



Introduction to Microbiology

Pharmaceutical Microbiology

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بسم الله الرحمن الرحيم
" اللهم اشرح لي صدري ويسر لي امري واحلل عقدة من لساني يفقهه قولي "
خلونا نكسب الصلاة عالنبى ونبدأ التفريغ 🤗

What is Microbiology

بداية لازم نعرف شو هو علم الاحياء الدقيقة

- Microbiology is the study of organisms or agents too small to be seen with naked eyes.

هو العلم المختص بدراسة الكائنات الصغيرة التي لا يمكن رؤيتها بالعين المجردة عن طريق اجهزة وادوات تساعد في التكبير

- Microorganisms are present everywhere. They present in soil, air and water.

طبيعة هاي الكائنات الدقيقة انها تتواجد بكل مكان والأسطح وحتى في الهواء والماء

نبدا نحكي عن خصائص هاي الكائنات (microorganisms)

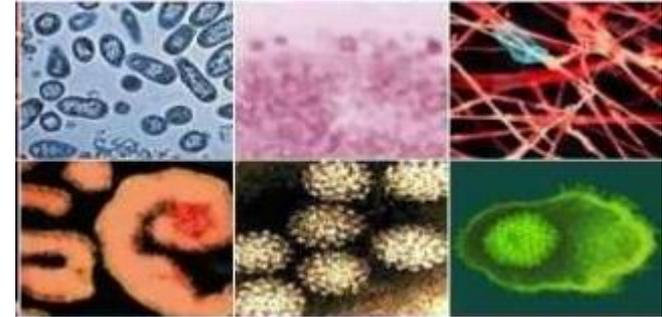
1. لا يمكن رؤيتها الا عن طريق العدسات المكبرات او المجهر

1. Microorganisms are very small organisms which cannot be seen with the unaided eye. They can be seen only with a magnifying glass or microscope.

2. Microorganisms may be unicellular or multicellular. 2. ممكن تكون وحيدة الخلية او متعددة الخلية

3. Microorganisms may exist alone or in colonies. 3. ان تكون منفردة او بشكل مجموعات

4. Microorganisms are found in all kinds of They are also found inside the bodies of other organisms



4. ممكن تعيش خارج الاجسام او بداخلها لا تحتاج لوسط محدد حتى تكمل دورة حياتها

Microorganisms

من الممكن دراسة بعض الكائنات التي ترى بالعين المجردة (زي الفطريات الناتجة بسبب عفن الخبز) باستخدام علم الاحياء الدقيقة

- Some organisms studies by microbiologists CAN be visualized without the aid of amplification [bread molds (fungus) and filamentous algae]
- These organisms are included in the discipline of microbiology because of similarities in properties and techniques used to study them والسبب هو التشابه الكبير بين خصائصهم والتقنيات المستخدمة لدراستهم .
- Techniques necessary to isolate and culture microorganisms:
 - Isolation
 - Sterilization
 - Culture in artificial media

من الامثلة عليها:
الفيروسات، البكتيريا،
الفطريات.





×

Microbes help us by

- decomposing organic waste
تحلل المخلفات العضوية
- performing photosynthesis
مساعدة بعض النباتات في عمليات البناء الضوئي الخاص بها
- producing ethanol, acetone, vinegar, cheese, bread, . . .
استخدامها في التخمير
- producing insulin and many other drugs
استخدام البكتيريا في انتاج الانسولين عن طريق البلازميد الخاص بها

Microbes harm us by

- causing disease
اضرارها : تسبب الامراض وتتلف المواد الغذائية
- causing food spoilage

Why is microbiology important?

- Applied aspects are concerned with practical problems. These are:
 - Disease study.
 - Water and waste water treatment.
 - Food spoilage and food production.
 - Industrial uses of microbes.

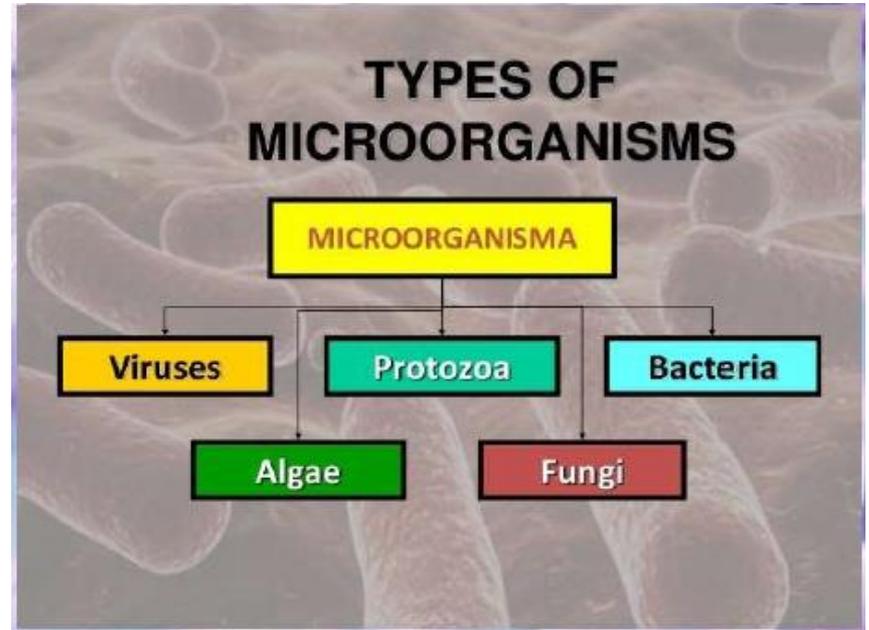
حكينا اهميتها تكمن في عدة شغلات منها
تنقية المياه ودراسة الامراض واكتشاف
العلاج والصناعات الغذائية

