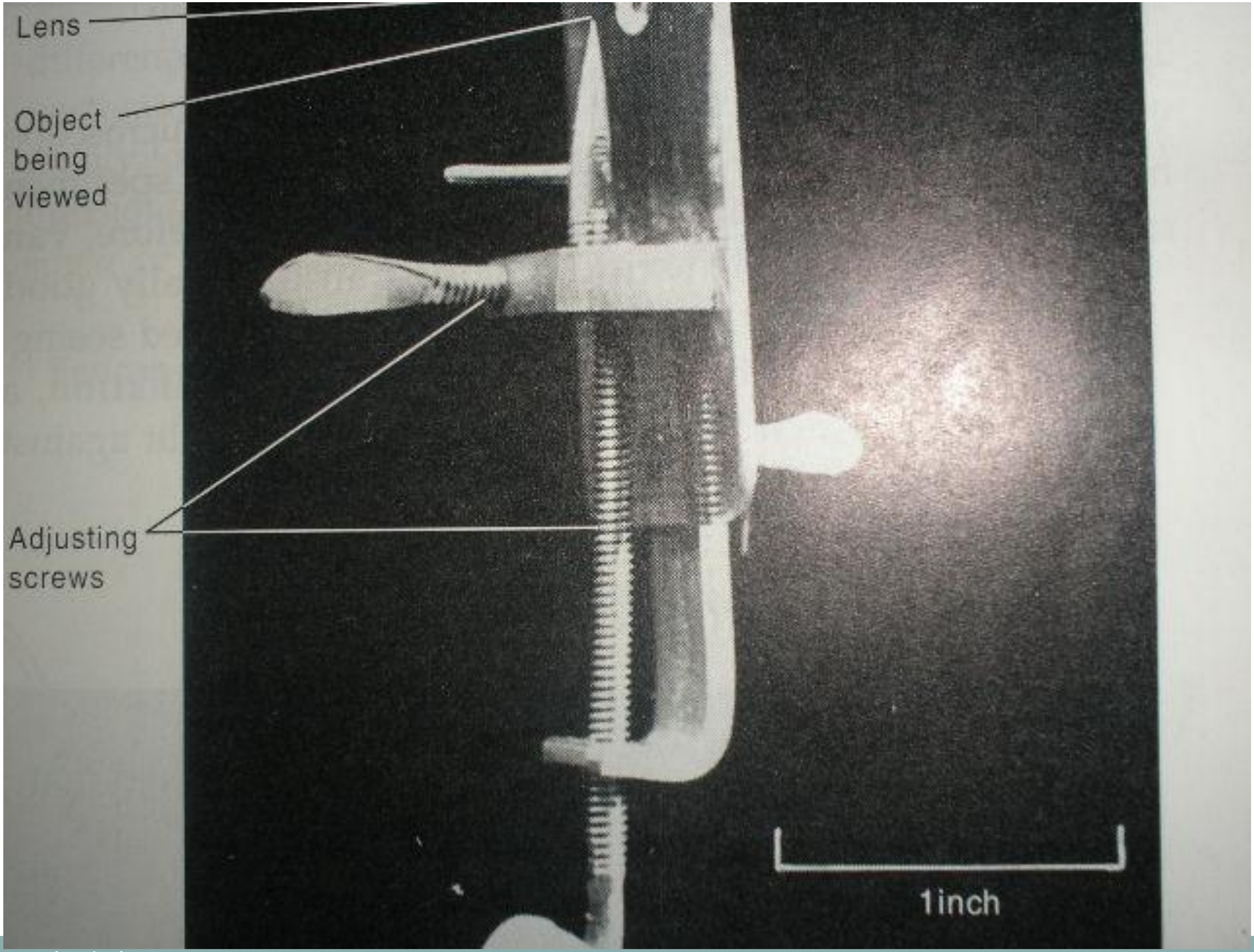
Earliest Known Infectious Diseases

Human pathogens have existed for thousands of years because damage caused by them has been observed in the bones and internal organs of mummies and early human fossils.

