وزارة التعليم العالي والبحث العلمي
الجامعة التقنية الشمالية
المعهد التقني الطبي كركوك

الحقيبة التعليمية

القسم العلمي:

اسم المقرر:احياء مجهرية

المرحلة / المستوى:

الفصل الدراسي: الاول

السنة الدراسية: 2024-2025

معلومات عامة

اسم المقرر:	**احياء مجهرية**
القسم:	تقنيات الصيدلة
الكلية:	المعهد التقني كركوك
المرحلة / المستوى	الاول
الفصل الدراسي:	الاول
عدد الساعات الاسبوعية:	نظري 2 عملي 2
عدد الوحدات الدراسية:	4
الرمز:	
نوع المادة	نظري عملي كلهما كلاهما
هل يتوفر نظير للمقرر في الاقسام الاخرى	كلا
اسم المقرر النظير	لا يوجد
القسم	
رمز المقرر النظير	

معلومات تدريسي المادة

اسم مدرس (مدرسي) المقرر:	د. يوكسل عزالدين سويد
اللقب العلمي:	**مدرس**
سنة الحصول على اللقب	2022
الشهادة :	**دكتوراه**
سنة الحصول على الشهادة	**2022**
عدد سنوات الخبرة (تدريس)	**23**

الوصف العام للمقرر

علم الاحياء المجهرية هو فرع من فروع علم الاحياء الدقيق الذي يدرس الكائنات الحية الدقيقة والتي تشمل البكتريا والفيروسات والطفليات والفطريات ويركز هذا العلم على فهم تراكيبها وأثيراها على البيئة والانسان

الاهداف العامة

فهم الكائنات الدقيقة مثل البكتريا والفايروسات والفطريات والطفليات

- تشخيص الامراض من خلال التعلم على اجراء الفحوصات المختبرية اللازمة
- مكافحة العدوى من خلال دراسة كيفية السيطرة على انتشار الامراض المعدية مثل المطهرات، اللقاحات و المضادات الحياتية

الأهداف الخاصة

- التعرف على تصنيف الكائنات المجهرية .
- فهم نمو الكائنات المجهرية ودراسة العوامل التي تؤثرعلى نمو الكائنات الدقيقة مثل البيئة ودرجة الحرارة والرطوبة .
- دراسة التفاعل بين المضيف والمرضمع جسم المضيف واسباب حدوث الامراض .
- تعلم تقنيات التشخيص المختبري باستخدام الاساليب والتقنيات الميكروبيولوجية المتقدمة

الأهداف السلوكية او نواتج التعلم

- التعرف على تحديد الخصائص المميزة للكائنات المجهرية
- فهم اليات التسبب في الامراض وكيفية تفاعل الكائنات الدقيقة مع المضيف
- التطبيق النظري للمفاهيم واستخدام الاحياء الدقيقة في التطبيقات الطبية
- **أمثلة أهداف تدريسية:**

بعد الانتهاء من الدرس (المحاضرة) سيكون الطالب قادرا على ان:

- اكتساب المعرفة الاساسية من حيث التعرف على الكائنات المجهرية .
- فهم الخصائص البيولوجية والوظيفية للكائنات المجهرية
- تحليل الابحاث العلمية
- تعزيز الوعي البيئي واستغلال الاحياء المجهرية في معالجة النفايات.

المتطلبات السابقة

- لا يوجد

الأهداف السلوكية او مخرجات التعليم الأساسية		
ت	تفصيل الهدف السلوكي او مخرج التعليم	آلية التقييم
1	يستطيع الطالب تحديد انواع الكائنات الدقيقة المختلفة وفهم الخصائص الاساسية.	اختبار شفهي وتحريري
2	يستطيع الطالب فهم اليات انتقال الامراض المعدية بين البشر وطرق انتشارها	تقارير علمية
3	القدرة على استخدام التقنيات الميكروبيولوجية الاساسية مثل الزراعة والتلوين والتحليل المجهري	نقاشات ومناظرات طلابية
4	يتعرف الطالب على اهمية الوقاية والسيطرة على العدوى في البيئات السريرية	اخيبار اليكتروني

أساليب التدريس (حدد مجموعة متنوعة من أساليب التدريس لتناسب احتياجات الطلاب ومحتوى المقرر)

	الاسلوب او الطريقة	مبررات الاختيار
1.	محاضرات تفاعلية	يتيح للطالب فهم المادة مع فرصة للتفاعل والنقاش
2.	مشاريع طلابية	يعزز التعلم العملي والتفكير النقدي وتطبيق المعرفة النظرية
3.	استخدام عرض الفيديوهات والعروض التقديمية	تجعل وصول المعلومة للطالب اكثر وضوحا
4.	استخدام منصات التعليم الاليكتروني	يتيح للطالب وصول الى المواد التعليمية في اي وقت

الفصل الاول من المحتوى العلمي						
عنوان الفصل	الوقت		العنوان الفرعي		طريقة التدريس	التقنيات	طرق القياس
التوزيع الزمني	النظري	العملي					
الأسبوع الأول	2	2	العناوين الفرعية				
			Harmful Microorganisms	Hıstory of mıcrobıology	تعليم مدمج	عرض تقديمي، اسئلة واجوبة ومناقشة	اختبار شفهي
			Branches of Microbiology				
الاسبوع الثاني	2	2	**Microbial cell structure**	**Bacterıal cell and typpes**	تعليم مدمج	عرض تقديمي ومناقشة	اختبار تحريري
			Prokaryotic cells				
			- Eukaryotic cells				
الا سبوع الثالث	2	2	**nutrıtıon**	Bacterıal physıology	تعليم مدمج	عرض تقديمي ومناقشة	تقارير
			metabolısm				
			aborsition				

الفصل الثاني							
عنوان الفصل	الوقت						
التوزيع الزمني	النظري	العملي	العنوان الفرعي		طريقة التدريس	التقنيات	طرق القياس
	2 ساعة	2	العناوين الفرعية		محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	
الأسبوع الرابع	2	2	**Methods of microbial inhibition**	Sterilization and disinfected	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار اليكتروني
			Chemical Disinfectants				
الأسبوع الخامس	2	2	Define bacterıatology	bacteriology	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار اليكتروني
			classification				
الاسبوع السادس	2	2	Types and cladsdıfıcatıon and dıseases and treatment	Gram negatıve bacterıa	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار اليكتروني
الاسبوع السابع	2	2	Types and classification and dieases and treatment	Gram postıve bacterıa	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار اليكتروني

الفصل الثالث							
عنوان الفصل	الوقت						
التوزيع الزمني	نظري	عملي	العنوان الفرعي		طريقة التدريس	التقنيات	طرق القياس
الأسبوع الثامن.	2	2	Identification of bacteria	Methods of identification	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اسئلة العصف الذهني
الأسبوع التاسع	2	2	mycology	Define and classıfıcatıon	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار ورقي
الاسبوع العاشر	2	2	mycology	Shapes and types and dıseases	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	حلقة نقاشية
الاسبوع الحادي عشر	2	2	parasıtology	Define parasıtology	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	واجب بيتي
الاسبوع الثاني عشر	2	2	parasıtology	Worm , heliment, protosoa	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار ورقي
الاسبوع الثالث عشر	2	2	vırology	Define and classification	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	جلسة نقاشية
الاسبوع الرابع عشر	2	2	vırology	Types of vıruses and how to work	محاضرة	عرض تقديمي، شرح، أسئلة وأجوبة، مناقشة	اختبار ورقي
الاسبوع الخامس عشر	الامتحان النهائي						

المحتوى العلمي

خارطة القياس المعتمدة

المحتويات (لكل فصل في المقرر)

رقم المحاضرة:	
عنوان المحاضرة:	microbiology
اســـم المدرس:	يوكسل عزالدين سويد
الفئة المستهدفة :	طلبة المستوى الاول
الهدف العام من المحاضرة :	
الأهداف السلوكية او مخرجات التعلم:	1- التعرف على معنى الاحياء المجهرية 2- من جاءت وكيف اكتشفت 3- التركيب البنائي والخلوي لها
استراتيجيات التيسير المستخدمة	
المهارات المكتسبة	
طرق القياس المعتمدة	

4 - الاسئلة القبلية

1- Microbiology studies organisms invisible to the naked eye. True
2- Microbes were the only life forms on Earth 3 billion years ago. True
3- All microorganisms are harmful. False
4- Bacteriology is the study of viruses. False
5- Prokaryotic cells have a nucleus. False

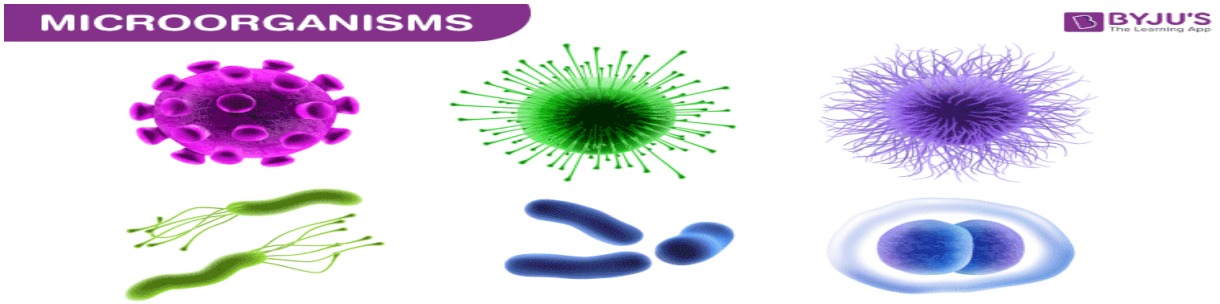
Microbiology

Microbiology is the study of a variety of living organisms which are invisible to the naked eye like bacteria and fungi and many other microscopic organisms.

Although tiny in size these organisms form the basis for all life on earth. These microbes are also known to produce the soil in which plants grow and fix the atmospheric gases that both plants and animals use. About 3 billion years ago at the time of the formation of the earth, microbes were the only lives on earth. Microorganisms have played a key role in the evolution of the planet earth. The history and scope of microbiology is a diverse topic which will be discussed later in detail.

Microorganisms affect animals, the environment, the food supply and also the healthcare industry. There are many different areas of microbiology including environmental, veterinary, food, pharmaceutical and medical microbiology, which is the most prominent.

Microorganisms are very important to the environment, human health and the economy. Few have immense beneficial effects without which we could not exist. Others are really harmful, and our effort to overcome their effects tests our understanding and skills. The uses of microbiology can be beneficial or harmful depending on what we require from them.



Harmful Microorganisms

Disease and decay are neither inherent properties of organic objects, nor are caused by physical damage, it is microorganisms that bring about these changes. We are surrounded by bacteria, viruses, and fungi. Many microorganisms cause diseases in cattle, crops and others are known for entering human bodies and causing various diseases.

Branches of Microbiology

There are various different branches of microbiology and these include the following:

1. Bacteriology- The study of bacteria

2. Mycology –The study of fungi

3. Phycology- The study of photosynthetic eukaryotes. (Algae- Seaweed)

4. Protozoology – The study of protozoa (Single-celled eukaryotes)

5. Virology- The study of viruses, non-cellular particles which parasitize cells.

6. Parasitology- The study of parasites which include pathogenic protozoa certain insects and helminth worms.

7. Nematology- The study of nematodes

Bacteria: pneumonia, bacterial dysentery, diphtheria, bubonic plague, meningitis, typhoid, cholera, salmonella, meningococcal

Virus: Chickenpox, measles, mumps, German measles, colds, warts, cold sores, influenza

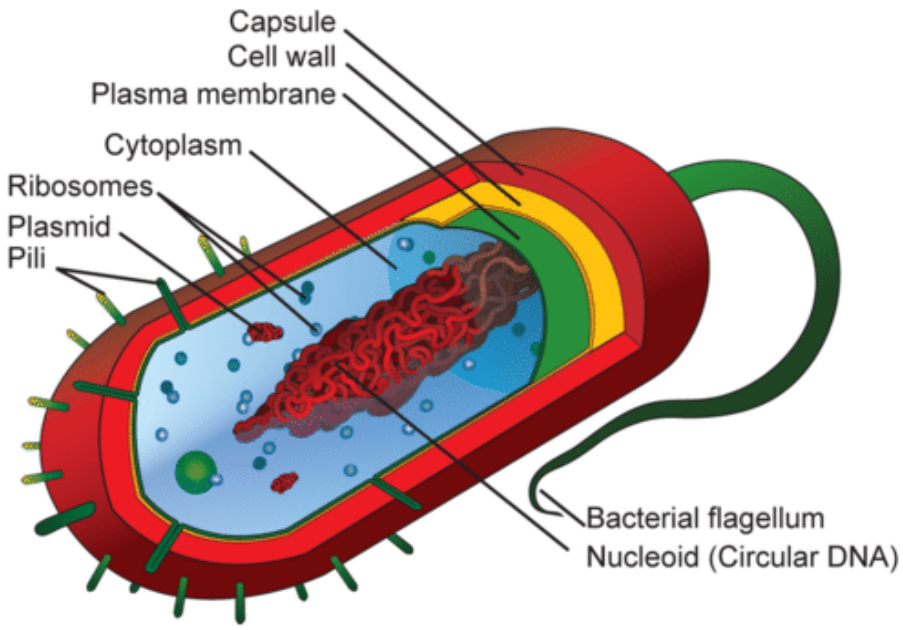
Protozoa: amoebic dysentery, malaria,

Fungi: ringworm, athlete's foot

Microbial cell structure:

There is another basic cell structure that is present in many but not all living cells: the nucleus. The **nucleus** of a cell is a structure in the cytoplasm that is surrounded by a membrane (the nuclear membrane) and contains, and protects, most of the cell's DNA. Based on whether they have a nucleus, there are two basic types of cells: prokaryotic cells and eukaryotic cells.