Types of microorganisms

طبعا مثال على الاحياء الدقيقة البكتيريا والطحالب والفطريات

They are :

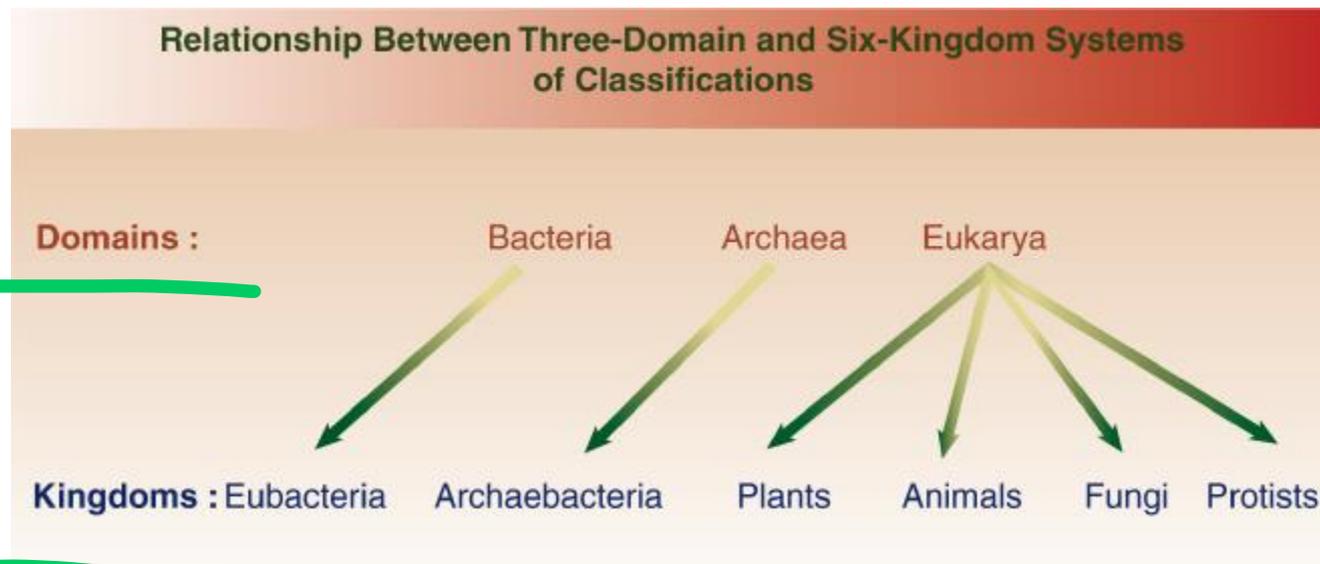
- bacteria, fungi, algae and protozoans.
- Viruses are also considered as microorganisms. They are different from other microorganisms. Why? because they reproduce only in the body of host



ومن الامثلة كمان الفايروسات لكنها مختلفة نوعا ما ليش؟
لانه الفايروس بحتاج وسط محدد لحتى يقدر يعيش
ويتكاثر والي هو جسم الكائن الحي

The highest – largest category, recent addition 3 domains

وتنقسم الى 3 نطاقات او انواع رئيسية وكل منها تنقسم الى ممالك محددة



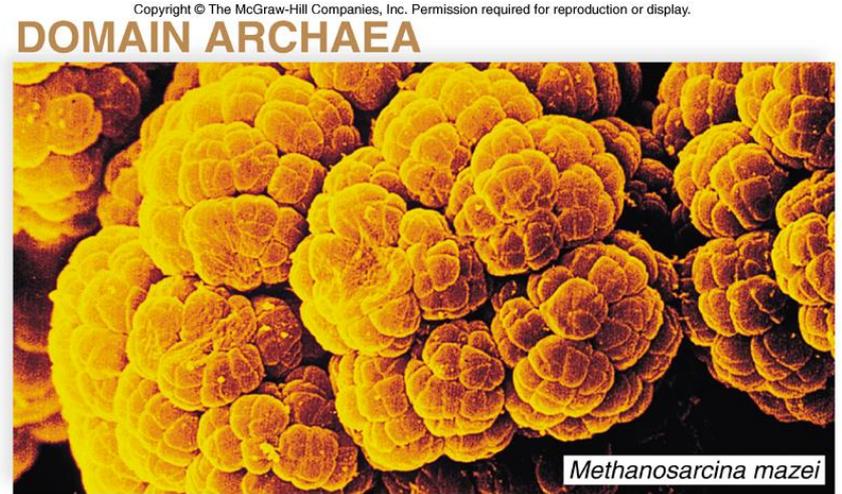
Domains

1. Archaea – ancient “bacteria”, unicellular like bacteria, also simple cell structure (prokaryote – no nucleus) but have distinct metabolism (chemistry) allowing them to exist in “extreme” environments

تختلف الاركيا عن البكتيريا بانها الها حمض اميني
مختلف وانها بتستطيع التكيف والعيش في ظروف
قاسية جدا

مثل التربة المالحة جداً و درجات الحرارة العالية او
المنخفضة الي ممكن توصل لدرجات حرارة بالسالب.