Pioneers in the Science of Microbiology

- Van Leeuwenhoek: the first using magnification glass to identify bacteria and to describe their shapes

he wasn't a scientist but he described microbes


Lens
Object being viewed
Adjusting screws
1 inch

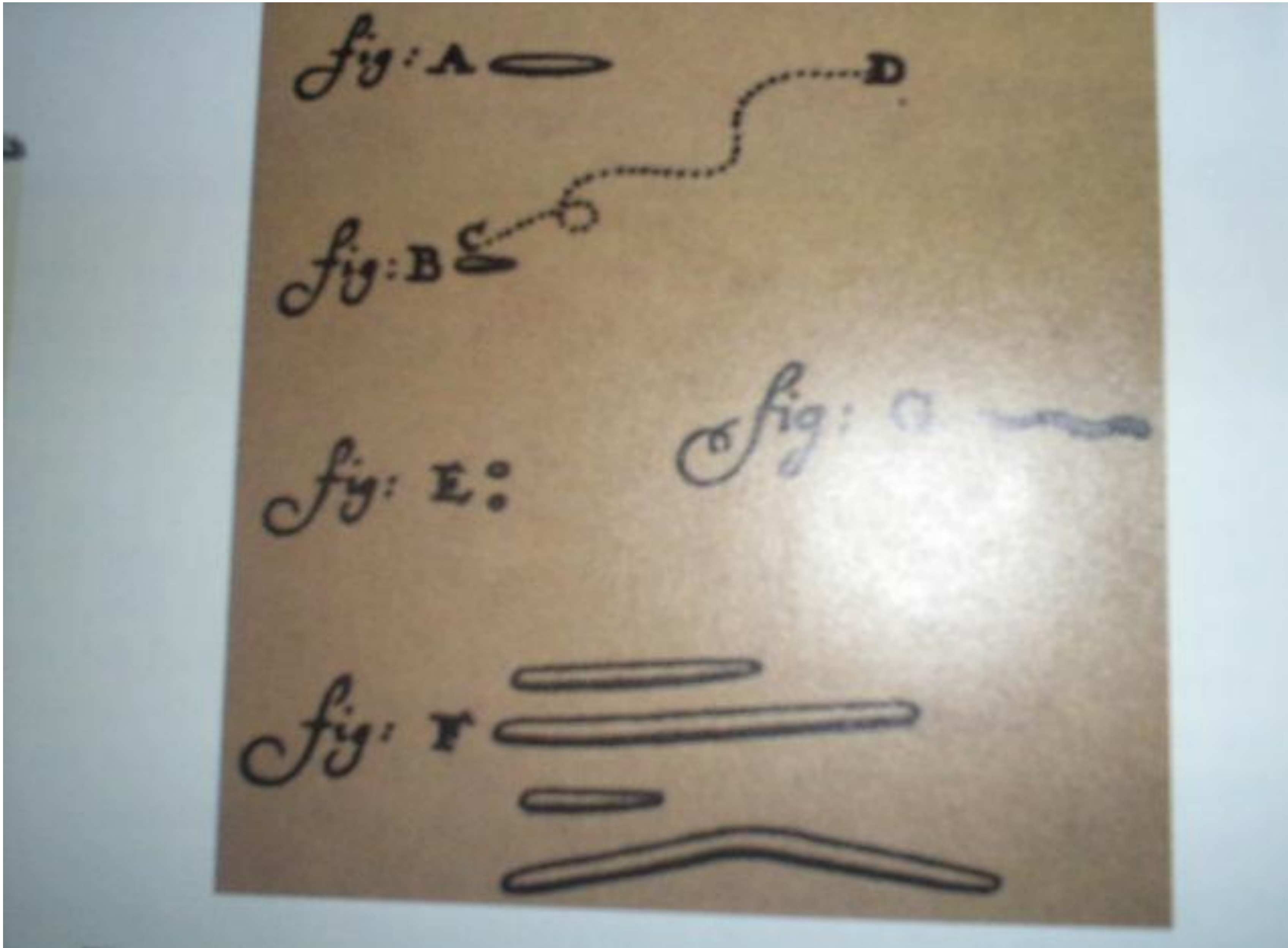


Figure 1.1

Spontaneous generation

ه الكائنات بتنخلق من مواد غير
حية

- life can arise spontaneously from nonliving material is called the theory of spontaneous generation or abiogenesis.