1- Prokaryotic cells: are cells without a nucleus. The DNA in prokaryotic cells is in the cytoplasm rather than enclosed within a nuclear membrane. Prokaryotic cells are found in single-celled organisms, such as bacteria



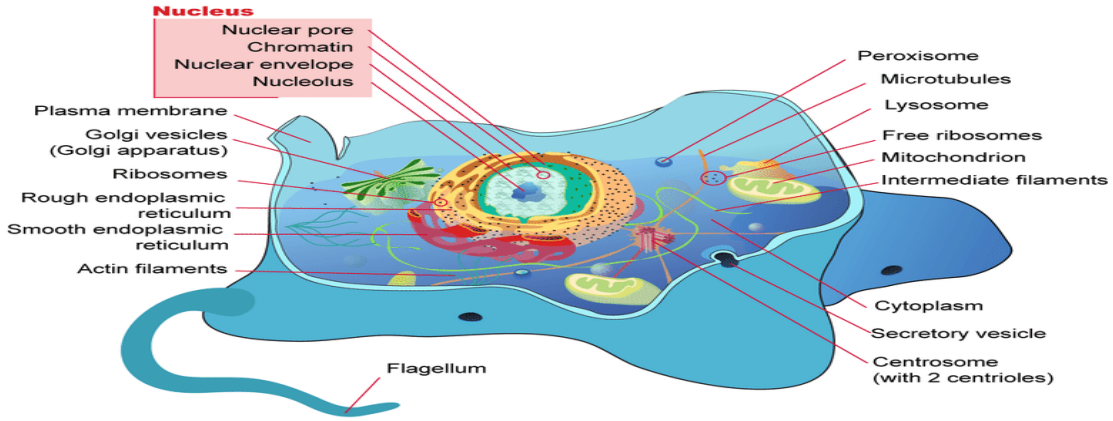
Prokaryotic cell features

1. **Nucleoid:** A central region of the cell that contains its DNA.
2. **Ribosome:** Ribosomes are responsible for protein synthesis.
3. **Cell wall:** The cell wall provides structure and protection from the outside environment. Most bacteria have a rigid cell wall made from carbohydrates and proteins called peptidoglycans.
4. **Cell membrane:** Every prokaryote has a cell membrane, also known as the plasma membrane, that separates the cell from the outside environment.
5. **Capsule:** Some bacteria have a layer of carbohydrates that surrounds the cell wall called the capsule. The capsule helps the bacterium attach to surfaces.
6. **Fimbriae:** Fimbriae are thin, hair-like structures that help with cellular attachment.

7. Pili: Pili are rod-shaped structures involved in multiple roles, including attachment and DNA transfer.

8. Flagella: Flagella are thin, tail-like structures that assist in movement.

2- Eukaryotic cells are cells that contain a nucleus. Eukaryotic cells are usually larger than prokaryotic cells, and they are found mainly in multicellular organisms. Organisms with eukaryotic cells are called **eukaryotes**, and they range from fungi to people.



Eukaryotic cell features

1. **Nucleus:** The nucleus stores the genetic information in chromatin form.
2. **Nucleolus:** Found inside of the nucleus, the nucleolus is the part of eukaryotic cells where ribosomal RNA is produced.
3. **Plasma membrane:** The plasma membrane is a phospholipid bilayer that surrounds the entire cell and encompasses the organelles within.
4. **Cytoskeleton or cell wall:** The cytoskeleton or cell wall provides structure, allows for cell movement, and plays a role in cell division.
5. **Ribosomes:** Ribosomes are responsible for protein synthesis.
6. **Mitochondria:** Mitochondria, also known as the powerhouses of the cell, are responsible for energy production.

7. **Cytoplasm:** The cytoplasm is the region of the cell between the nuclear envelope and plasma membrane.

8. **Cytosol:** Cytosol is a gel-like substance within the cell that contains the organelles.

9. Endoplasmic reticulum: The endoplasmic reticulum is an organelle dedicated to protein maturation and transportation.

10. Vesicles and vacuoles: Vesicles and vacuoles are membrane-bound sacs involved in transportation and storage.

Compare between Prokaryote and Eukasryote

	prokaryote	**Eukaryote**
Nucleus	Absent	Present
Membrane-bound organelles	Absent	Present
Cell structure	Unicellular	Mostly multicellular; some unicellular
Cell size	Smaller (0.1-5 µm)	Larger (10-100 µm)
Complexity	Simpler	More complex
DNA Form	Circular	Linear
Examples	Bacteria, archaea	Animals, plants, fungi, parasite

Types of bacterial spore

1. Endospore:

It is produced within the bacterial cell. Bacteria producing endospore are: *Bacillus, Clostridium*

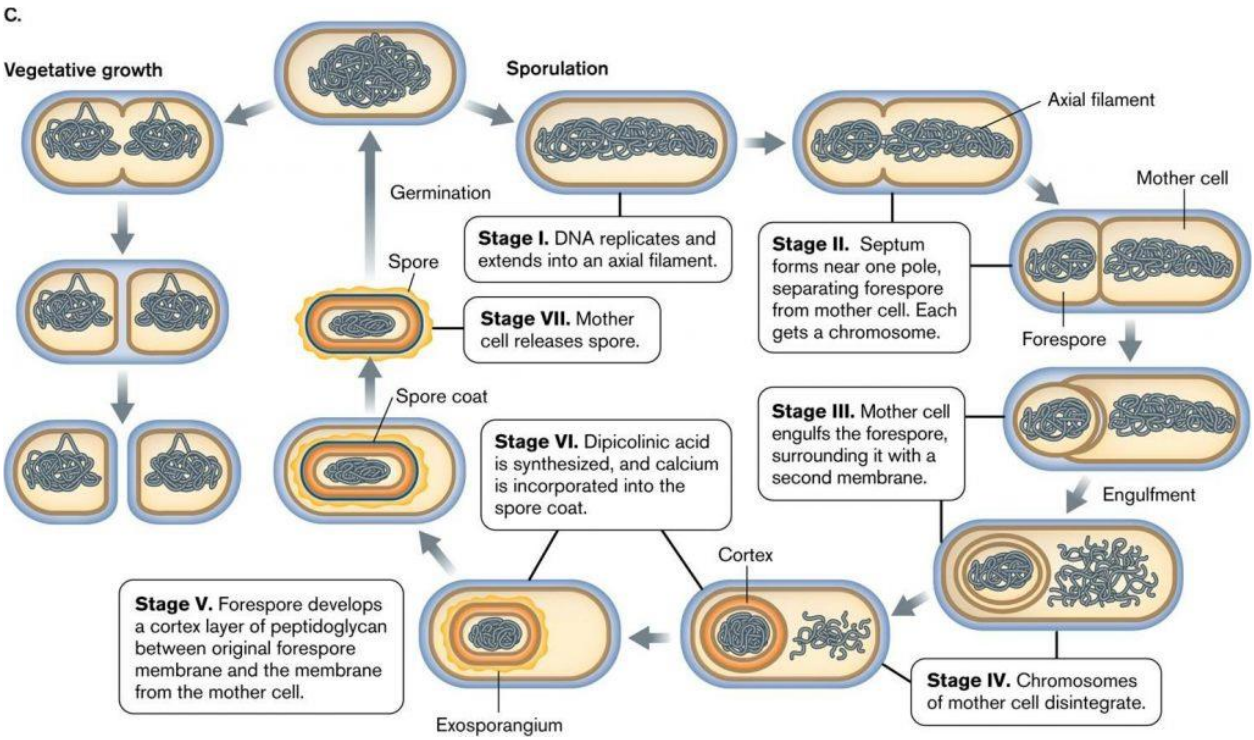
2. Exospore:

It is produced outside the cell. Bacteria producing exospore: *Methylosinus*

Sporulation

During unfavorable condition, vegetative cell converts into spore by the process known as **sporulation**. Sporulation can be divided into several stages. In *Bacillus subtilis*, entire process of sporulation takes 8 hours to complete from stage 0 to stage VII

Stages of sporulation:



Stage 0

- Normal conditions of a vegetative cell

Stage I: Axial filament formation stage

- In this stage bacterial chromosome become thread like known as axial filament
- Axial filaments attached to cytoplasmic membrane by mesosome
- Elongation of cell take places
- PHBA is the reserved food material in *Bacillus spp* is utilized in sporulation.

Stage II: forespore formation

- Asymmetric cell division occurs
- Cell membrane forms septum near one end which encloses a small portion of DNA forming forespore

Stage III: engulfment of forespore

- Mother cell membrane grow around the forespore engulfing it.
- Fore spore now has two membrane layer

Stage IV: synthesis of exosporium

- Chromosome of mother cell disintegrates
- Exosporium synthesis occurs
- Forespore starts Forming primodial cortex between two membrane.
- Dehydration of cell

Stage V: synthesis of dipicolonic cacid

- Production of SASPs and dipicolinic acid occurs
- Incorporation of calcium ions with dipicolonic acid occur forming calcium dipicolonate
- Further dehydration of cytoplasm

- Formation of coat layer

Stage VI: maturation

- Maturation of endospore

Stage VII: release of endospore

- Cell lysis and release of endospore

Spore germination

Endospore remains dormant for years. But under favorable conditions each endospore germinates to give rise to a vegetative cell.

Spore germination involves 3 process.

1. Activation
2. Germination
3. Outgrowth

1- Activation of endospore:

The germination of bacterial spore do not occur even when the environment is favorable unless it is first activated. At first the Spore coat must be damaged by heating for several minutes.

2- Germination:

The activated spore initiates germination after binding of effector molecules. Binding of effectors molecules activates autolysis that destroy peptidoglycan of cortex. After destruction of peptidoglycan, water is taken up and calcium dipicolinic acid is released.

3- Outgrowth:

After uptake of water swelling of spore occurs. Along with swelling, synthesis of DNA, RNA and proteins also occurs. A small germ cell emerges out after breaking the Spore coat and begins to grow into vegetative cell.

Microbial growth inhibition

In microbiology, growth inhibition procedures are laboratory techniques that prevent the ability of microorganism to grow.

Methods of microbial inhibition

1- Sterilization

2- Disinfection

1- Sterilization: Sterilization is defined as a process of complete elimination or destruction of all forms of microbial life (i.e., both vegetative and spore forms), which is carried out by various physical and chemical methods. Technically, there is reduction $\geq 10^6$ log colony forming units (CFU) of the most resistant spores achieved at the half-time of a regular cycle.

Methods of Sterilization

1- Heat Method

The heat method is the most commonly used method of sterilization. The process uses high temperatures to kill microorganisms in the substance. The degree of sterilization is affected by the heating temperature and heating duration. Thermal processes are classified according to the type of heat used, which are

a- wet heat/steam Sterilization

b- dry heat sterilization.

2- Chemical Method

The heating method provides a reliable way to remove all microorganisms, but it is not always reasonable because it may damage the sterilization material, which is when chemical sterilization methods are used.

The procedure uses harmful liquids and toxic gases that do not affect the materials. Sterilization with gas is effective because it, like steam, can penetrate the material quickly. There are certain risks associated with the chemical method of sterilization, like explosions, and the cost may also be of concern using this method.

3- Filtration

Filtration is the fastest way to sterilize a solution without heating. The pore size used in this method is too small to filter microorganisms.

Filters with a pore size of 0.2 µm are usually used to remove bacteria. Membrane filters are more commonly used than sintered filters or Seitz filters or candle filters. It should be noted that viruses and phages are much smaller than bacteria, so when they are in the foreground, filtering methods are not applicable.

4- Radiation Sterilization

In this process, packaging materials are exposed to radiation (ultraviolet rays, X-rays, gamma rays) for sterilization. The main difference between different types of radiation is their penetrability and effectiveness.

a- Ultraviolet rays have poor penetration, so the effect is poor, but it is relatively safe and can be used for small-area disinfection. Ultraviolet radiation is usually used to disinfect the inside of a biological safety cabinet between uses

b- X-rays and gamma rays have much stronger penetrating power, so they are more effective for large-scale sterilization. However, they are more dangerous, so special attention is required.

- **X-rays** are used to sterilize large packages and pallet loads of medical devices.
- **Gamma radiation** is commonly used to sterilize disposable medical devices (such as syringes, needles, cannulas, and IV infusion sets) and food.

2- Disinfection: Disinfection is defined as a process of complete elimination of vegetative forms of microorganisms except the bacterial spores from inanimate objects. Technically, there is reduction of $\geq 10^3$ log CFU of microorganisms by this method without spores.

Methods of Disinfection

a- **Chemical Disinfectants**

- Alcohol
- Chlorine and chlorine compounds
- Formaldehyde
- Glutaraldehyde
- Hydrogen peroxide
- Iodophors
- Ortho-phthalaldehyde (OPA)
- Peracetic acid
- Peracetic acid and hydrogen peroxide
- Phenolics
- Quaternary ammonium compounds

b- **Miscellaneous Inactivating Agents**

- Other germicides
- Metals as microbicides
- Ultraviolet radiation
- Pasteurization
- Flushing- and washer-disinfectors

Bacterial Growth

Bacteria are unicellular organisms that tend to reproduce asexually by the means of binary fission. Bacterial growth is the increase in the number of bacterial cells rather than the increase in their cell size.

Growth Curve

In a closed system with enough nutrients, a bacteria shows a predictable growth pattern that is the bacterial growth curve.

Phases of the Bacterial Growth Curve

1- **Lag Phase**

The bacteria upon introduction into the nutrient medium take some time to adapt to the new environment. In this phase, the bacteria does not reproduce but prepares itself for reproduction. The cells are active metabolically and keep increasing in size. The cells synthesis RNA, growth factors and other molecules required for cell division.

2- Log Phase

The log phase is also known as the exponential phase. This phase is marked by the doubling of the bacterial cells. The cell number increases in a logarithmic

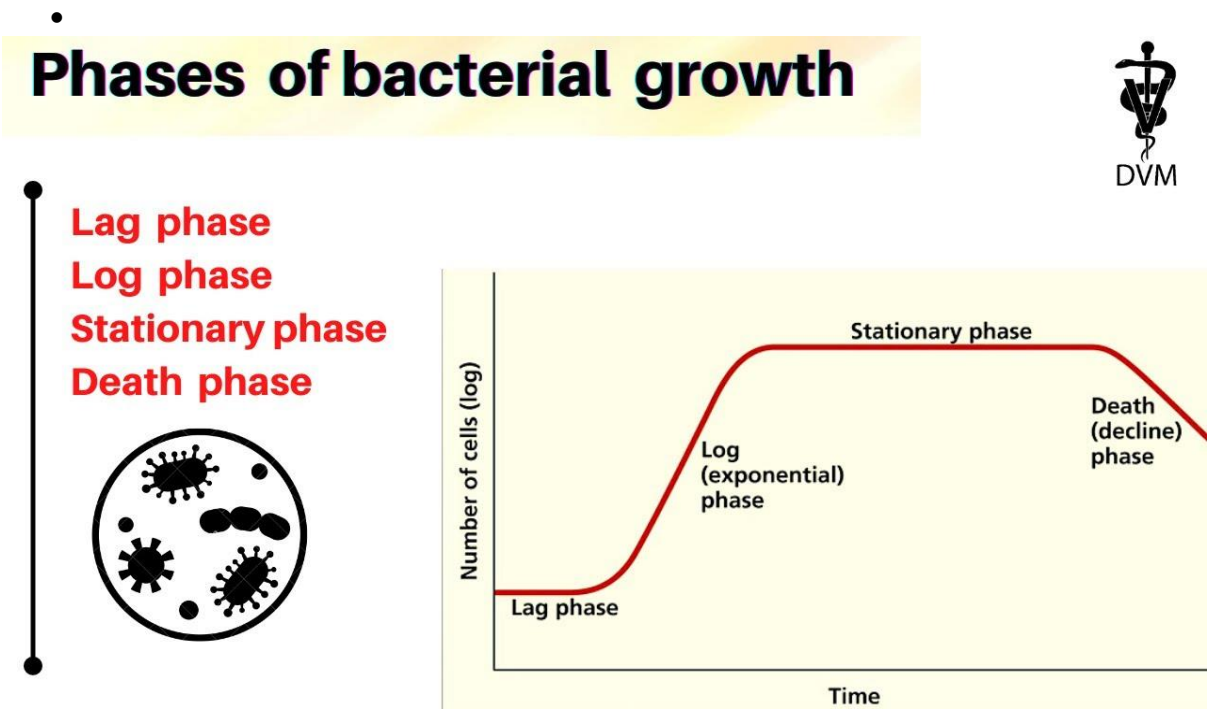
fashion such that the cell constituent is maintained. The log phase continues until there is depletion of nutrients in the setup. The stage also comes to a stop if toxic substances start to accumulate, resulting in a slower growth rate.