وليس لها نواة (صفة التشابه بينها وبين البكتيريا)



a. Archaea are capable of living in extreme environments.

© Ralph Robinson/Visuals Unlimited

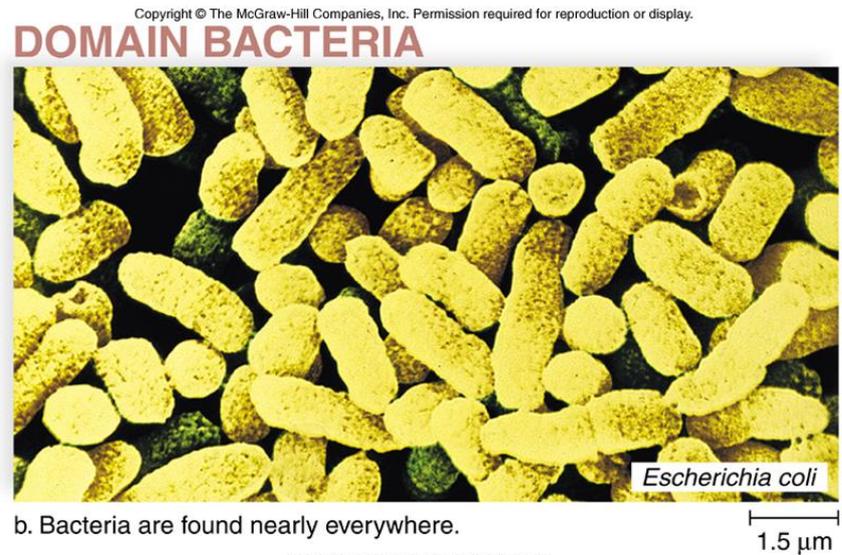
1.6 μm

Domain Bacteria

2-Bacteria are single-celled organisms that lack a membrane-bound nucleus. (Prokaryote also)

- Bacteria are found almost everywhere on the planet Earth.

اما البكتيريا ما فيها نواة
وموجودة بكل مكان في الكرة الارضية
وليس لها القدرة على التكيف مع الظروف القاسية



Domain Eukarya

3. Eukarya – unicellular to multicellular, complex and organized cells with nuclei and organelles (mitochondria)

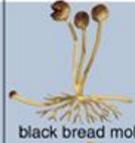
Eukarya are further categorized into one of four Kingdoms.

(know these kingdoms) اما حقيقيات النواة ممكن تكون متعددة النواة او وحيدة النواة

وتنقسم لاربع ممالك

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DOMAIN EUKARYA

Kingdom	Organization	Type of Nutrition	Representative Organisms				
Protista	Complex single cell, some multicellular	Absorb, photosynthesize, or ingest food	 paramecium	 euglenoid	 slime mold	 dinoflagellate	Protozoans, algae, water molds, and slime molds
Fungi	Some unicellular, most multicellular filamentous forms with specialized complex cells	Absorb food	 black bread mold	 yeast	 mushroom	 bracket fungus	Molds, yeasts, and mushrooms
Plantae	Multicellular form with specialized complex cells	Photosynthesize food	 moss	 fern	 pine tree	 nonwoody flowering plant	Mosses, ferns, nonwoody and woody flowering plants
Animalia	Multicellular form with specialized complex cells	Ingest food	 sea star	 earthworm	 finch	 raccoon	Invertebrates, fishes, reptiles, amphibians, birds, and mammals

الطلائعيات

الفطريات

النباتات

الحيوانات

ركزوا ع حفظ ال Kingdom

History of microbiology

هو العالم الي اخترع وابتكر عدسة المجهر

□ **Anton van Leeuwenhoek (1632–1723):** was the first microbiologist and the first person to observe bacteria using a single-lens microscope of his own design.

□ **Louis Pasteur (1822–1895):** Pasteur developed a process (today known as pasteurization) to kill microbes. pasteurization is accomplished by heating liquids to 63 to 65 C for 30 minutes or to 73 to 75 C for 15 seconds.