- life can only arise from preexisting life. This is called the theory of biogenesis

Spontaneous generation

- Francesco Redi debunk the spontaneous generation theory by simple experiment

he covered pieces of meat with strong mesh
to prevent microbes to reach them,meat
won't be decayed

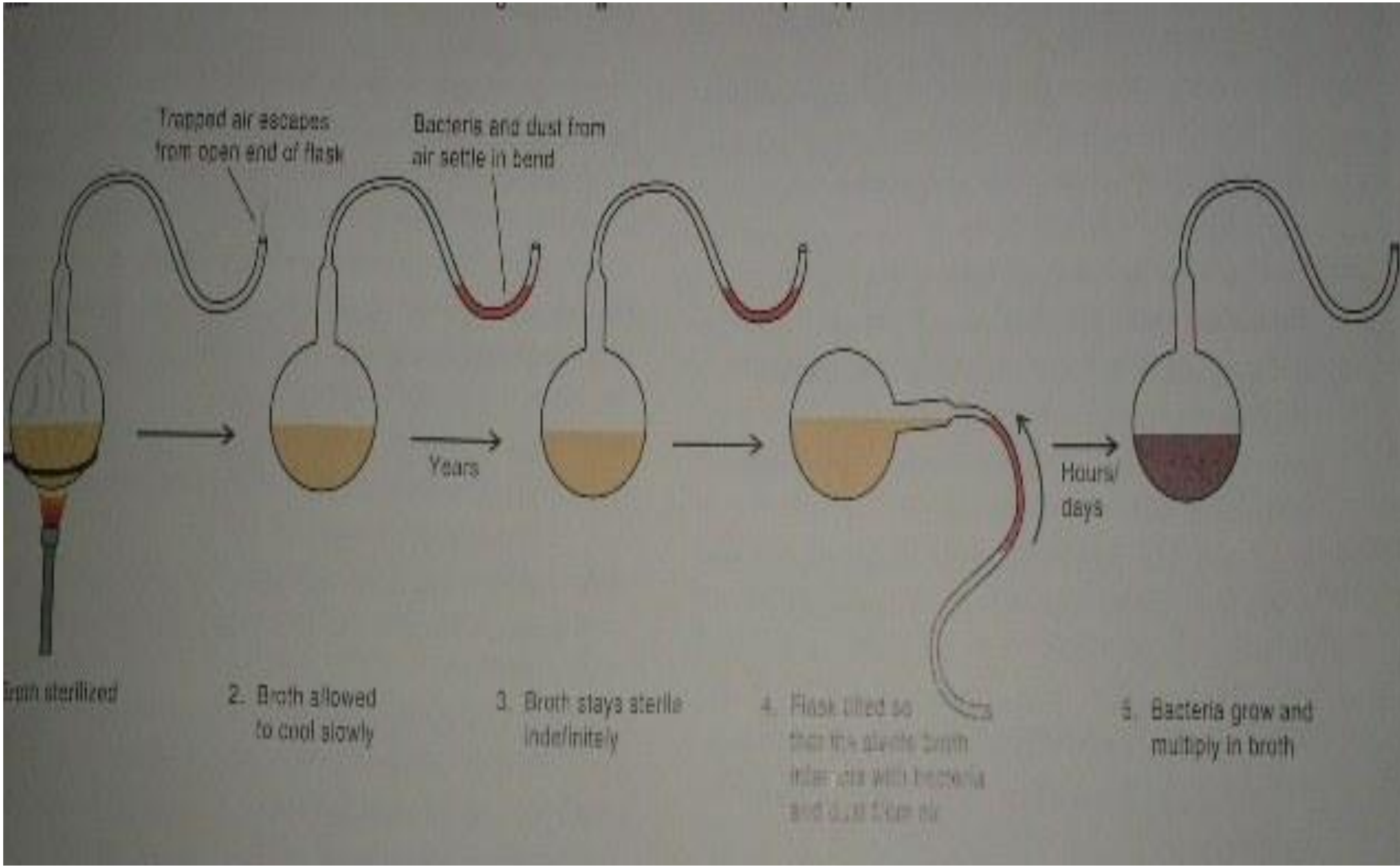
- Pasteur experiment

pasteur designed an experiment
to debunk spontaneous
generation theory
(Swann neck exper.)