3- Stationary Phase

In the stationary phase, the rate of growth of the cells becomes equal to its rate of death. The rate of growth of the bacterial cells is limited by the accumulation of toxic compounds and also depletion of nutrients in the media. The cell population remains constant at this stage.

4- Death Phase

This is the last phase of the bacterial growth also called decline phase. At this stage, the rate of death is greater than the rate of formation of new cells. Lack of nutrients, physical conditions or other injuries to the cell leads to death of the cells.



What is microbiology, and why is it important for life on Earth?

Describe the roles of microorganisms in the environment and human health.

What are the major branches of microbiology? Provide a brief description of each.

What distinguishes eukaryotic cells from prokaryotic cells?

List and explain the functions of at least five organelles found in eukaryotic cells.

What is the role of the nucleus in eukaryotic cells?

Compare and contrast the cellular structures of prokaryotes and eukaryotes.

What are some examples of organisms classified as prokaryotes and eukaryotes?

رقم المحاضرة:	
عنوان المحاضرة:	bacterıology
اســـم المدرس:	يوكسل عزالدين سويد
الفئة المستهدفة :	طلبة المستوى الاول
الهدف العام من المحاضرة :	
الأهداف السلوكية او مخرجات التعلم:	1- التعرف على البكتريا 2- من جاءت وكيف اكتشفت 3- انواع البكتريا والامراضية

الاختبار القبلي

1* What is bacteriology?

2* How can bacteria be classified based on shape?

3*What is a coccobacillus?

4*What are the two types of spore-forming bacteria?

5*Define facultative anaerobes.

Bacteriology

Bacteriology: a branch of microbiology dealing with the identification, study, and cultivation of bacteria and with their applications in medicine, agriculture, industry, and biotechnology.

Bacteria: Bacteria are one-celled microscopic living organisms (ranged from 0.5-2.0 micron in diameter) it can be seen just under light microscope with the aid of oil immersion lenses (100x).

Classification of Bacteria

1-Shape: The bacteria can classify according to their shape

a- Cocci (Spherical)

1- Diplococci e.g.: Streptococcus pneumonia

2- Chain (Cocci) e.g.: Streptococcus pyogenes

3- Cluster or Grape like shape e.g.: Staphylococcus aureus

b- Bacilli

1- Short Bacilli e.g.: Bacillus subtilis.

2- Long Bacilli e.g.: Lactobacillus. spp.

3- Coccobacilli e.g.: like members of Enterobacteriaceae family (Escherichia coli, Shigella, Salmonella).

c- **Kidney shape**: e.g.: Neisseria gonorrhea.

d- **comma shape**: e.g.: Vibrio cholera.

e- **Spiral shape**: e.g.: Helicobacter pylori

2- Ability to form spores: The bacteria are divided to two groups according to their ability to form spores.

a- Non- spore - former Bacteria: e.g. - Staphylococcus spp., Escherichia coli, Streptococcus spp.

b- spore- former Bacteria: e.g.: Bacillus, Clostridium and Sporolactobacillus.

3- Oxygen requirements:

a- Obligates (strict) aerobes bacteria: e.g.: Bacillus, Pseudomonas.

b- Obligates (strict) anaerobes bacteria: e.g.: Clostridium.

c- Facultative anaerobes e.g.: Enterobacteriaceae e.g.: Escherichia coli, Shigella, Salmonella and Staphylococcus spp.

d- **Microaerophiles** e.g. Helicobacter pylori.

e- **Aerotolerant** e.g. Streptococcus

4-Reaction to the Gram stain: The Bacteria are divided in two groups according to the reaction with Gram stain

• **Gram positive bacteria**. e.g.: Streptococcus, Staphylococcus, Bacillus and Clostridium.

•**Gram Negative Bacteria.** e.g. All the members of Enterobacteriaceae (Escherichia coli,Shigella, Salmonella,…..)

5- Bacterial Nutrition

A) Autotrophic bacteria: These bacteria synthesize all their food from inorganic substances (CO2 and hydrogen donor), the autotrophic bacteria are including two types:

(i) Photosynthetic bacteria.

(ii) Chemosynthetic bacteria.

B) Heterotrophic bacteria: The heterotrophic bacteria obtain their ready-made food from organic substances, living or dead. These bacteria including three types:

(i) Saprophytic bacteria.

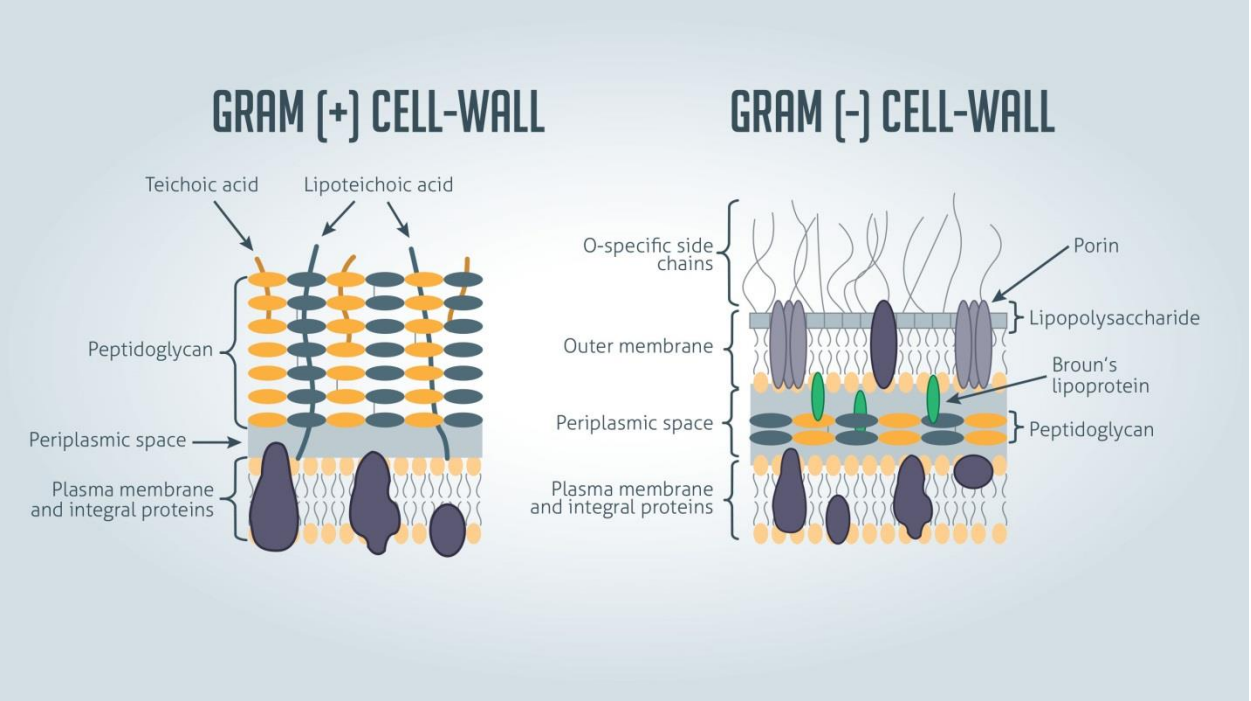
(ii) Parasitic bacteria.

(iii) Symbiotic bacteria.

6-Mode of energy production: (glycolysis, cellular respiration).

Difference in structure of Gram positive and Gram negative bacteria

The two key features that lead to the differing visualization properties of Gram positive and Gram negative species are the thickness of the peptidoglycan layer and presence or absence of the outer lipid membrane. This is because the wall structure affects the cell's ability to retain the crystal violet stain used in the Gram staining procedure which can then be visualized under a light microscope**.**



Gram positive bacteria	Gram negative bacteria
1- Distinctive purple appearance after gram staining	1- Pale reddish color after gram staining
2- Bacteria include all *staphylococci*, all *streptococci* and some *listeria* species	2- Bacteria include e*nterobacter* species, s*almonella* species and *pseudomonas* species
3- Thick peptidoglycan layer	3- Thin peptidoglycan layer
4- No outer lipid membrane	4- Outer lipid membrane present
5- No O-specific side chains present	5- O-specific side chains present
6- Teichoic and lipoteichoic acids present	6- Teichoic and lipoteichoic acids not present

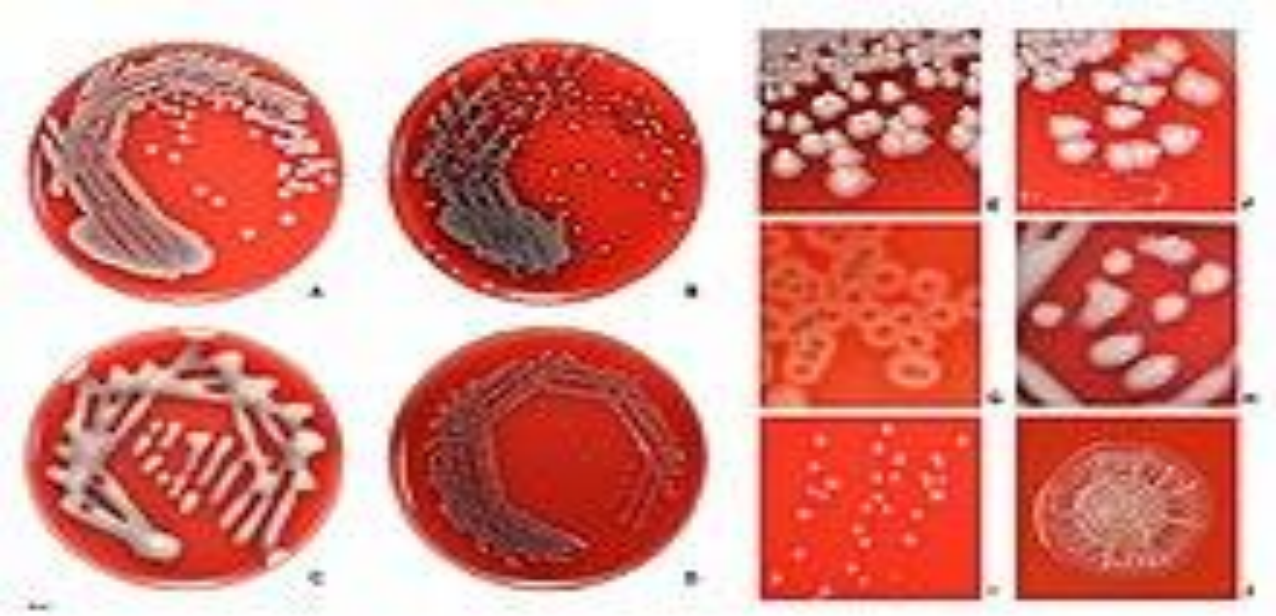
Gram negative bacteria

Escherichia coli: is a gram-negative, facultative anaerobic, rod-shaped, coliform bacterium of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms. Most E. coli strains are harmless, but some

serotypes such as EPEC, and ETEC are pathogenic and can cause serious food poisoning in their hosts, and are occasionally responsible for food contamination incidents that prompt product recalls. Most strains are part of the normal microbiota of the gut and are harmless or even beneficial to humans. For example, some strains of E. coli benefit their hosts by producing vitamin K2 or by preventing the colonization of the intestine by pathogenic bacteria.

Culture growth

Optimum growth of E. coli occurs at 37 °C (99 °F), but some laboratory strains can multiply at temperatures up to 49 °C (120 °F). E. Growth can be driven by aerobic or anaerobic respiration, using a large variety of redox pairs, including the oxidation of pyruvic acid, formic acid, hydrogen, and amino acids, and the reduction of substrates such as oxygen, nitrate, fumarate, dimethyl sulfoxide, and trimethylamine N-oxide.



Normal microbiota

E. coli belongs to a group of bacteria informally known as coliforms that are found in the gastrointestinal tract of warm-blooded animals. E. coli normally colonizes an infant's gastrointestinal tract within 40 hours of birth, arriving with food or water or from the individuals handling the child. In the bowel, E. coli

adheres to the mucus of the large intestine. It is the primary facultative anaerobe of the human gastrointestinal tract. (Facultative anaerobes are organisms that can grow in either the presence or absence of oxygen.) As long as these bacteria do not acquire genetic elements encoding for virulence factors, they remain benign commensals.

Diseases

gastroenteritis, urinary tract infections, neonatal meningitis, hemorrhagic colitis, and Crohn's disease. peritonitis, mastitis, sepsis, and gram-negative pneumonia

Symptoms

Common signs and symptoms include severe abdominal cramps, diarrhea, hemorrhagic colitis, vomiting, and sometimes fever. In rarer cases, virulent strains are also responsible for bowel necrosis (tissue death) and perforation without progressing to hemolytic-uremic syndrome.

Treatment

fluoroquinolones or azithromycin, with an emerging role for rifaximin, ciprofloxacin

***Salmonella* species**

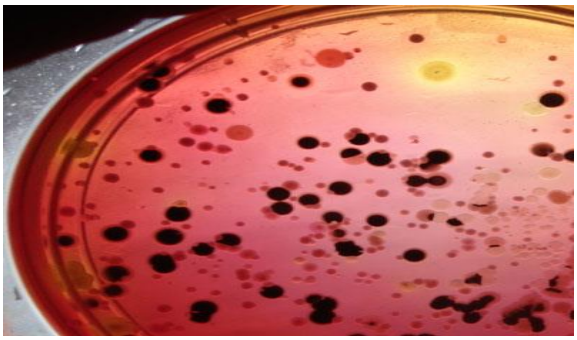
Salmonella is a genus of rod-shaped (bacillus) gram-negative bacteria of the family Enterobacteriaceae. The two known species of Salmonella are *Salmonella enterica* and *Salmonella bongori*. S. enterica is the type species and is further divided into six subspecies.

Salmonella species are non-spore-forming, predominantly motile enterobacteria with cell diameters between about 0.7 and 1.5 μm, lengths from 2 to 5 μm, and peritrichous flagella (all around the cell body, allowing them to move). They are

chemotrophs, obtaining their energy from oxidation and reduction reactions, using organic sources. They are also facultative anaerobes, capable of generating adenosine triphosphate with oxygen ("aerobically") when it is available, or using other electron acceptors or fermentation ("anaerobically") when oxygen is not available.

Nontyphoidal Salmonella serotypes are zoonotic and can be transferred from animals and between humans. They usually invade only the gastrointestinal tract and cause salmonellosis, the symptoms of which can be resolved without antibiotics.