وهو العالم الي اكتشف طريقة البسترة الي بتقتل الميكروبات الموجودة بالحليب عن طريق التسخين والغلي

Pasteurization: رفع درجة حرارة السائل

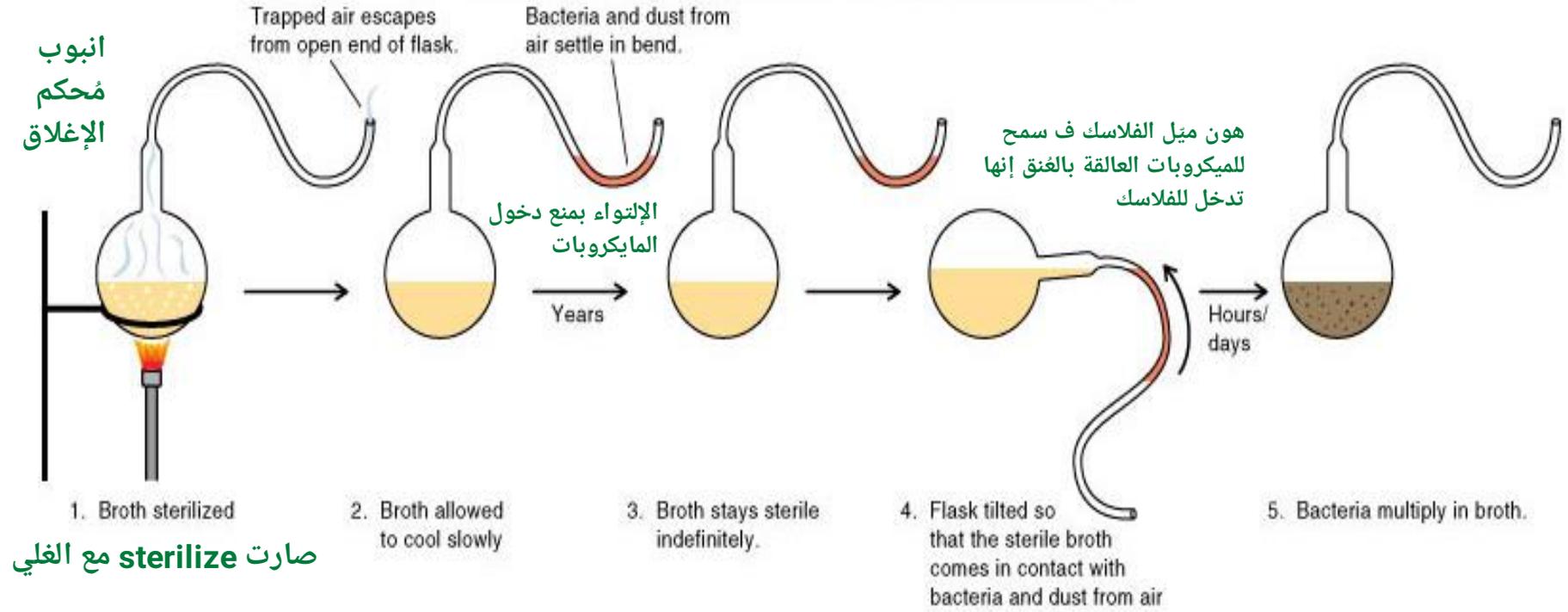
LOUIS PASTEUR (1822 - 1895)

أثبت إنه ما في إشي بنشأ من العدم



- Disproved spontaneous generation of microbes by preventing “dust particles” from reaching the sterile broth
- In 1861 completes experiments that lays to rest spontaneous generation.
- Showed microbes caused fermentation and spoilage
- Considered by many as “Father of Microbiology” : لقبه

PASTEUR'S EXPERIMENT



Pasteur's swan-necked flasks. Broth solutions rich in nutrients were placed in flasks and boiled. The necks of the flasks were heated and drawn out into a curve, but kept open to the atmosphere. Pasteur showed that the broth remained sterile because any contaminating dust and microorganisms remained trapped in the neck of the flask as long as it remained upright.

أثبت بتجربته العملية (غلي الحليب وجمع الميكروبات في الانبوب الملتوي على شكل حرف s) انه الميكروبات لا تنشأ من العدم.