mesh can prevent microbes but if they
contain eggs before the mesh is used eggs
will pass through the fine mesh

experimental design هذا اظهر انه النظرية فيها خلل
problem

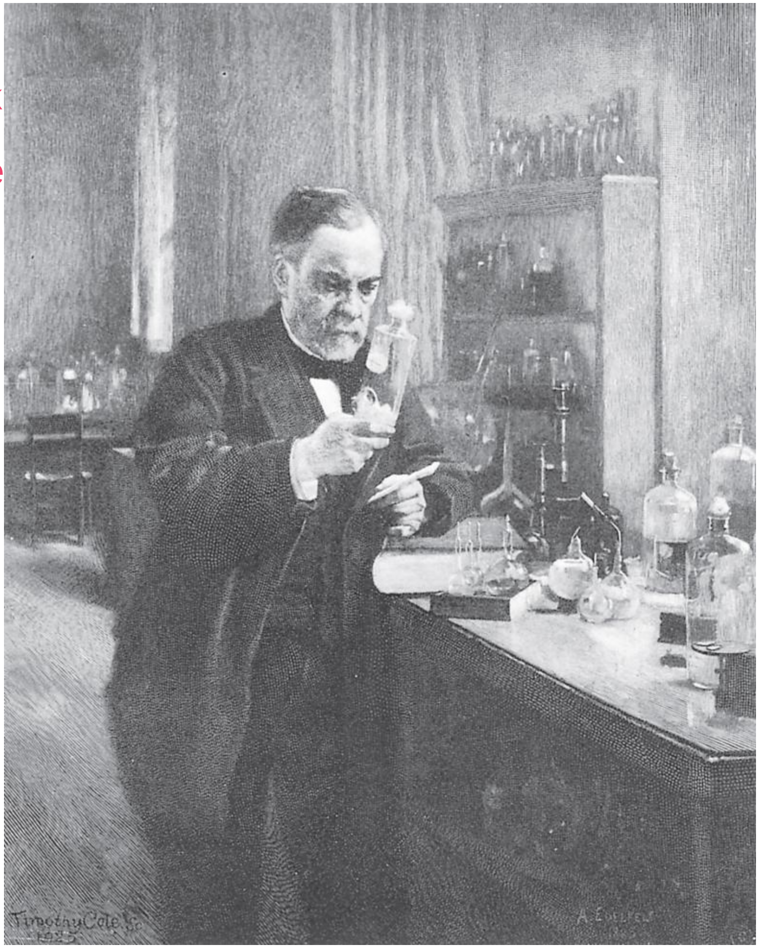
Francesco redi experiment was
disapproved by another scientist



Trapped air escapes from open end of flask
Bacteria and dust from air settle in bend
Years
Hours/ days
roth sterilized
2. Broth allowed to cool slowly
3. Broth stays sterile indefinitely
4. Flask tilted so
5. Bacteria grow and multiply in broth

starting with sterilization of nutrient media(broth media),no microbes in this broth in the flask ,and by keeping the flask vertical to microbes or air could enter the broth,because of the injection of the neck"no bacterial growth in the broth "

when the flask is tipped down the air starts to enter the flask and reaching in face to face or exposed to the organism ,the organism now will start to grow in the broth



sterilization<>pasteuralization

Pasteur

pasteur defined disease specifity (every single organism can cause specific disease in specific organ)

في امراض بتحدث باعظاء معينة فقط
like Ecoli infects urethra as its receprtors are there so it didn't cause symptoms if affect the lungs