The bacteria are not destroyed by freezing, but UV light and heat accelerate their destruction. They perish after being heated to 55 °C for 90 min, or to 60 °C for 12 min, although if inoculated in high fat, high liquid substances like peanut butter, they gain heat resistance and can survive up to 90 °C for 30 min. To protect against Salmonella infection, heating food to an internal temperature of 75 °C is recommended.



Clinical symptoms

Salmonellosis is known to be able to cause back pain. It can manifest as five clinical patterns: gastrointestinal tract infection, enteric fever, bacteremia, local infection, and the chronic reservoir state. The initial symptoms are nonspecific fever and weakness. In the bacteremia state, it can spread to any parts of the body and this induces localized infection or it forms abscesses. The forms of localized Salmonella infections are arthritis, urinary tract infection, infection of the central nervous system, bone infection, soft tissue infection, etc. Infection may remain as the latent form for a long time.

Diseases

Gastroenteritis and diarrhea, typhoid fever, paratyphoid fever, and food poisoning

Treatment

Fluids to prevent dehydration**.** If you need antibiotics for a Salmonella infection, your healthcare provider might prescribe:

Ciprofloxacin, Ceftriaxone, Trimethoprim-sulfamethoxazole, and Azithromycin.

Vibrio cholerae

Vibrio cholerae is a species of Gram-negative, facultative anaerobe, motile, and comma-shaped bacteria. The bacteria naturally live in saltwater where they attach themselves easily to the chitin-containing shells of crabs, shrimp, and other shellfish. Some strains of *V. cholerae* are pathogenic to humans and cause a deadly disease called cholera, which can be derived from the consumption of undercooked or raw marine life species

The bacterium has a flagellum at one pole and several pili throughout its cell surface. It undergoes respiratory and fermentative metabolism. Two serogroups

called O1 and O139 are responsible for cholera outbreaks, measures 0.3 μm in diameter and 1.3 μm in length.

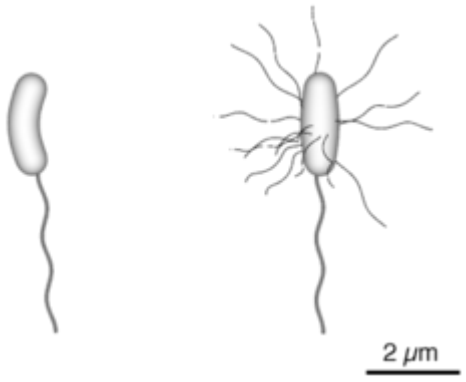


Diagram of the bacterium, V. cholera

Yellow colored (sucrose-fermenting) colonies of Vibrio cholerae on TCBS agar.

Cholera illness and symptoms

V. cholerae infects the intestine and causes diarrhea (rice water diarrhea), the hallmark symptom of cholera. Infection can be spread by eating contaminated food or drinking contaminated water. Infection can be spread by eating contaminated food or drinking contaminated water. It also can spread through skin contact with contaminated human feces. Not all infection indicated symptoms, only about 1 in 10 people develop diarrhea. The major symptoms include: watery diarrhea, vomiting, rapid heart rate, loss of skin elasticity, low blood pressure, thirst, and muscle cramps. This illness can get serious as it can progress to kidney failure and possible coma. If diagnosed, it can be treated using medications.

Treatment

The basic, overall treatment for Cholera is re-hydration, to replace the fluids that have been lost. Those with mild dehydration can be treated orally with an oral rehydration solution (ORS). When patients are severely dehydrated and unable to take in the proper amount of ORS, IV fluid treatment is generally pursued. Antibiotics are used in some cases, typically fluoroquinolones and tetracyclines.

Bacteriology is the study of _____.

Bacteria that are spherical in shape are called _____.

Escherichia coli is an example of a _____ bacterium.

Bacteria that can survive with or without oxygen are known as _____ anaerobes.

Gram-positive bacteria appear _____ after Gram staining.

The presence of an outer lipid membrane is characteristic of _____ bacteria.

_____ is a type of bacteria known to cause typhoid fever.

The thick layer of _____ is what gives Gram-positive bacteria their ability to retain the crystal violet stain.

_____ bacteria can produce their own food through photosynthesis or chemosynthesis.

Salmonella infections are often transmitted through contaminated _____ or water.

Non-spore-forming bacteria include _____ and Escherichia coli.

The optimal growth temperature for E. coli is _____ °C.

Salmonella and E. coli are both part of the _____ family.

A cluster or grape-like arrangement of cocci is characteristic of _____ bacteria.

Antibiotics like _____ are commonly used to treat serious E. coli infections.

Bacteria that lack the ability to form spores are classified as _____.

Helicobacter pylori is an example of a _____-shaped bacterium.

The main structural difference between Gram-positive and Gram-negative bacteria is the thickness of their _____ layer.

E. coli in the gut can produce vitamin _____ for the host.

Pathogenic strains of E. coli can cause diseases like _____ and urinary tract infections.

رقم المحاضرة:	
عنوان المحاضرة:	Gram postive bacteria
اســـم المدرس:	يوكسل عزالدين سويد
الفئة المستهدفة :	طلبة المستوى الاول
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الأهداف السلوكية او مخرجات التعلم:	1- التعرف على معنى gram positive bacteria 2- من جاءت وكيف اكتشفت 3- الامراضية

الاختبار القبلي

What color do Gram-positive bacteria stain?

What is the shape of Staphylococcus bacteria?

Which Staphylococcus species is most pathogenic?

How do Staphylococcus bacteria arrange themselves under a microscope?

What infections can Staphylococcus epidermidis cause?

What antibiotic is often used to treat MRSA?

What type of hemolysis produces a greenish color on blood agar?

Which bacterium is the leading cause of bacterial pneumonia?

What is the causative agent of tuberculosis?

How is Mycobacterium tuberculosis primarily spread?

What test is commonly used to diagnose tuberculosis?

What is the role of mycolic acid in M. tuberculosis?

What condition is caused by Clostridium perfringens?

What toxin is responsible for gas gangrene in C. perfringens infections?

Where is Clostridium perfringens commonly found in nature?

What shape are Streptococcus bacteria?

What is the difference between alpha and beta hemolysis?

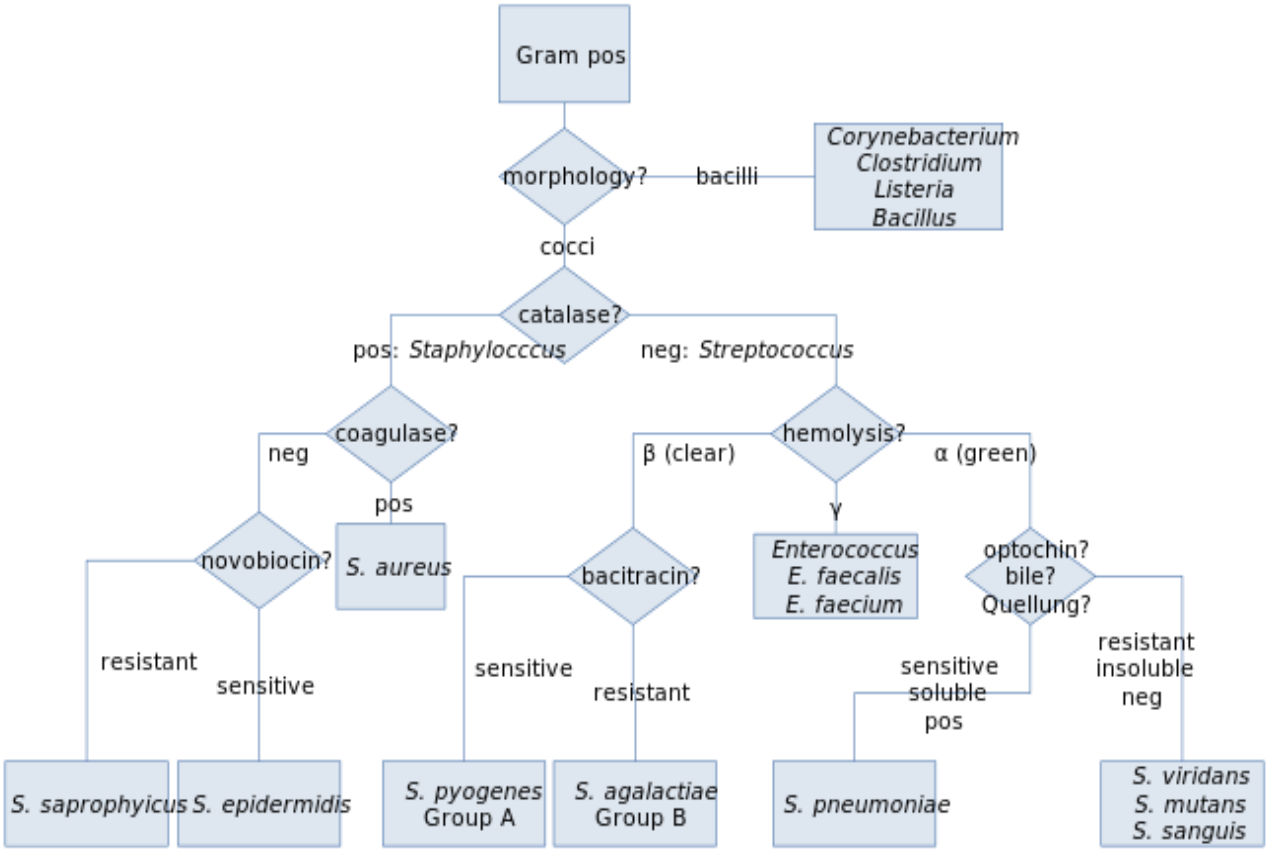
Which bacterium is associated with urinary tract infections in young women?

What are facultative anaerobes?

How does Streptococcus pyogenes cause beta-hemolysis?

Gram positive bacteria

Gram-positive bacteria are classified by the color they turn after a chemical called Gram stain is applied to them. Gram-positive bacteria stain blue when this stain is applied to them.



Staphylococcus

Staphylococcus: is a genus of Gram-positive bacteria in the family Staphylococcaceae from the order Bacillus's. Under the microscope, they appear spherical (cocci), and form in grape-like clusters. Staphylococcus species are

facultative anaerobic organisms (capable of growth both aerobically and anaerobically).

Staphylococcus was one of the leading infections in hospitals and many strains of this bacterium have become antibiotic resistant. Despite strong attempts to get rid of them, staph bacteria stay present in hospitals, where they can infect people who are most at risk of infection.

Staphylococcus includes at least 43 species. Of these, nine have two subspecies, one has three subspecies, and one has four subspecies. Many species cannot cause disease and reside normally on the skin and mucous membranes of humans and other animals. Staphylococcus species have been found to be nectar-inhabiting microbes. They are also a small component of the soil microbiome.

Staphylococcus aureus

S. aureus is the most pathogenic staphylococci bacteria. It's responsible for most staphylococci infections, including:

- skin infections, like cellulitis and folliculitis, septic arthritis, abscesses, endocarditis, bacterial pneumonia, food poisoning, toxic shock syndrome, scalded skin syndrome, and MRSA

Staphylococcus epidermidis

Often, *S. epidermis* causes infections in people with weakened immune systems or who are in the hospital. It causes:

- infections of medical devices like urinary catheters, bacteremia, surgical site infections, and eye keratitis, and endophthalmitis (inner eye infection)

Staphylococcus saprophyticus

S. saprophyticus, which is normally found in the genital tract and perineum. It causes:

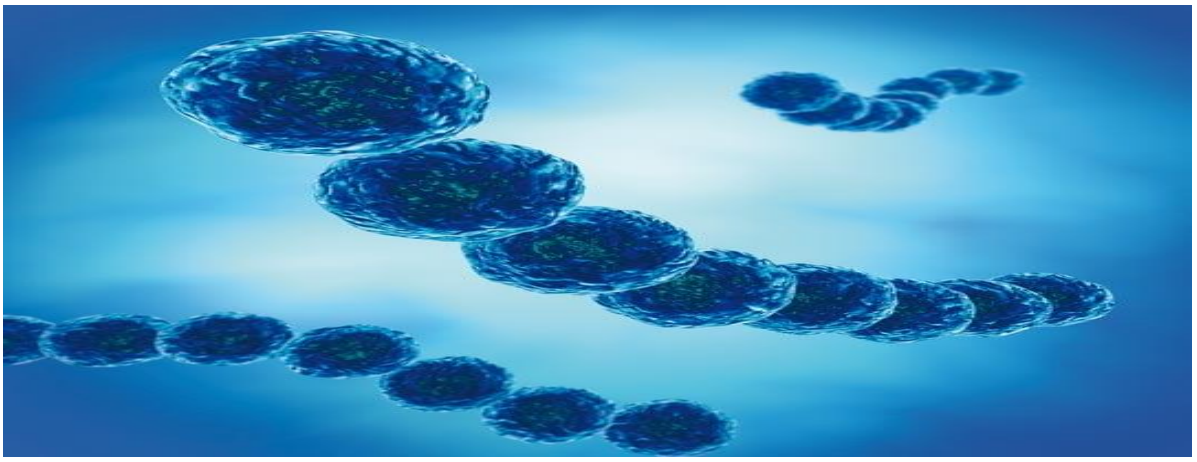
- uncomplicated urinary tract infections (most common), urethritis, prostatitis, acute pyelonephritis, and epididymitis

Treatment

Infections acquired outside hospitals can usually be treated with penicillinase-resistant β-lactams. Hospital acquired infection is often caused by antibiotic resistant strains and can only be treated with vancomycin.

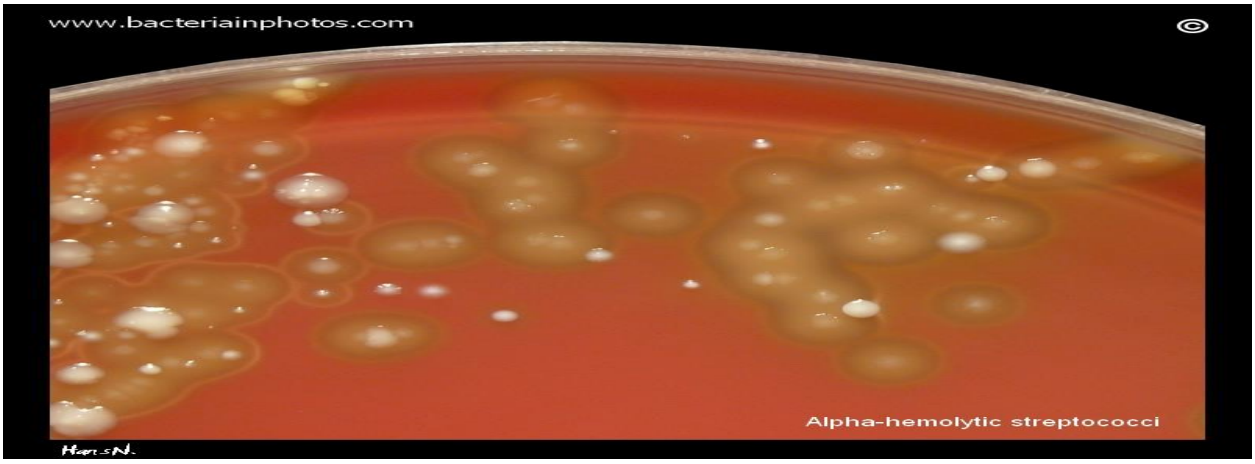
Streptococcus

Streptococcus is a genus of gram-positive coccus (pl.: cocci) or spherical bacteria that belongs to the family Streptococcaceae, within the order Lactobacillales (lactic acid bacteria), in the phylum Bacillota. Cell division in streptococci occurs along a single axis, so as they grow, they tend to form pairs or chains that may appear bent or twisted. This differs from staphylococci, which divide along multiple axes, thereby generating irregular, grape-like clusters of cells. Most streptococci are oxidase-negative and catalase-negative, and many are facultative anaerobes (capable of growth both aerobically and anaerobically).