Demonstrations that microorganisms cause disease: **Germ theory**

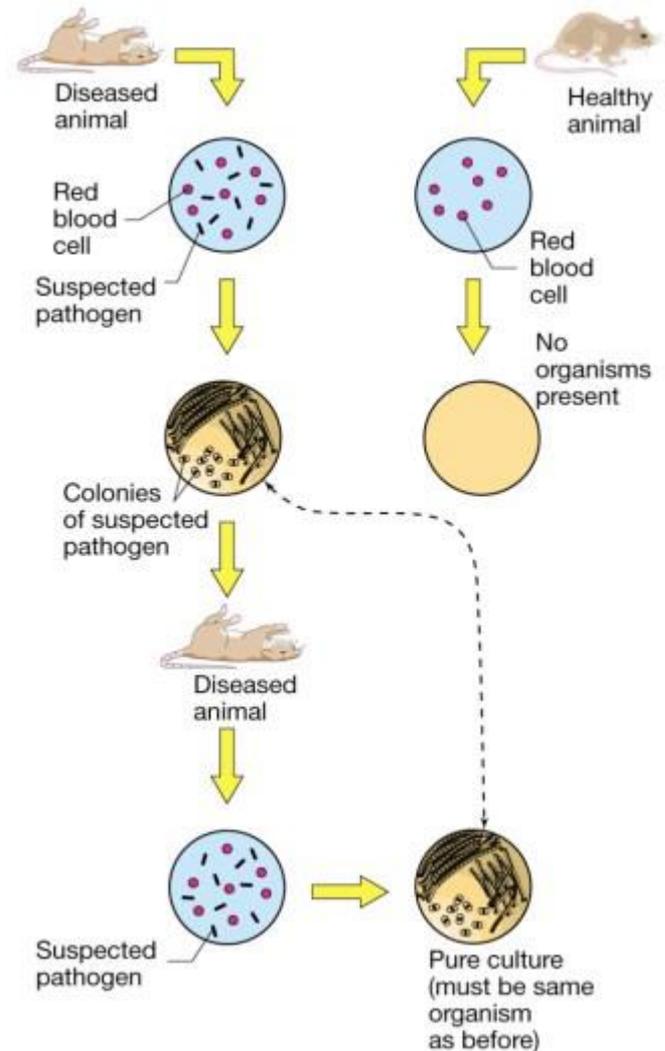
❑ **Robert Koch (1843–1910)**: was a pioneer in medical microbiology and worked in cholera, anthrax and tuberculosis. He was awarded a Nobel prize in 1905 (Koch's postulates) he set out criteria to test.

اما العالم روبرت كوخ كان عنده نظرية والي هي انه في علاقة
مباشرة بين الاصابة بالمرض والعدوى والميكروبات (انتقال العدوى
من الجسم السليم للجسم المريض عن طريق هاي الميكروبات)

- His criteria (is still used) to establish the link between a microorganism and a particular disease that it cause, is known as Koch's postulates.

Koch's Postulates

- 1 The microorganism must be present in every instance of the disease and absent from healthy individuals.
- 2 The microorganism must be capable of being isolated and grown in pure culture.
- 3 When the microorganism is inoculated into a healthy host, the same disease condition must result.
- 4 The same microorganism must be re-isolated from the experimentally infected host.



وكانت التجربة كالآتي
احضر فأرين واحد منهم مصاب عليه علامات واعراض
المرض والثاني سليم
وبعدين اخذ خزعة من دم كل واحد فيهم وشاف انه خزعة
دم الفأر المريض فيها ميكروبات اما الثاني لا

وبعدين نقل جزء من هاي الميكروبات للخزعة السليمة فوجد انها بدأت
بالتكاثر والنمو حتى ظهرت نفس العلامات والاعراض على جسم الفأر
الثاني وصار مريض

وبهاي الطريقة قدر يثبت نظريته بانه الميكروبات هي
المسؤولة عن نقل العدوى المسببة للامراض بين الاجسام
السليمة والمصابة

History of Microbiology – Aseptic Technique- Joseph Lister

- He is popularly known as “Father of antiseptic surgery”.
- He was deeply interested in the prevention of postoperative sepsis.
- He was attracted by Pasteur’s germ theory of disease and concluded that sepsis or wound infection may be due to microbial growth derived from the atmosphere.

هذا العالم كان المسؤول عن العمليات الي كانوا يستخدمو فيها الادوات المعقمة عشان ما يصير نقل لاي بكتيريا او ميكروبات وتسبب الامراض (عمليات التعقيم)



ALEXANDER FLEMING

In 1928 Fleming observed that the growth of the bacterium *staphylococcus aureus* was inhibited in the areas surrounding the colony of a mold that had contaminated a Petri plate. The mold was identified as *Penicillium notatum*, and its active compound was named penicillin.

أما العالم فليمينغ فهو المسؤول عن اكتشاف البنسلين الناتج من البكتيريا

Flemming and Penicillium



طريقة تصنيف وتسمية ال microorganisms

Naming and Classifying microorganisms

- Linnaeus system for scientific nomenclature
- Each organism has two names:
 - 1) Genus حسب الجنس
 - 2) Specific epithet حسب الكنية

Scientific Names

ممکن يكون الاسم مقسم لجزئين او اكثر
لكن بالعادة يكونو 2

- Italicized or underlined.

The genus is capitalized, and the specific epithet is with lowercase

ببدأ بأول مقطع من الاسم ولازم يكون اول حرف من الكلمة كبير

- Could be as an honor for the scientist والمقطع الثاني لازم يكون اول حرف منه صغير

- A Latin origin

وبكتب الاسم كامل بخط مائل
اذا ما قدرنا نكتب بخط مائل بنقدر نكتبها بشكل العادي ونحط خط تحت
كل كلمة بنكتبها

e.g. *Escherichia coli* (*E. coli*)

In intestine

- discoverer: Theodor Escherich
- describes the habitat (colon/intestine)

e.g. *Staphylococcus aureus* (*S. aureus*)