- Pasteur introduced the terms “aerobes” and “anaerobes”

before 120 yr

- Pasteur developed Pasteurization

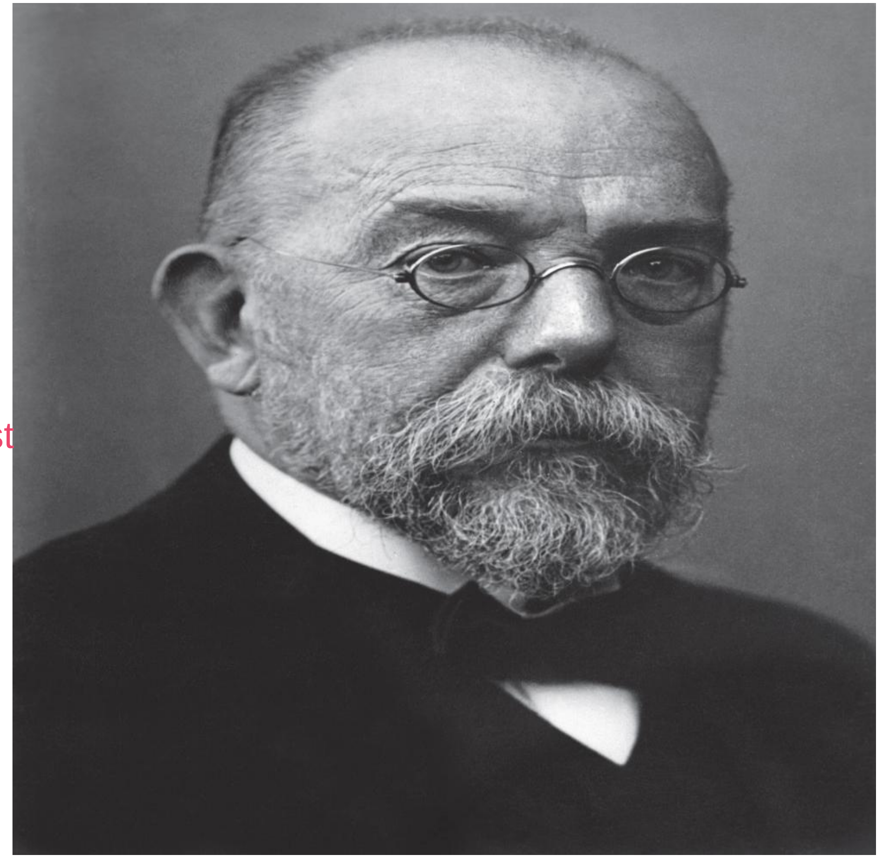
pasteurization:using middle to high temp for a short time to kill pathogens only not all mirobes

- Pasteur made significant contributions to the germ theory of disease
- Anthrax → (Bacillus anthracis)
- Pasteur lead changes in hospital practices tominimize the spread of disease by pathogens.
- Pasteur developed vaccines to prevent chicken cholera, anthrax, and swine erysipelas (a skin disease).
- Pasteur developed a vaccine to prevent rabies in dogs

rabies: داء السعار

made an actual experiment designed by an experimental animal "every single disease should have a single organism and a single pathogen"

one pathogen causes a disease in suspectible host if we isolate the causative agent of this disease and inject it in another organism he will be infected by the same host



Robert Koch.

- Koch discovered that B. anthracis produces spores

- Koch developed methods of cultivating bacteria on solid media

- Koch discovered the bacterium (M. tuberculosis) that causes tuberculosis and the bacterium (Vibrio cholerae) that causes cholera.

tuberculosis is a re-emirging disease(بسبب كثرة الامراض التي تؤدي الى نقص المناعةlike AIDS)

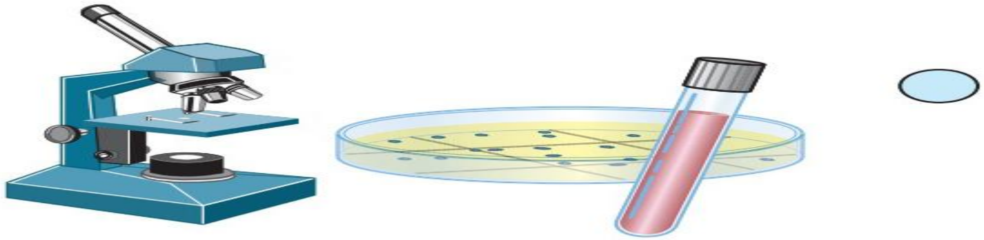
- Koch's work on tuberculin

tuberculin:purified protein derivative used in ,is a combination of proteins that are used in identifying TB