Alpha-hemolytic

When alpha-hemolysis (α-hemolysis) is present, the agar under the colony will appear dark and greenish due to the conversion of hemoglobin to green biliverdin. Alpha-hemolysis is also termed incomplete hemolysis or partial hemolysis because the cell membranes of the red blood cells are left intact. This is also sometimes called green hemolysis because of the color change in the agar.



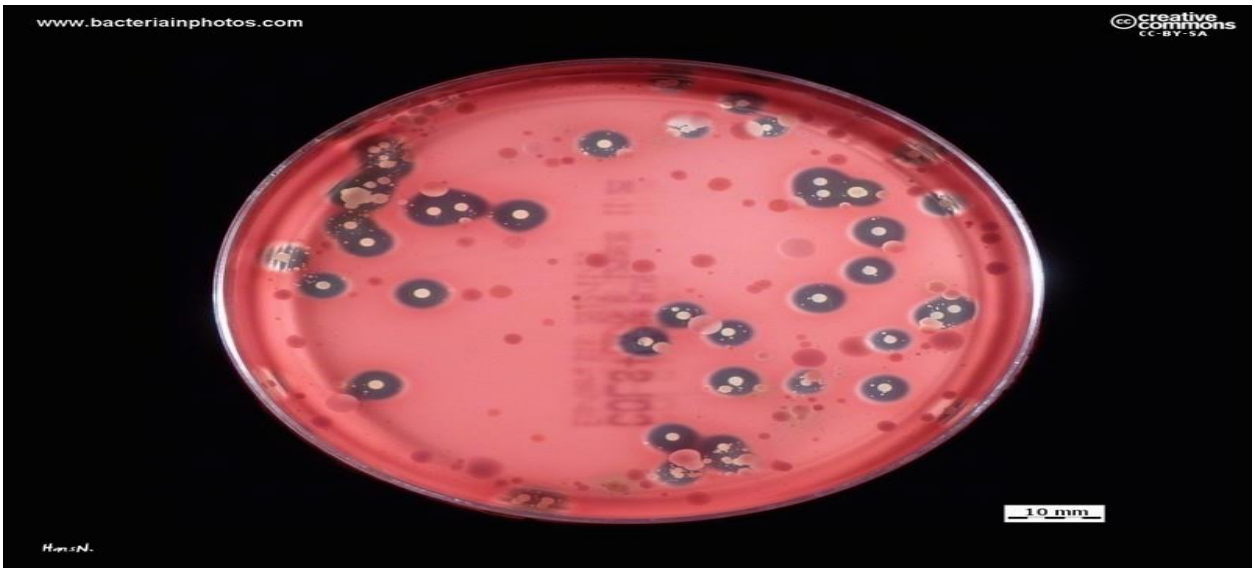
Pneumococci

S. pneumoniae (sometimes called pneumococcus), is a leading cause of bacterial pneumonia and occasional etiology of otitis media, sinusitis, meningitis, and peritonitis.

Beta-hemolytic

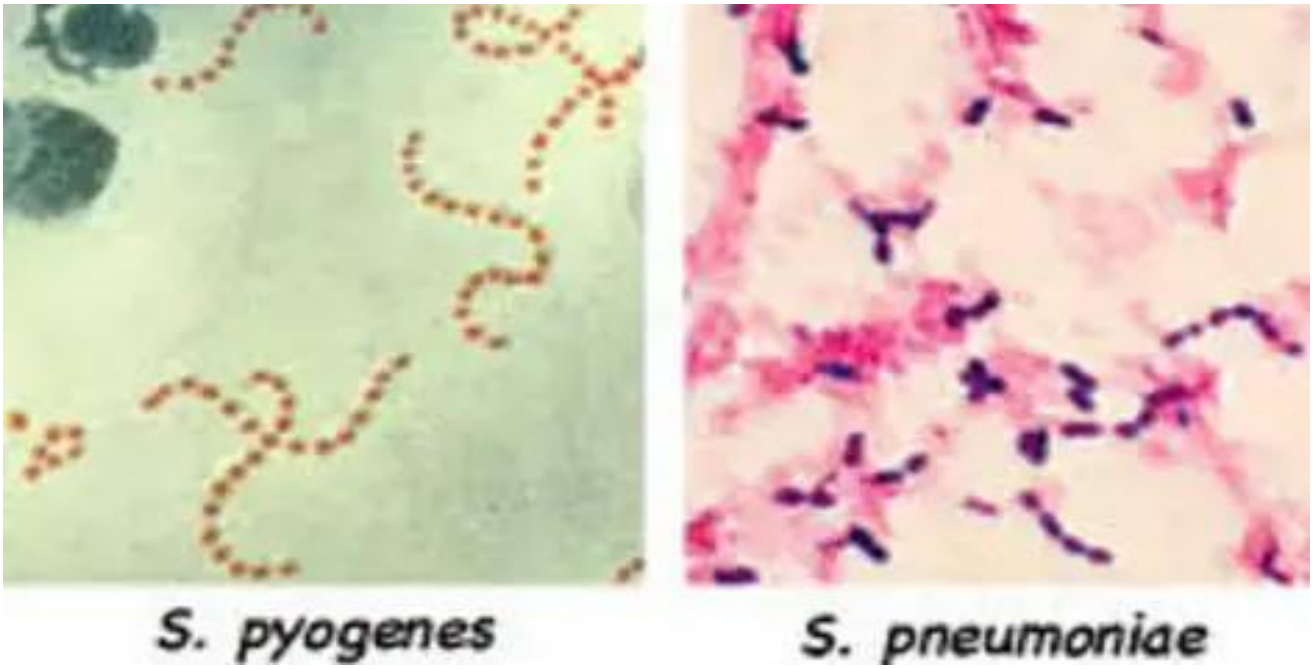
Beta-hemolysis (β-hemolysis), sometimes called complete hemolysis, is a complete lysis of red cells in the media around and under the colonies: the area appears lightened (yellow) and transparent. Streptolysin, an exotoxin, is the enzyme produced by the bacteria which causes the complete lysis of red blood cells. There are two types of streptolysin: Streptolysin O (SLO) and streptolysin S (SLS). Streptolysin O is an oxygen-sensitive cytotoxin, secreted by most group A *Streptococcus* (GAS), and interacts with cholesterol in the membrane of eukaryotic cells (mainly red and white blood cells, macrophages, and platelets),

and usually results in beta-hemolysis under the surface of blood agar. Streptolysin S is an oxygen-stable cytotoxin also produced by most GAS strains which results in clearing on the surface of blood agar. SLS affects immune cells, including polymorphonuclear leukocytes and lymphocytes, and is thought to prevent the host immune system from clearing infection. *Streptococcus pyogenes.*



Streptococcus pyogenes

S. pyogenes is the causative agent in a wide range of group A streptococcal infections (GAS). These infections may be noninvasive or invasive. The noninvasive infections tend to be more common and less severe. The most common of these infections include streptococcal pharyngitis (strep throat) and impetigo. Scarlet fever.



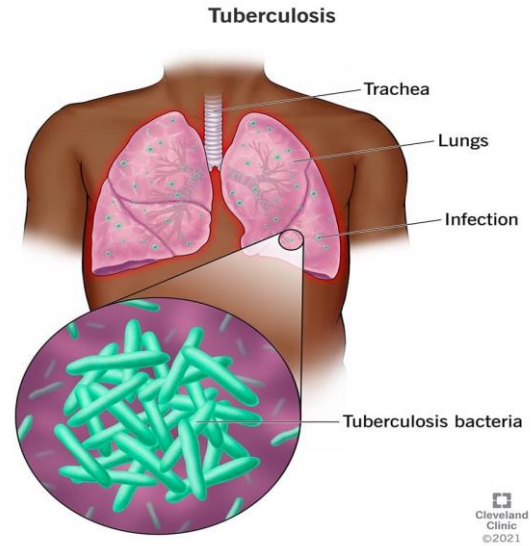
Treatment

- Antibiotics (usually penicillin)
- For necrotizing fasciitis, surgery to remove dead tissue

Mycobacterium tuberculosis

Mycobacterium tuberculosis: also known as Koch's bacillus, is a species of pathogenic bacteria in the family Mycobacteriaceae and the causative agent of tuberculosis. First discovered in 1882 by Robert Koch, *M. tuberculosis* has an unusual, waxy coating on its cell surface primarily due to the presence of mycolic acid. This coating makes the cells impervious to Gram staining, and as a result, *M. tuberculosis* can appear weakly Gram-positive. Acid-fast stains such as Ziehl–Neelsen, or fluorescent stains such as auramine are used instead to identify *M. tuberculosis* with a microscope. The physiology of *M. tuberculosis* is highly aerobic and requires high levels of oxygen. Primarily a pathogen of the mammalian respiratory system, it infects the lungs. The most frequently used diagnostic methods for tuberculosis are the tuberculin skin test, acid-fast stain, culture, and polymerase chain reaction.

It requires oxygen to grow, and is nonmotile. *M. tuberculosis* divides every 18–24 hours. This is extremely slow compared with other bacteria, which tend to have division times measured in minutes (*Escherichia coli* can divide roughly every 20 minutes). It is a small bacillus that can withstand weak disinfectants and can survive in a dry state for weeks. Its unusual cell wall is rich in lipids such as mycolic acid and cord factor glycolipid, is likely responsible for its resistance to desiccation and is a key virulence factor.



Humans are the only known reservoirs of *M. tuberculosis*. A misconception is that *M. tuberculosis* can be spread by shaking hands, making contact with toilet seats, sharing food or drink, or sharing toothbrushes. However, major spread is

through air droplets originating from a person who has the disease either coughing, sneezing, speaking, or singing.

Teatment

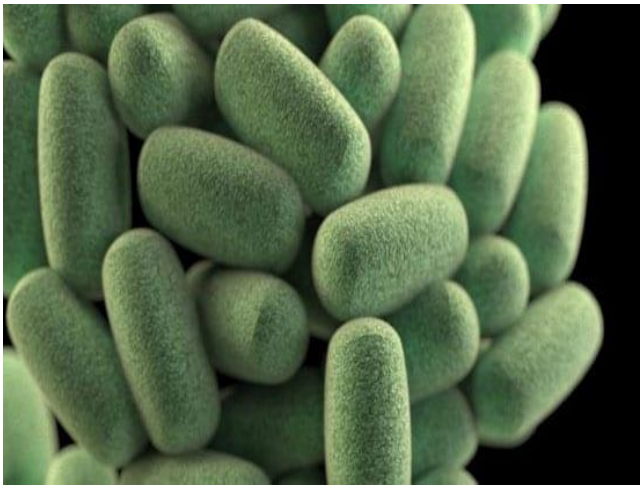
1- The BCG vaccine (bacille Calmette-Guerin), which was derived from *M. bovis*, while effective against childhood and severe forms of tuberculosis, has limited success in preventing the most common form of the disease today, adult pulmonary tuberculosis.

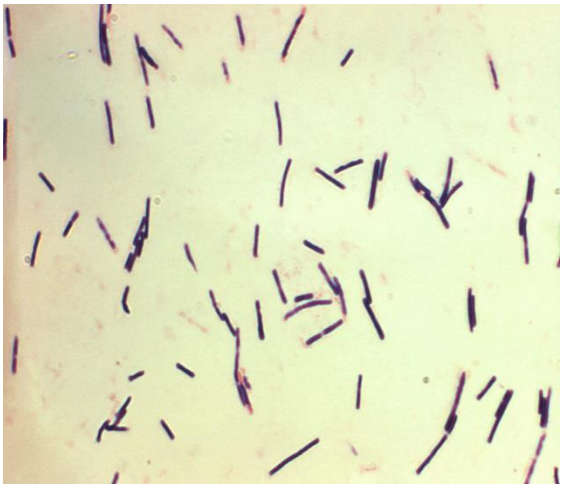
2- TB infection and disease is treated with these drugs:

- Isoniazid, Rifampin, Ethambutol, and Pyrazinamide.

Clostridium perfringens

Clostridium perfringens: is a Gram-positive, bacillus (rod-shaped), anaerobic, spore-forming pathogenic bacterium of the genus *Clostridium*. *C. perfringens* is ever-present in nature and can be found as a normal component of decaying vegetation, marine sediment, the intestinal tract of humans and other vertebrates, insects, and soil. It has the shortest reported generation time of any organism at 6.3 minutes in thioglycolate medium.





Infections due to *C. perfringens* show evidence of tissue necrosis, bacteremia, emphysematous cholecystitis, and gas gangrene, also known as clostridial myonecrosis. The specific name, *perfringens*, is derived from the Latin *per* (meaning "through") and *frango* ("burst"), referring to the disruption of tissue that occurs during gas gangrene. The toxin involved in gas gangrene is α-toxin, which inserts into the plasma membrane of cells, producing gaps in the membrane that disrupt normal cellular function. *C. perfringens* can participate in polymicrobial anaerobic infections. It is commonly encountered in infections as a component of the normal flora. In this case, its role in disease is minor.

Major toxins

There are five major toxins produced by *Clostridium perfringens*. Alpha, beta, epsilon and enterotoxin are toxins that increase a cells permeability which causes an ion imbalance while iota toxins destroy the cell's actin cytoskeleton. On the basis of which toxins are produced, *C. perfringens* can be classified into seven "toxinotypes", A, B, C, D, E, F and G.

Alpha toxin

Alpha toxin (CPA): This toxin is linked to gas gangrene of humans and animals. Most cases of gas gangrene has been related to a deep wound being contaminated by soil that harbors *C. perfringens*.

Beta toxin

Beta toxins (CPB) are a protein that causes hemorrhagic necrotizing enteritis and enterotoxaemia in both animals (type B) and humans (type C) which leads to the infected individual's feces becoming bloody and their intestines necrotizing.

Epsilon toxin

Epsilon toxin (ETX) is a protein produced by type B and type D strains of *C. perfringens*. This toxin is currently ranked the third most potent bacterial toxin known. ETX causes enterotoxaemia in mainly goats and sheep, but cattle are sometime susceptible to it as well. This causes severe edema in organs such as the brain and kidneys.