On skin

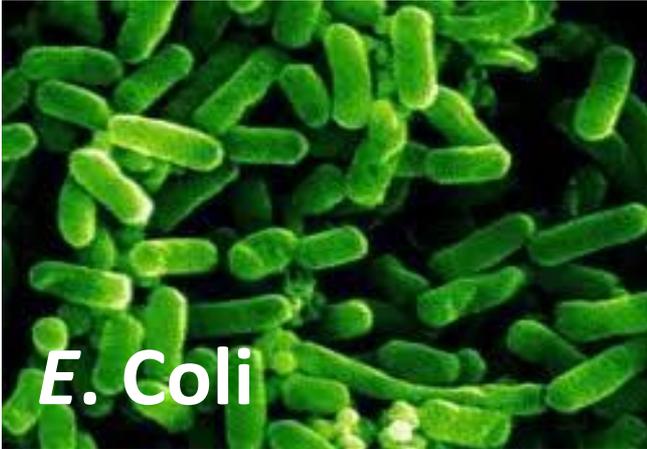
- Clustered (staphylo), spherical (cocci)
- Gold colored colonies (aureus)

Scientific Names

Scientific Binomial	Source of Genus Name	Source of Specific Epithet
<i>Klebsiella pneumoniae</i>	Honors Edwin Klebs	The disease
<i>Streptococcus pyogenes</i>	Chains of cells (<i>strepto-</i>)	Forms pus (<i>pyo-</i>)
<i>Penicillium chrysogenum</i> شكلاها بشبه ال brush	Tuftlike (<i>penicill-</i>) شكل المفتاح	Produces a yellow (<i>chryso-</i>) pigment
<i>Trypanosoma cruzi</i>	Corkscrew-like (<i>trypano-</i> , borer; <i>soma-</i> , body)	Honors Oswaldo Cruz

هذا جدول بوضحي كل بكتيريا او ميكروب كيف تسمت وبناءا على شو (حسب الشكل، الترتيب، اللون وهكذا)

Scientific Names



E. Coli



Staph. aureus



Penicillium chrysogenum



Trypanosoma cruzi

5 micrometers

Scientific Names

الاسماء علمية وبناءا على ماذا تم تسميتها

Genera named after individuals:

حسب اسم العالم الي اكتشفها

Escherichia coli: Theodore escherich invented the bacteria which causes disease in colon.

Neisseria gonorrhoea: Albert Neisser discovered the bacteria which causes gonorrhoea.

Scientific Names

Genera named after Microbe's shape:

Vibrio cholerae:

حسب شكل الميكروب

Bacteria is comma shaped which causes cholera.

Staphyococcus epidermidis:

Staphylo means clusters; coccus means spheres.

Genera named after Attribute of the Microbe:

Saccharomyces cerevisiae:

حسب ال action

Saccharo means sugar; Myces means fungus; cerevisiae means beer. yeast which converts sugar in the sample into Alcohol.

How do we view microorganisms?

- Units of measurement

ممکن نستخدم النانومتر والميكرومتر لقياس حجمهم

When talking about cells and microscopic organisms, you would be measuring using **MICROMETRE** (abbreviated: μ --micron) or stated as: μm (micrometer).

$$1 \mu\text{m} = 1 \times 10^{-6} \text{ meters} / 1 \times 10^{-3} \text{ mm}$$

$$1 \text{ mm} = 1 \times 10^6 \text{ nanometers} / 1 \times 10^3 \mu\text{m}$$

To give you the idea of how small a micro metre is,

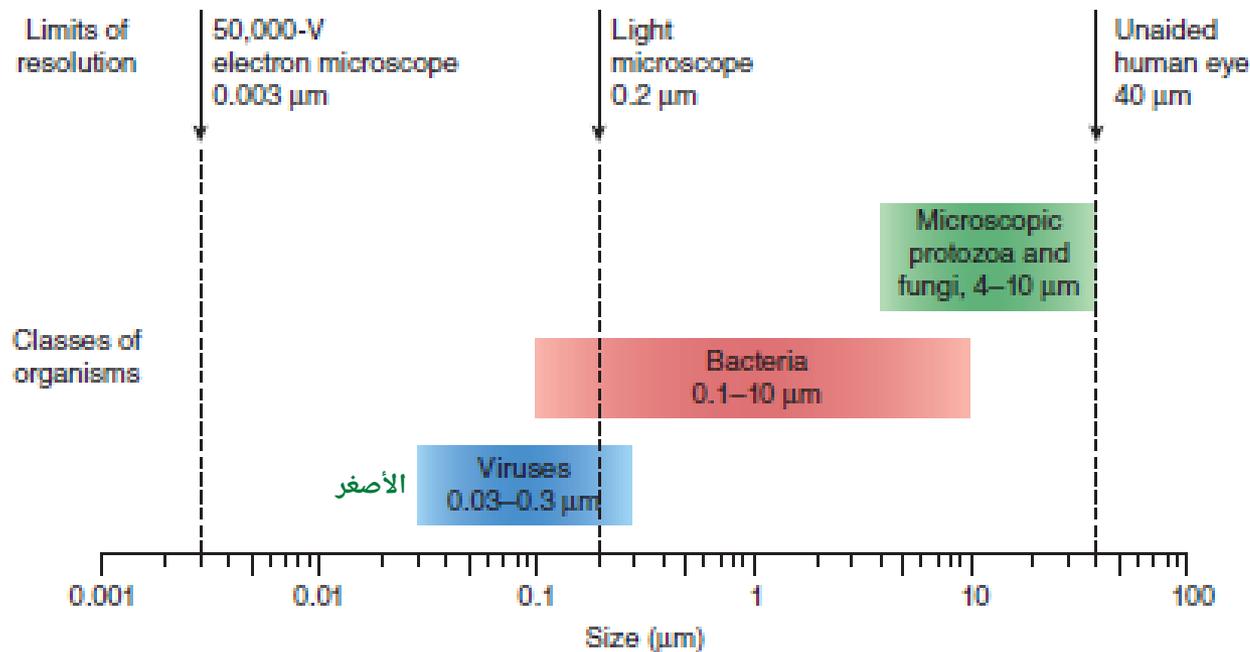
1- a human hair is about $100 \mu\text{m}$, wide,