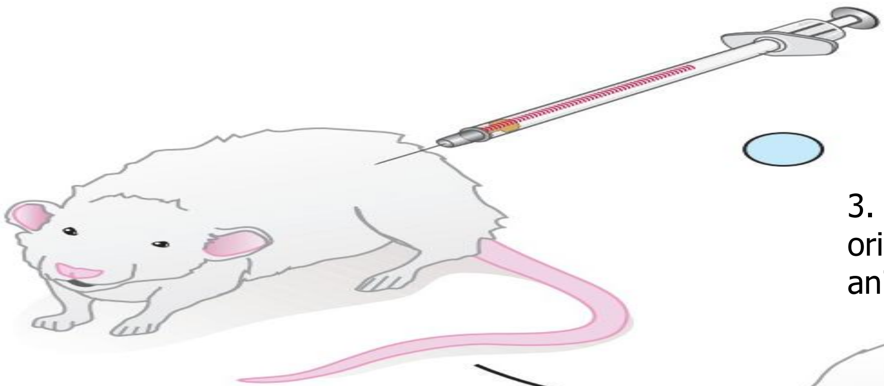
1/3 of world population contains TB but in its inactive form(latent form)

active TB symptoms:coughing,fever.weight loss,night sweat 😰

1. The microorganism must always be found in similarly diseased animals but not in healthy ones.

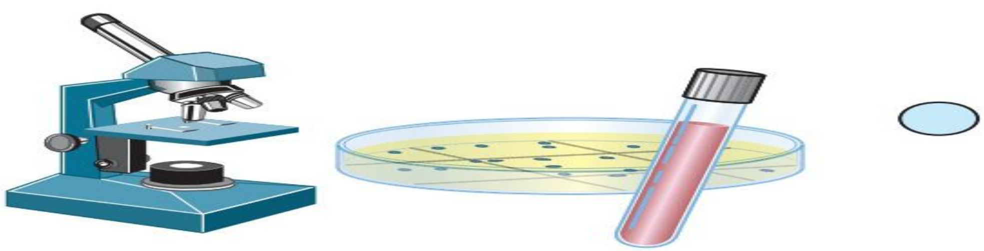


2. The microorganism must be isolated from a diseased animal and grown in pure culture.



3. The isolated microorganism must cause the original disease when inoculated into a susceptible animal.

Sick



4. The microorganism can be reisolated from the experimentally infected animal.

Peptic(gastric)ulcer=helicopacter pylori

MODERN ERA:

Nobel Laureates

Years	Nobel laureates	Contribution
1901	*Von behring*	Dipth antitox
1902	*Ronald Ross*	Malaria
1905	*Robert koch*	Tb
1908	*Metchnikoff*	Phagocytosis
1945	*Flemming*	Penicillin
1962	*Watson, Crick*	Structur DNA
1968	*Holley, Khorana*	Genetic code
1997	*Pruisner*	Prions
2002	*Brenner, Hervitz*	Genetic regulation of organ development &cell death

Medical microbiology-past triumphs

- Golden Age of microbiology 1875-1918, most pathogenic bacteria were identified

- 10 million died of small pox, as a result of vaccination no cases have been reported since 1977

small pox is from top ten lethal diseases

- 1346-1350, 1/3 of the entire population of Europe died from bubonic plague

- The discovery of antibiotic provided an important weapon against bacterial diseases

In 1964, the surgeon general of the United States delivered a speech to Congress: "It is time to close the book on infectious diseases," he said. "The war against pestilence is over."

pestilence:وباء

In 1998, Surgeon General David Satcher had a different message. The *Miami Herald reported his speech with this headline:* "Infectious Diseases a Rising Peril; Death Rates in U.S. Up 58% Since 1980."