Iota toxin

Iota toxin (ITX) is a protein produced by type E strains of *C. perfringens*. Iota toxins are made up of two, unlinked proteins that form a multimeric complex on cells. Iota toxins prevent the formation of filamentous actin. This causes the destruction of the cells cytoskeleton which in turn leads to the death of the cell as it can no longer maintain homeostasis.

Enterotoxin

This toxin (CPE) causes food poisoning. It alters intracellular claudin tight junctions in gut epithelial cells. This pore-forming toxin also can bind to human ileal and colonic epithelium in vitro and necrotize it. Through the caspase-3 pathway, this toxin can cause apoptosis of affected cells. This toxin is linked to type F strains, but has also been found to be produced by certain types of C, D, and E strains.

Other toxins

TpeL is a toxin found in type B, C, and G strains. It is in the same protein family as *C. difficile* toxin A. It does not appear important in the pathogenesis of types B and C infections, but may contribute to virulence in type G strains.

Treatment

The most important aspect of treatment is prompt and extensive surgical debridement of the involved area and excision of all devitalized tissue, in which the organisms are prone to grow.

Administration of antimicrobial drugs, particularly penicillin, is begun at the same time. *Clostridium perfringens* is more often susceptible to vancomycin compared to other pathogenic Clostridia and 20% of the strains are resistant to clindamycin. Hyperbaric oxygen may be of help in the medical management of clostridial tissue infections.

Most people who suffer from food poisoning caused by *C. perfringens* tend to fight off the illness without the need of any antibiotics. Extra fluids should be drunk consistently until diarrhea stop.

الاختبار البعدي

1*Gram-positive bacteria stain _____ when the Gram stain is applied.

2*The genus _____ includes bacteria that form grape-like clusters.

3_____ bacteria can grow in both aerobic and anaerobic conditions.

4Hospital-acquired staph infections often involve antibiotic-resistant strains like _____

5Staphylococcus aureus is known for causing _____, such as toxic shock syndrome and MRSA.

6*Staphylococcus epidermidis frequently causes infections related to _____.

7* Staphylococcus saprophyticus is commonly associated with _____ infections.

8* _____ is used to treat hospital-acquired infections caused by resistant strains of Staphylococcus.

9* Streptococci form chains due to their cell division along a _____ axis.

10*_____ hemolysis results in a greenish discoloration of the agar.

11*Streptococcus pneumoniae is a common cause of bacterial _____.

12*Streptococcus pyogenes produces _____, an exotoxin that causes beta-hemolysis

13*Clostridium perfringens is a Gram-positive, _____-forming bacterium.

14*_____ is a serious infection caused by Clostridium perfringens, characterized by tissue necrosis.

15*The _____ toxin of C. perfringens is responsible for cell membrane disruption during gas gangrene.

16*C. perfringens has the shortest reported generation time of any organism, at _____ minutes.

17*In addition to humans, Clostridium perfringens is commonly found in _____ and soil.

رقم المحاضرة:	
عنوان المحاضرة:	mycology
اســـم المدرس:	يوكسل عزالدين سويد
الفئة المستهدفة :	طلبة المستوى الاول
الهدف العام من المحاضرة :	
الأهداف السلوكية او مخرجات التعلم:	1- التعرف على الفطريات 2- يتعرف الطالب على اشكالها ومدى ضرواتها 3- التركيب البنائي والخلوي لها

الاختبار القبلي

 _____ is the study of fungi and their physical features.

 Fungi have cell walls made of _____, which provide rigidity and support.

 Fungi are _____ organisms, meaning they have true nuclei with nuclear membranes.

 _____ fungi obtain nutrients from dead organic matter.

 Lichens are an example of a _____ relationship between fungi and algae.

 The sexual spores of Ascomycetes are called _____.

 _____ are known as sac fungi and can reproduce through conidiospores.

 _____ fungi have a yeast form at 37°C and a mycelial form at 25°C.

 An example of a yeast is _____.

 _____ occurs when Candida albicans grows excessively in the mouth or throat.

 _____ fungi grow partly as yeast and partly as elongated cells resembling hyphae.

 Fungi reproduce asexually through spores like _____ or _____.

 _____ are long branching filaments that form the mycelium in molds.

 Antifungal medications for Candida infections can be _____ (taken by mouth) or _____ (applied directly).

 _____ is a severe Candida infection that affects the blood, bones, and other organs.

Mycology

Mycology: is the branch of Biology, involved with the study of fungi, their physical features, their unique relationships with other organisms and their applications..

Fungi: is any member of the group of eukaryotic organisms that includes microorganisms such as yeasts and molds, as well as the more familiar mushrooms.

Fungi are eukaryotic; differ from bacteria and other prokaryotes.

1. Cell walls containing chitin (rigidity & support), mannan & other polysaccharides

2. Cytoplasmic membrane contains ergosterols

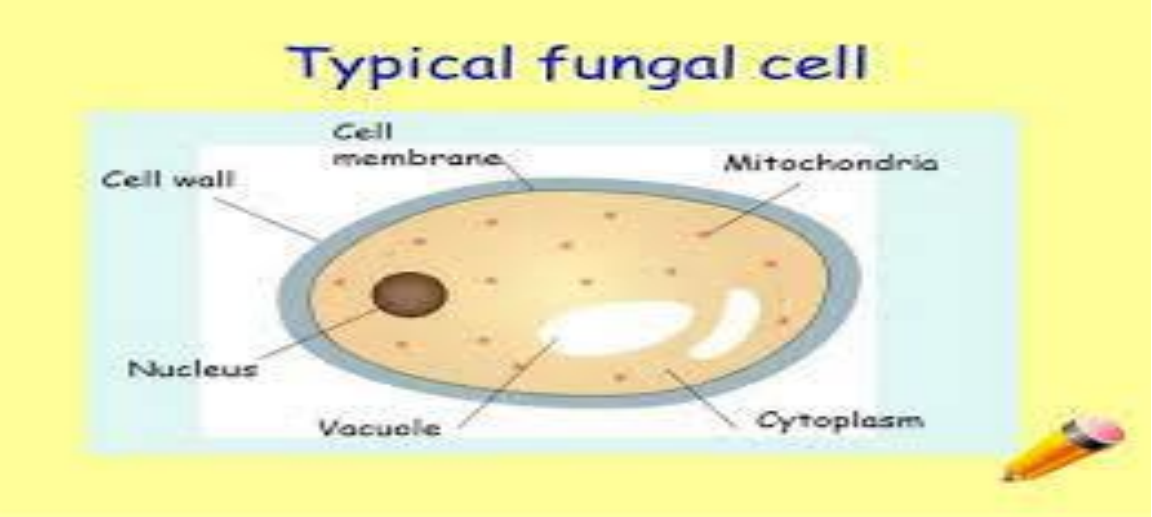
3. Possess true nuclei with nuclear membrane & paired chromosomes

4. Cytoplasmic contents include mitochondria and endoplasmic reticulum

5. Divide asexually, sexually or by both

6. Unicellular or multicellular

7. Most fungi are obligate or facultative aerobes



Classification of Fungi

Kingdom Fungi are classified based on different modes. The different classification of fungi is as follows:

A- Based on Mode of nutrition

On the basis of nutrition, kingdom fungi can be classified into 3 groups.

1. **Saprophytic** – The fungi obtain their nutrition by feeding on dead organic substances. Examples: *Rhizopus*, *Penicillium* and *Aspergillus*.
2. **Parasitic** – The fungi obtain their nutrition by living on other living organisms (plants or animals) and absorb nutrients from their host. Examples: *Taphrina* and *Puccinia*.
3. **Symbiotic** – These fungi live by having an interdependent relationship with other species in which both are mutually benefited. Examples: Lichens and mycorrhiza. Lichens are the symbiotic association between algae and fungi. Here both algae and fungi are mutually benefited as fungi provide shelter for algae and in reverse algae synthesis carbohydrates for fungi. Mycorrhiza is the symbiotic association present between fungi and plants. Fungi improve nutrient uptake by plants, whereas, plants provides organic molecules like sugar to the fungus.

B- Based on Spore Formation

Kingdom Fungi are classified into the following based on the formation of spores:

1. **Zygomycetes** – These are formed by the fusion of two different cells. The sexual spores are known as zygospores, while the asexual spores are known as sporangiospores. The hyphae are without the septa. Example – *Mucor*.
2. **Ascomycetes** – They are also called sac fungi. They can be coprophilous, decomposers, parasitic or saprophytic. The sexual spores are called ascospores. Asexual reproduction occurs by conidiospores. Example – *Saccharomyces.*
3. **Basidiomycetes** – Mushrooms are the most commonly found basidiomycetes and mostly live as parasites. Sexual reproduction occurs by basidiospores. Asexual reproduction occurs by conidia, budding or fragmentation. Example- *Agaricus.*
4. **Deuteromycetes** – They are otherwise called imperfect fungi as they do not follow the regular reproduction cycle as the other fungi. They do not reproduce sexually. Asexual reproduction occurs by conidia. Example – *Trichoderma*.

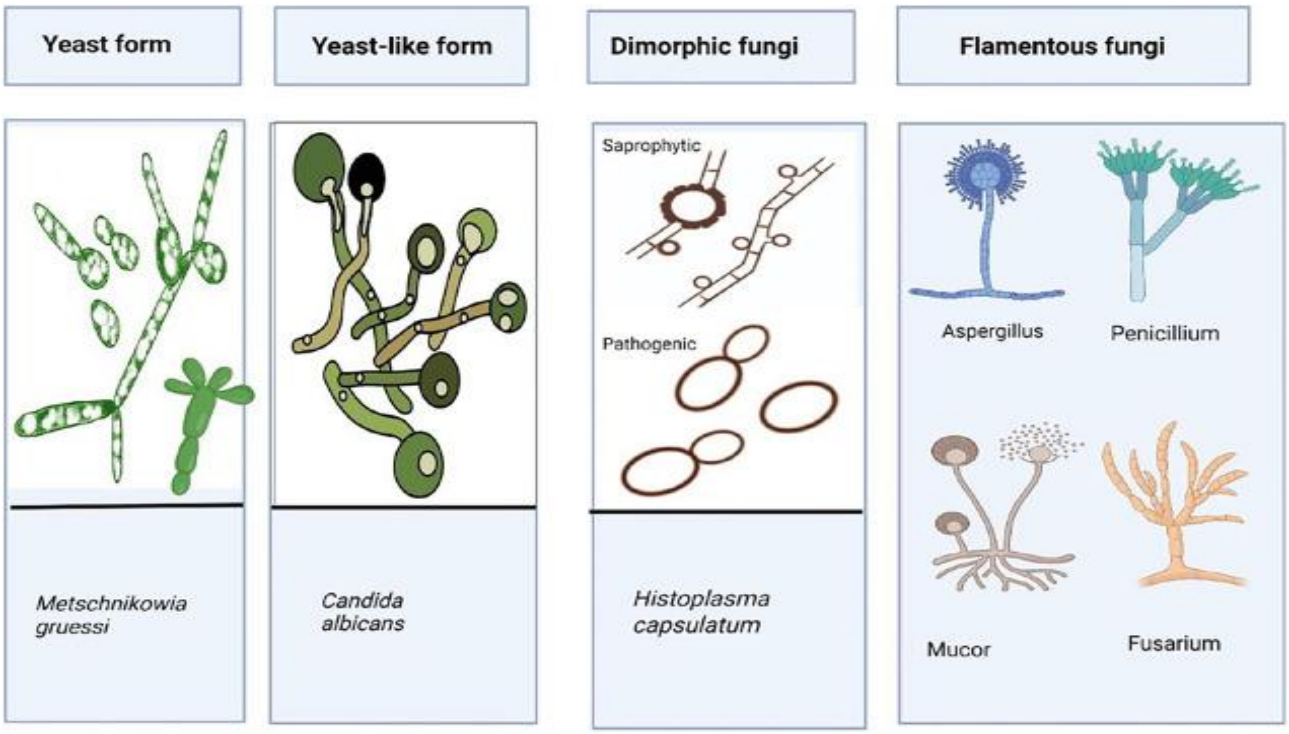
C- Morphological classification

1- Yeasts

2. Yeast-like fungi

3. Filamentous fungi (molds)

4. Dimorphic fungi



1- Yeasts

These occur in the form of round or oval bodies which reproduce by an asexual process called budding in which the cell develops a protuberance which enlarges and eventually separates from the parent cell. Yeasts colonies resemble bacterial colonies in appearance and in consistency.

Examples are- Saccharomyces cerevisiae, Cryptococcus neoformans

2- Yeast-Like Yeast like fungi grow partly as yeast and partly as elongated cells resembling hyphae. The latter form a pseudomycelium.

Example: Candida albicans

3- Molds or Filamentous Fungi

The basic morphological elements of filamentous fungi are long branching filaments or hyphae, which intertwine to produce a mass of filaments or mycelium Colonies are strongly adherent to the medium and unlike most bacterial

colonies cannot be emulsified in water ¬ The surface of these colonies may be velvety, powdery, or may show a cottony aerial mycelium. ¬ Reproduce by the formation of different types of spores ¬ Example: Dermatophytes, Aspergillus, Penicillium, Mucor, Rhizopus

4- Dimorphic Fungi

These are fungi which exhibit a yeast form in the host tissue and in vitro at 370C on enriched media and mycelial form in vitro at 250C

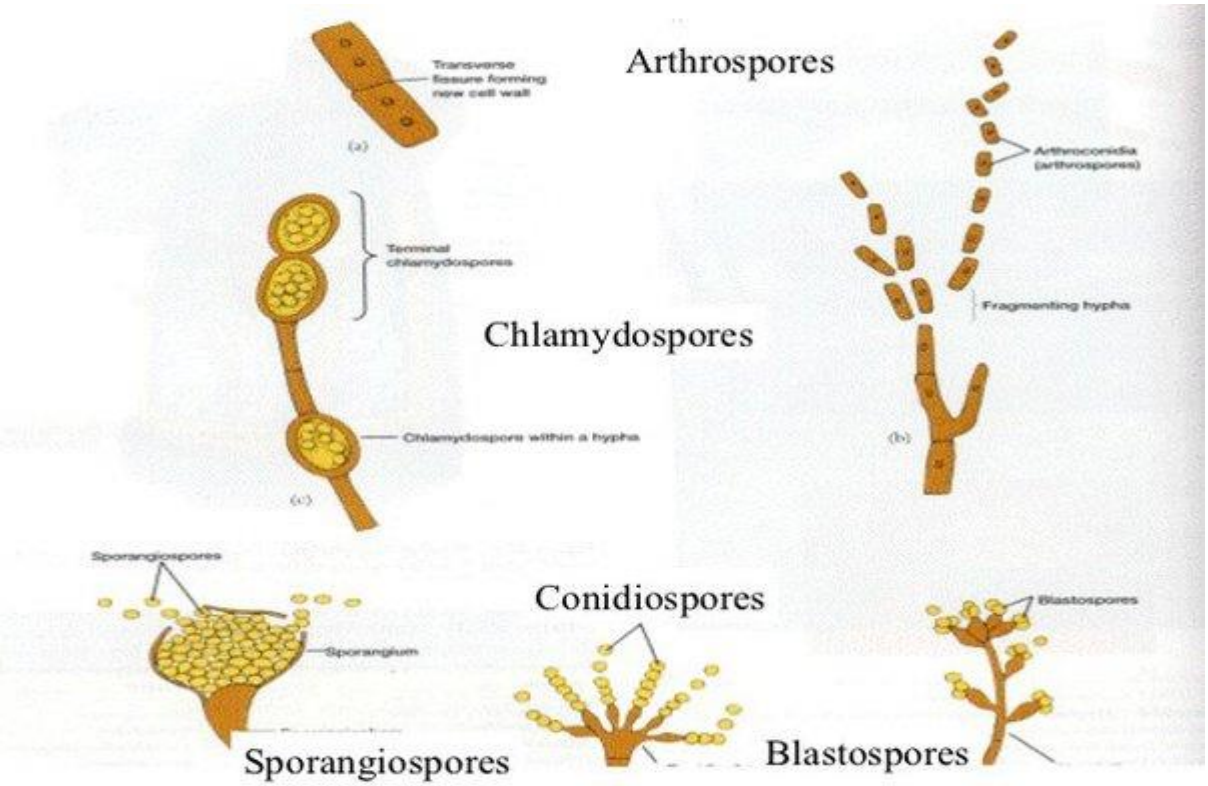
Examples: Histoplasma capsulatum, Blastomyces dermatitidis, Coccidioides, and Paracoccidoides brasiliesis.