2 a red blood cell would be around $8 \mu\text{m}$ wide

3 typical size of an animal cell would be from $10 - 100 \mu\text{m}$

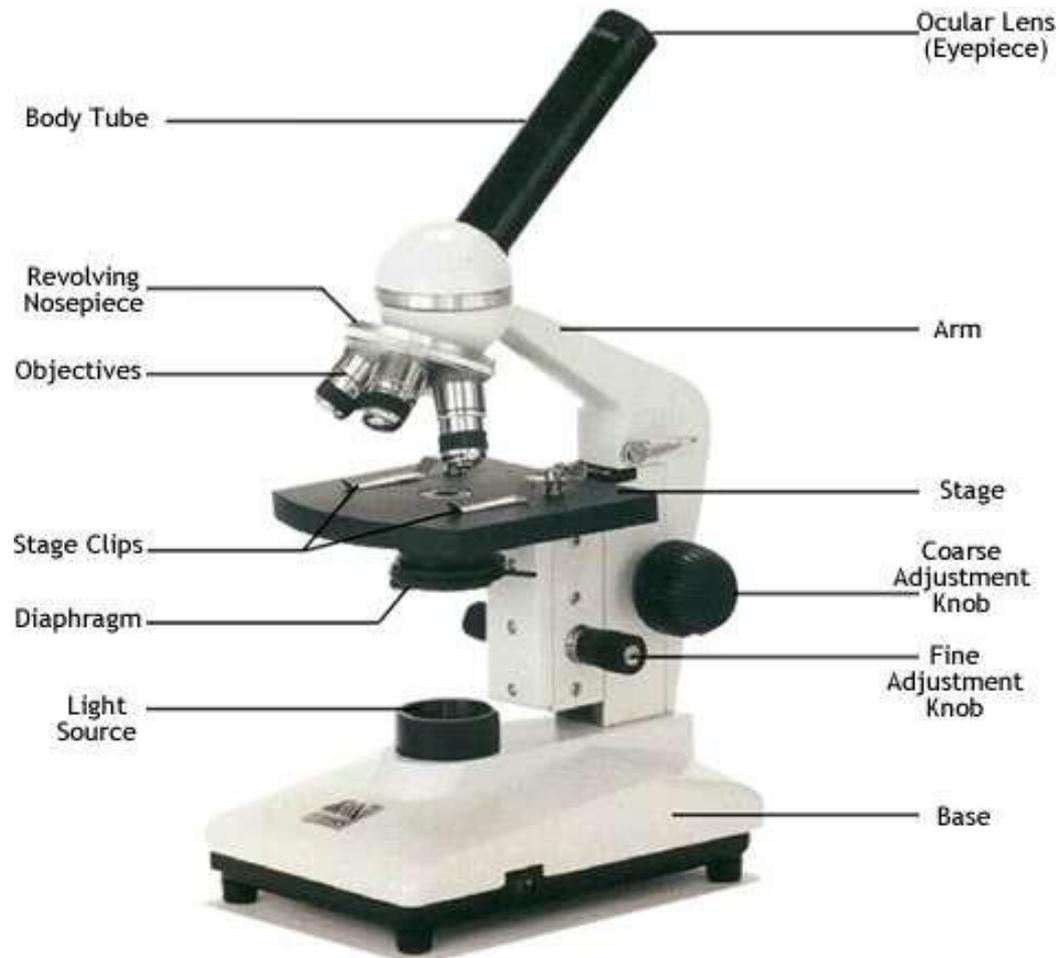
(مش للحفظ)

Relative size of microorganisms.