collistin resistant bacteria :bacteria that have resistant
to antimicrobials

Medical microbiology- future challenges

- The importance of medical microbiology as an active field of research
- 750 million cases of infectious diseases occur in the USA leading to 200 000 deaths annually and results in tens of billions of dollars in health care costs alone
- Respiratory infections and diarrheal diseases are the leading causes of illness and deaths
- Diseases that were attributed to other causes have now been shown to be caused by microorganisms i.e peptic ulcer

90% of the causes of peptic ulcer are from H.pylori

Medical microbiology- future challenges

- New diseases continue to arise i.e legionnaires disease, AIDS, toxic shock syndrome

TSS:a condition caused by bacterial toxins

- Many infectious diseases started to increase again i.e international traveler incubating a disease in his body could theoretically circle the globe, such diseases as malaria, cholera, plague still exist, these diseases have been eliminated through sanitation, vaccination and quarantine

globalization:القرية العالمية اي سهولة الاتصال بين الشعوب

Medical microbiology- future challenges

- Control by vaccination of childhood diseases (measles, mumps, whooping cough) results in lax about having their children vaccinated and a dramatic increase in the number of those infected has resulted.

  reimergent diseases arise from the unuse of

- Treatment of infectious diseases result in prolonged life of people that lower the diseases resistance of patients weaken the ability of the immune system to fight diseases

- TB has increased worldwide and thousands of cases are reported annually, these new cases of TB is resistant to the drugs that once effective in curing the disease

Top Causes of Death—All Diseases

United States	No. of Deaths
1. Heart disease	652,000
2. Cancer	559,000
3. Stroke	144,000
4. Chronic respiratory disease	131,000
5. Unintentional injury (accidents)	118,000
6. Diabètes	75,000
7. Alzheimer's disease	72,000
8. Influenza and pneumonia	63,000
9. Kidney problems	44,000
10. Septicemia (bloodstream infection)	34,000

Worldwide	No. of Deaths
1.Heart disease	12.2 million
2. Stroke	5.7 million
3. Cancer	5.7 million
4. Respiratory infections*	3.9 million
5. Chronic respiratory disease	3.6 million
6. Accidents	3.5 million
7. HIV/AIDS	2.9 million
8. Perinatal conditions	2.5 million
9. Diarrheal diseases	2.0 million
10. Tuberculosis	1.6 million

influenza and pneumonia and septecima

world wide infectious diseases:TB,diarrheal diseases,Rinfections,HIV

*Diseases in red are those most clearly caused by microorganisms.

Source: Data from the World Health Organization, 2008.

Beneficial applications of microbiology

- Human life would not exist on this planet without the activities of bacteria

Medical Microbiology

This branch deals with microbes that cause diseases in humans and animals. Researchers examine factors that make the microbes virulent and mechanisms for inhibiting them.

Public Health Microbiology and Epidemiology

These branches monitor and control the spread of diseases in communities

Immunology

This branch studies the complex web of protective substances and cells produced in response to infection. It includes such diverse areas as vaccination, blood testing, and allergy

Agricultural Microbiology

This branch is concerned with the relationships between microbes and domesticated plants and animals.

Plant specialists focus on plant diseases, soil fertility, and nutritional interactions.

Animal specialists work with infectious diseases and other associations animals have with microorganisms.

Industrial Microbiology

This branch safeguards our food and water, and also includes biotechnology, the use of microbial metabolism to arrive at a desired product, ranging from bread making to gene therapy.

Microbes can be used to create large quantities of substances such as amino acids, beer, drugs, enzymes, and vitamins

Environmental Microbiology

These microbiologists study the effect of microbes on the earth’s diverse habitats. Whether the microbes are in freshwater or saltwater, topsoil or the earth’s crust, they have profound effects on our planet.

Careers in Microbiology

A microbiologist is a scientist who studies microbes. He or she might have a bachelor's, master's, or doctoral degree in microbiology.

Medical Microbiology

An excellent career field for individuals having interests in medicine and microbiology

Clinical microbiology or diagnostic microbiology

An excellent career field for individuals with interests in laboratory sciences and microbiology.