Reproduction in Fungi

Reproduction in fungi is both by sexual and asexual means. The sexual mode of reproduction is referred to as teleomorph and the asexual mode of reproduction is referred to as anamorph.

Vegetative reproduction in fungi –This takes place by budding, fission and fragmentation.

Asexual reproduction – This takes place with the help of spores called conidia or zoospores, or sporangiospores.



Sexual reproduction This occurs by ascospores, basidiospores, basidiospore and oospores.The conventional mode of **sexual reproduction** is not always observed in the kingdom Fungi. In some fungi, the fusion of two haploid hyphae does not result in the formation of a diploid cell. In such cases, there appears an intermediate stage called the dikaryophase. This stage is followed by the formation of diploid cells.

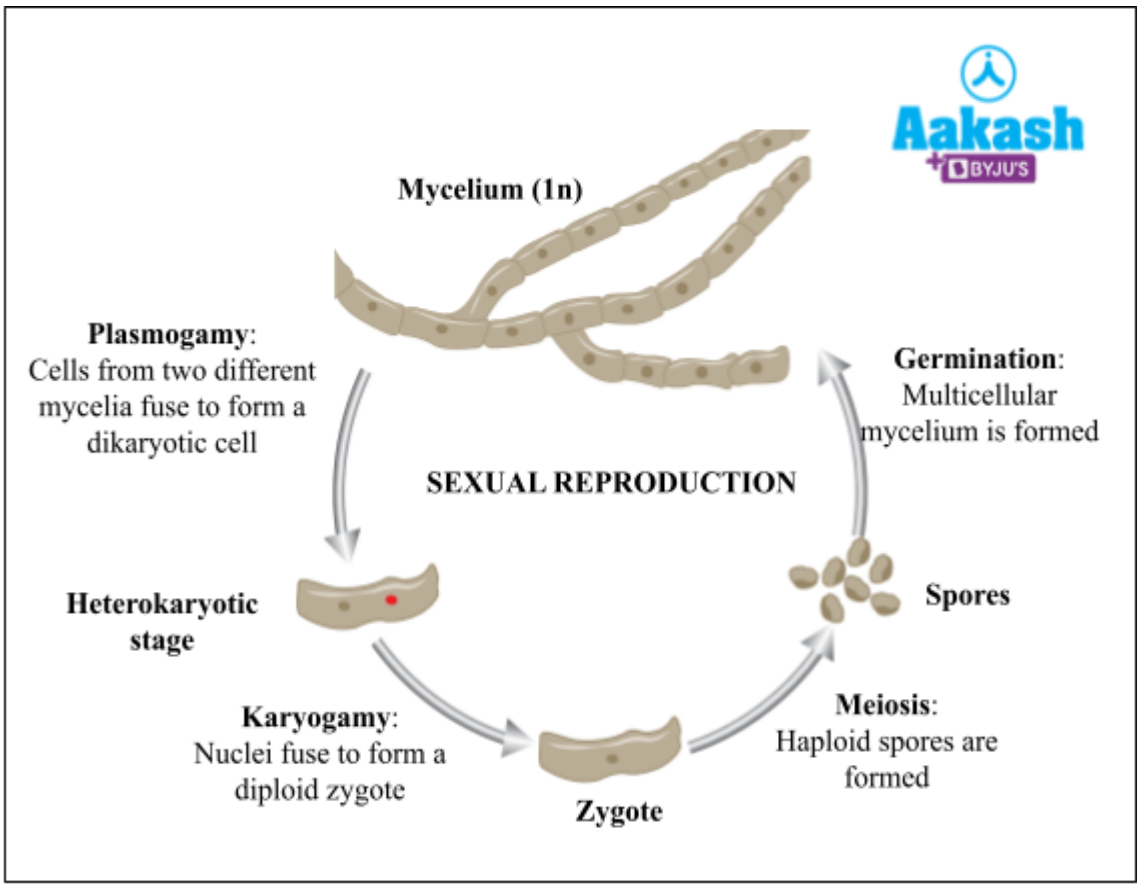
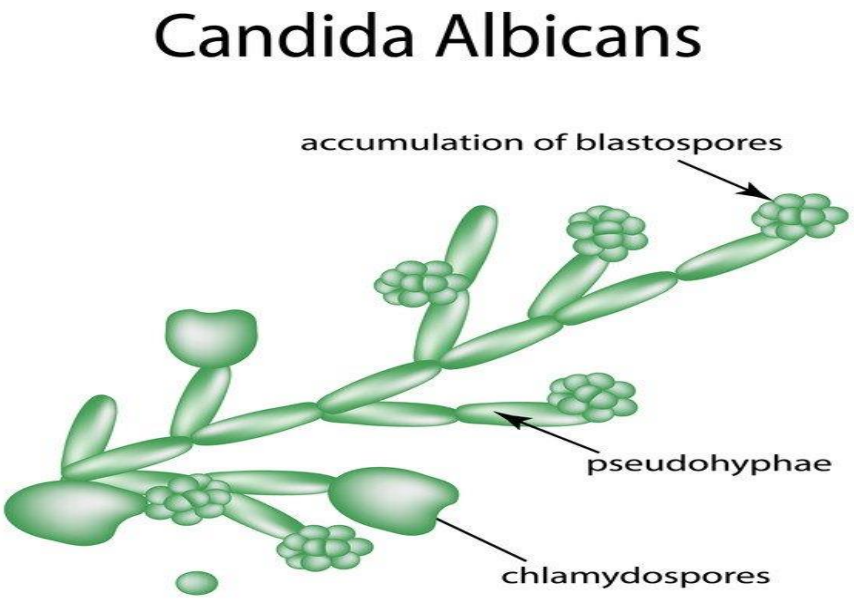


Fig: Sexual reproduction in fungi

Candida Albicans

Candida albicans is a fungus that naturally lives on your body. *Candida* is yeast, a type of fungus, that that is typically found in small amounts on your mouth, skin and in your intestines. Healthy bacteria in your body (microbiome) control the balance of *Candida*. Often when *Candida* is off-balance, the yeast overgrows and causes infection (candidiasis). *Candida* albicans is not a sexually transmitted infection.



Common types of infections caused by *Candida* albicans include:

1- **Thrush:** An overgrowth of yeast forms inside of your mouth and throat that appear as white, raised bumps.
2- **Vaginal yeast infection:** Yeast multiplies inside of your vagina and causes infection. Other names for a vaginal yeast infection are "vaginal candidiasis" or "candidal vaginitis."
3- **Invasive candidiasis:** A severe infection that targets your whole body, specifically your blood, bones, brain and heart.

Clinical signs

Symptoms of infection from *Candida* albicans usually form in areas where *Candida* lives naturally, including:

1- Inside your mouth and throat.
2- Inside your vagina and rectum.
3- Near the diaper region on infants.

4- On folds of your skin (under breasts).

Symptoms of infection include:

1- Skin redness (rash).
2- Itching.
3- Blisters.
4- Lumpy white patches.
5- Pain, soreness or discomfort.
6- Burning sensation.
7- Vaginal discharge.

Treatment

Since *Candida* is a fungus, an antifungal medicine treats the infection to stop overgrowth. Antifungal medications come in two forms:

- **Oral:** Medicine taken by mouth (tablet, liquid or lozenge).
- **Topical:** Medicine applied directly to the affected area (creams or ointments).

Your healthcare provider will give you directions on how to use each type of antifungal medication to make sure the infection clears up and doesn't return.

الاختبار البعدي

1. **What is Mycology?**
   A) Study of bacteria
   B) Study of fungi
   C) Study of viruses
   D) Study of algae

Answer: B) Study of fungi

2. **Which of the following is a component of fungal cell walls?**
   A) Cellulose
   B) Chitin
   C) Peptidoglycan
   D) Collagen

Answer: B) Chitin

3. **Which type of fungi obtain nutrients from dead organic matter?**
   A) Symbiotic
   B) Parasitic
   C) Saprophytic
   D) Autotrophic

Answer: C) Saprophytic

4. **Lichens represent a symbiotic relationship between fungi and which other organism?**
   A) Bacteria
   B) Plants
   C) Algae
   D) Protozoa

Answer: C) Algae

5. **Which class of fungi reproduces through ascospores?**
   A) Zygomycetes
   B) Basidiomycetes
   C) Ascomycetes
   D) Deuteromycetes

Answer: C) Ascomycetes

6. **Which of the following is an example of a yeast?**

   A) Mucor

   B) Aspergillus

   C) Saccharomyces cerevisiae

   D) Rhizopus

Answer: C) Saccharomyces cerevisiae

7. **Candida albicans is commonly associated with which type of infection?**

   A) Viral infection

   B) Bacterial infection

   C) Yeast infection

   D) Parasitic infection

Answer: C) Yeast infection

8. **Dimorphic fungi exhibit which form in the host tissue?**

   A) Mycelial form

   B) Hyphal form

   C) Spore form

   D) Yeast form

Answer: D) Yeast form

9. **Which of the following is a common antifungal treatment method for Candida infections?**

   A) Antibiotics

   B) Antiviral drugs

   C) Antifungal medication

   D) Antiparasitic drugs

Answer: C) Antifungal medication

10. **Which of the following is an example of a filamentous fungus?**

A) Candida albicans

B) Cryptococcus neoformans

C) Penicillium

D) Saccharomyces cerevisiae

Answer: C) Penicillium

رقم المحاضرة:	
عنوان المحاضرة:	virology
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الاختبار القبلي

- **Viruses can infect only humans.**

False — Viruses can infect humans, animals, plants, bacteria, and fungi.

- **Retroviruses use RNA as their genetic material, which they convert into DNA inside the host cell.**

True

- **Viruses can reproduce without a host cell.**

False — Viruses need a host cell to reproduce.

- **The genetic material of viruses can be either DNA or RNA.**

True

- **All viruses have an envelope surrounding their capsid.**

False — Some viruses are "naked" and lack an envelope.

- **Bacteriophages are viruses that specifically infect bacterial cells.**

True

- **The lytic cycle involves a dormant phase where the virus integrates into the host genome.**

False — The lytic cycle involves the immediate takeover of the host cell to produce new viruses, while the lysogenic cycle has a dormant phase.

- **Coronaviruses include the virus that causes COVID-19, as well as other viruses that cause mild illnesses like the common cold.**

True

- **Hepatitis viruses all belong to the same family or genus.**

False — Hepatitis viruses can belong to different families but all target the liver.

- **Oncoviruses are capable of causing cancer in their host.**

True

- **Satellite viruses can reproduce on their own without the help of another virus.**

False — Satellite viruses need a helper virus to reproduce.

- **Flaviviruses are typically transmitted through mosquito bites.**

True

- **HIV is an example of a retrovirus.**

True

- **Orthopoxviruses cause diseases like smallpox and monkeypox.**

True

- **A virus's capsid is responsible for protecting its genetic material.**

True

Virology

Viruses are small germs (pathogens) that can infect you and make you sick. They can infect humans, plants, animals, bacteria and fungi. Each one infects only specific types of hosts.

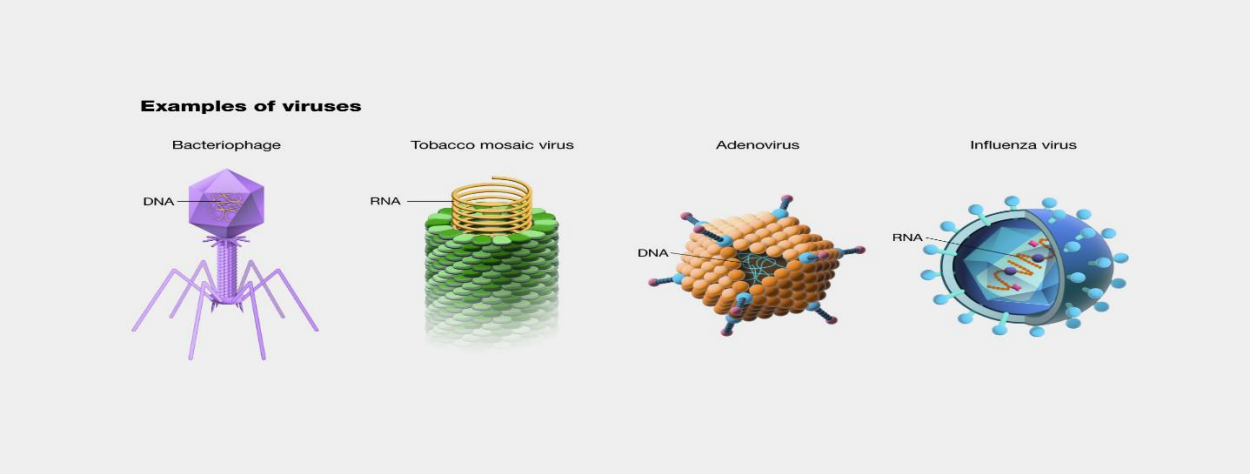
Viral infections in humans can cause no symptoms or make you extremely ill. Types of diseases they can cause include:

1- Respiratory illnesses.

2- Diarrhea and vomiting.

3- Sexually transmitted infections (STIs).

4- Skin conditions.



Virus features

Viruses share some common features.

1- Are made up of genetic material (RNA or DNA) and a protective protein coating (capsid).

2- Sometimes have another layer called an envelope around the capsid. Viruses without an envelope are called “naked viruses.”

3- Are similar to parasites — they need a host to reproduce. They’ll survive outside of a host until their capsid breaks down over time.

4-Are 100 to 1,000 times smaller than the cells in your body.

Types of viruses

Experts group viruses into categories — like family and genus — based on similar features, like size, shape and the type of genetic material they carry. Some common types of viruses that you might hear about include:

1- Influenza viruses.