Microscope

light microscope



حفظ الجدول

Parts of the Microscope

Parts	Functions
Eyeiece	To observe specimen. Contains two or more lenses. The most common magnification for the eyepiece is 10X. There are also 2x and 5x. An eye piece is a removable, can be interchanged for different magnification.
Objective Lenses	More than one objective lenses. These are the primary lenses of a compound microscope and can have specific magnification
Stage	The platform below the objective lens on which the object to be viewed is placed. A hole in the stage allows light beam to pass and illuminate the specimen.
Stage Clips	There are two stage clips one on each side of the stage. Once the slide containing the specimen is placed on the stage, the stage clips are used to hold the slide in place.
Diaphragm	It is located on the lower surface of the stage. It is used to control the amount of light that reaches the specimen through the hole in the stage.
Illuminator	is the light source for a microscope , typically located in the base of the microscope . Most light microscopes use low voltage, halogen bulbs with continuous variable lighting control located within the base.
The Adjustments	2 adjustment knobs: fine adjustment & coarse adjustment knob; refine the focus of the lenses. The coarse adjustment knob helps in improving the focus of the low powers whereas the fine adjustment knob helps in adjusting the focus of the lenses with higher magnification.

Types of Microscopes

الفرق بين كل نوع :

Light Microscope - found in most schools, use compound lenses and light to magnify objects. The lenses bend or refract the light, which makes the object beneath them appear closer.

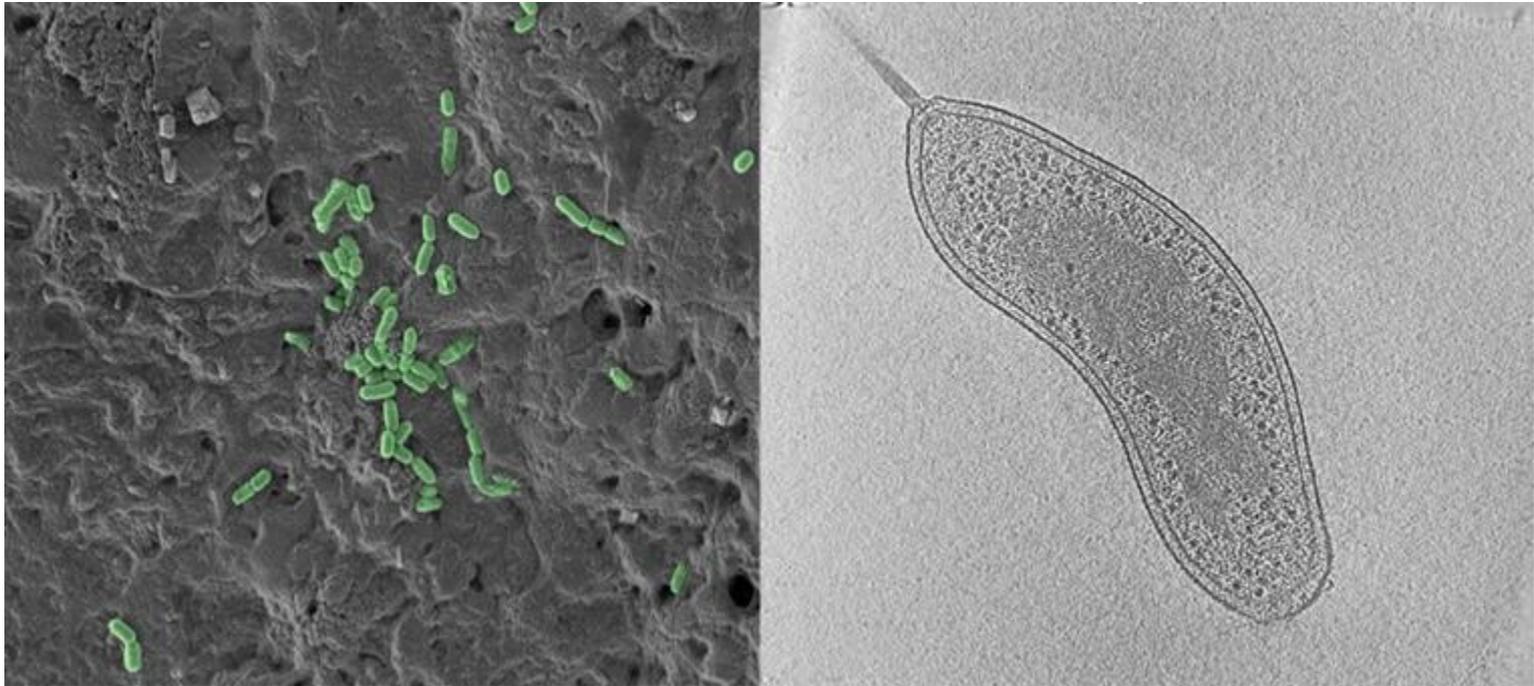
Scanning Electron Microscope - allow scientists to view a universe too small to be seen with a light microscope. SEMs do not use light waves; they use electrons (negatively charged electrical particles) to magnify objects

الي يعتمد فيه على الالكترونات كمصدر للطاقة

Transmission Electron Microscope - also uses electrons, but instead of scanning the surface (as with SEM's) electrons are passed through very thin specimens. Specimens may be stained with heavy metal salts

بقدر اشوف فيه اكبر قدر ممكن من التفاصيل

Electron microscope: is the best and higher resolution



SEM (left) and TEM (right) images of bacteria. Whereas SEM shows numerous bacteria on a surface (green), the TEM image shows the interior structure of a single bacterium



Artery Academy

دعواتكم

زميلتكم انغام صلاحات 