2- Human herpesviruses.

3- Coronavirus.

4- Human papillomaviruses.

5- Enteroviruses.

6- Flaviviruses.

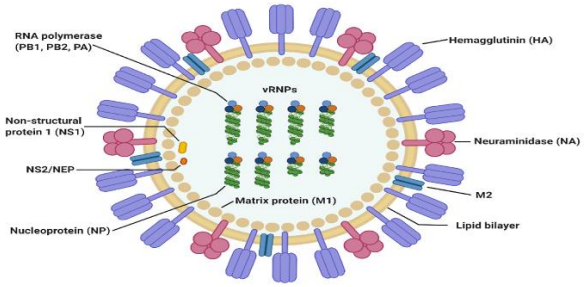
7- Orthopoxviruses.

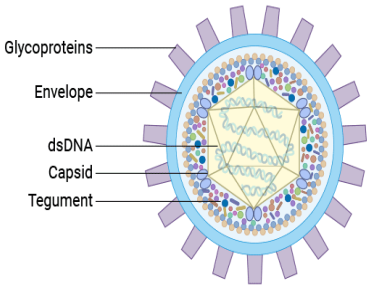
8- Hepatitis viruses.

There are also some viruses that have unique qualities, like retroviruses and oncoviruses.

Influenza viruses (Orthomyxoviridae)

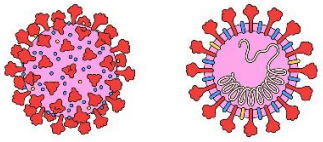
The Orthomyxoviridae family of viruses includes influenza A and B, which cause the flu. Strains of influenza A also cause avian flu (“bird flu”) and swine flu (H1N1).





Human herpesvirus (Herpesviridae)

Herpesviridae is a large family of viruses. They cause several types of illnesses, like oral and genital herpes, chickenpox, shingles, Epstein-Barr and cytomegalovirus (CMV).

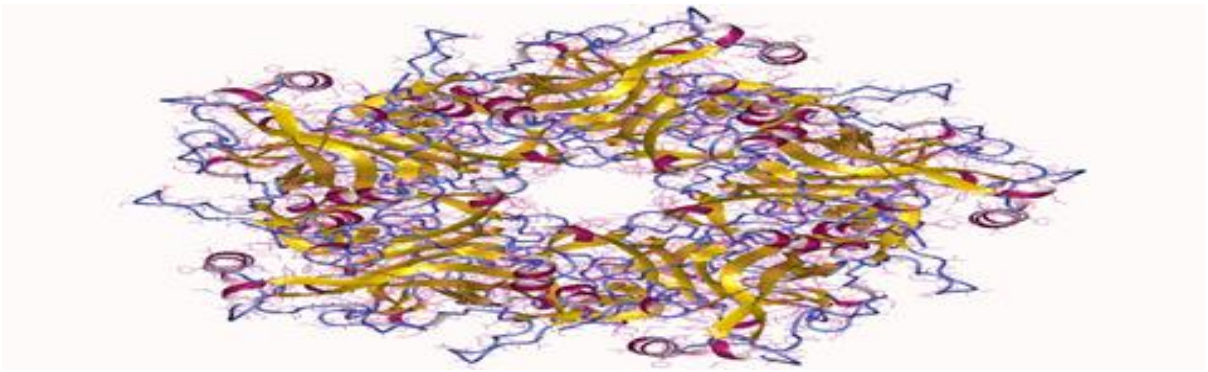


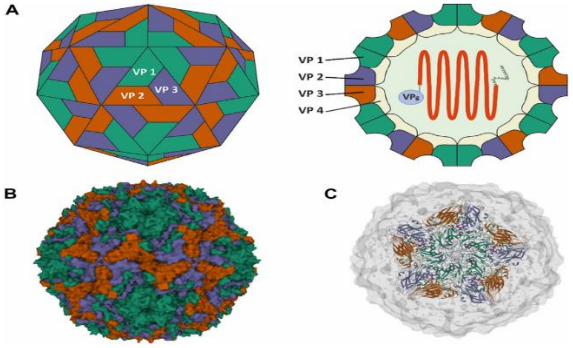
Coronaviruses

Coronaviruses are a subfamily of viruses. SARS-CoV-2, the virus that causes COVID-19, is probably the most well-known coronavirus. But other types of coronaviruses cause mild illnesses, like a cold.

Human papillomavirus (HPV)

Human papillomaviruses are part of the Papillomaviridae family of viruses. They cause warts. Some types of HPV can lead to cancers.





Enteroviruses

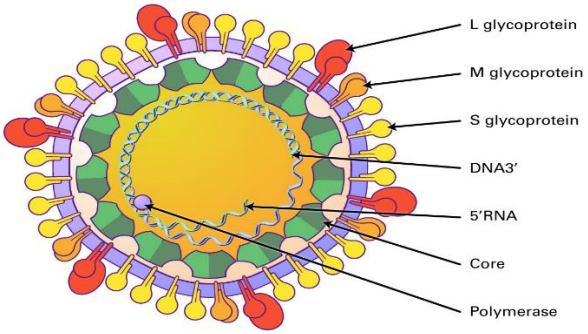
Enterovirus is a genus (one level smaller than the group called a “family”) of viruses that infect your intestinal tract. Types of enteroviruses cause polio and hand, foot and mouth disease.

Flaviviruses

Viruses in this genus are often spread by mosquitoes. They cause illnesses like Zika, West Nile, dengue fever and yellow fever.

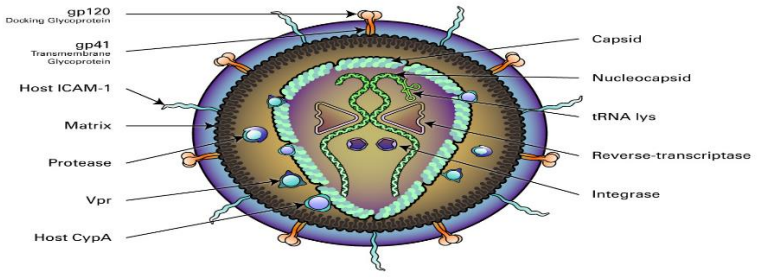
Orthopoxviruses

Viruses in the genus Orthopoxvirus cause blistering rashes. Mpox and smallpox are orthopoxviruses.



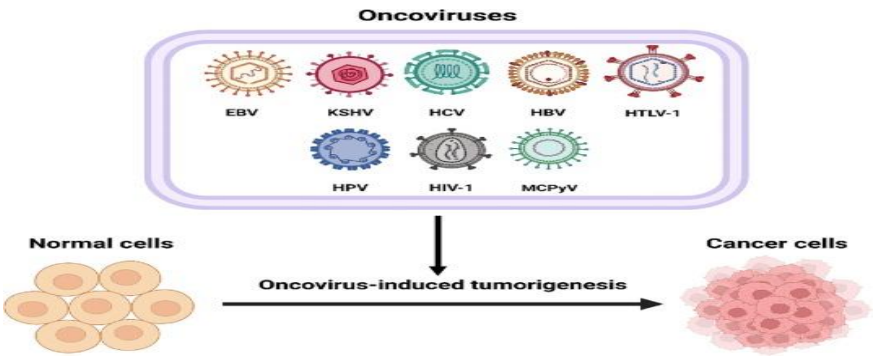
Hepatitis viruses

Though they don’t all belong to the same family or genus, hepatitis viruses all infect your liver. Hepatitis A, B and C are the most common.



Retroviruses

Retroviruses are RNA viruses that use special proteins to make DNA. The virus then inserts its DNA into yours. Your cells read the viral DNA as if it were its own instructions. HIV and human T-lymphotropic virus 1 (HTLV-1) are retroviruses.

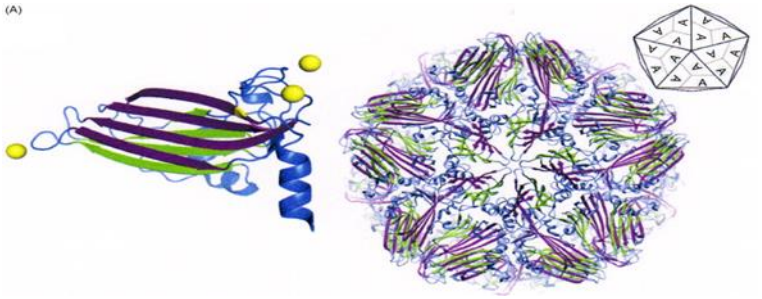


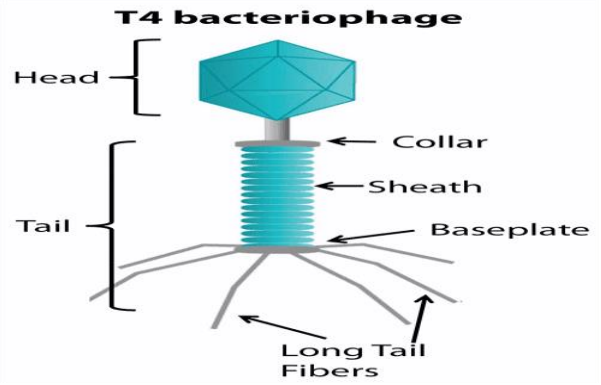
Oncoviruses

Oncoviruses are viruses that can cause cancer. Viruses that have been linked to specific cancers include: (HPV,Epstein-Barr, HIV, Hepatitis B and C, HTLV-1, Human herpesvirus 8 (HHV-8).

Satellite viruses

Satellite viruses can't reproduce without other, "helper" viruses. Most satellite viruses are found in plants.





Bacteriophages

Also just called "phages," bacteriophages are viruses that specifically infect bacteria. Scientists are studying bacteriophage therapy as a potential way to treat bacterial infections that don't respond to antibiotics.

Function

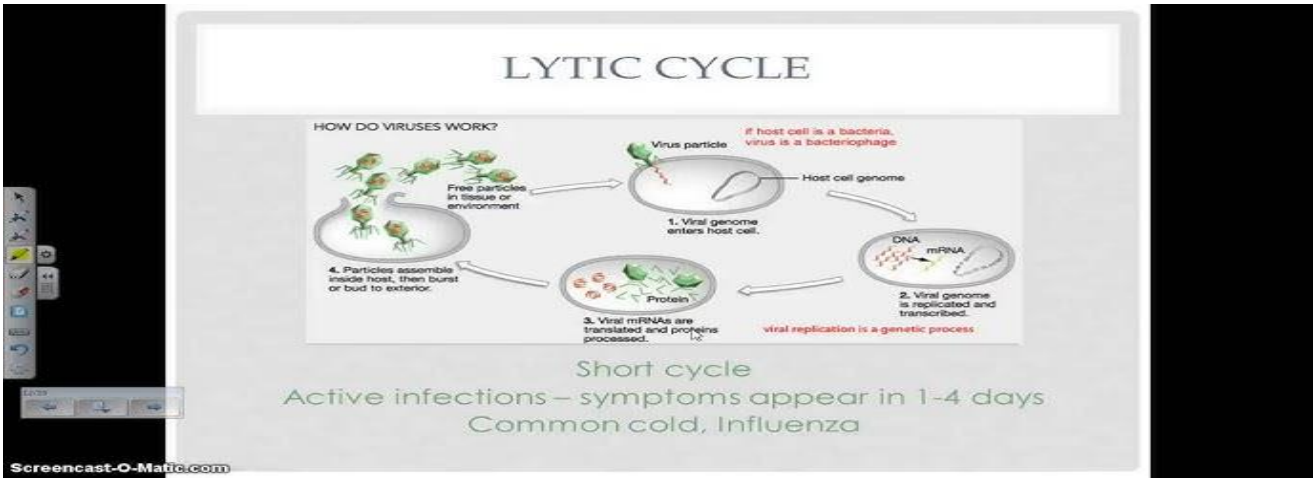
Viruses usually enter your body through your mucous membranes. These include your eyes, nose, mouth, penis, vagina and anus. Some viruses get in through a break in your skin or from a bite from a mosquito or tick.

Viruses work:-

Viruses have several steps to infecting cells and reproducing. They include:

1- Attachment 2- Entry 3- Replication 4- Assembly 5- Release

6- Attachment and entry



Viruses can get inside of cells in three ways:

- Receptor binding. Cells have receptors on the outside that can receive signals from proteins in your body. Think of them like doors. Some viruses trick cells into thinking they should be allowed inside, so the cells let them in the door.
- Direct fusion. Some viruses attach directly to host cells to get inside.
- Bacteriophages inject their genetic material into bacterial cells. The entire virus doesn't need to get inside.

Replication, assembly and release

Once the virus or its genetic material is inside of a cell, it uses either a lytic cycle or lysogenic cycle to reproduce (some use both):

- Lytic cycle. The virus uses the host cell's machinery to make more copies of itself. Pieces of the virus assemble, wrapping up the genetic material in the capsid. Viruses make many copies of themselves this way. Eventually, there are so many copies of the virus inside the cell that it bursts. Those virions can now go and infect more cells.

Lysogenic cycle. Some viruses have a dormant, or silent phase. They get inside cells and then wait. Instead of setting up shop to cook in your kitchen right away, it's as if they put their recipe into your body's recipe book without you knowing it. The cells don't realize the virus is there and continue to reproduce as they normally would. Each new copy of the cell also has a copy of the virus in it. Certain triggers can cause those cells to burst, spreading viral particles into your body that can infect other cells. Triggers could include stress, chemical signals or temperature changes

الاختبار البعدي

- **What is the main characteristic that viruses share with parasites?**

A) They are made of DNA only.
B) They can reproduce on their own.
C) They need a host to reproduce.
D) They are larger than bacteria.

Answer: C) They need a host to reproduce.

- **Which of the following is a type of virus that can cause cancer?**

A) Orthopoxvirus
B) Enterovirus
C) Oncovirus
D) Bacteriophage

Answer: C) Oncovirus

- **What is a key feature of retroviruses?**

A) They have a protein coat called a capsid.
B) They directly kill host cells.
C) They use RNA to make DNA and insert it into the host's genome.
D) They infect bacteria.

Answer: C) They use RNA to make DNA and insert it into the host's genome.

- **Which of the following is NOT a mode of entry for viruses into cells?**

A) Receptor binding
B) Endocytosis
C) Direct fusion
D) Active transport through ATP usage

Answer: D) Active transport through ATP usage

- **Which family of viruses includes those that cause influenza?**

A) Herpesviridae
B) Orthomyxoviridae
C) Flaviviridae
D) Papillomaviridae

Answer: B) Orthomyxoviridae

- **What is the lytic cycle in viral replication?**

A) The virus integrates its DNA into the host's genome.
B) The virus remains dormant within the host cell.
C) The virus uses the host cell's machinery to produce many copies, leading to cell bursting.
D) The virus is slowly released from the host cell without causing damage.

Answer: C) The virus uses the host cell's machinery to produce many copies, leading to cell bursting.

- **Which of the following is a type of virus that infects bacteria?**

A) Enterovirus
B) Orthopoxvirus
C) Bacteriophage
D) Retrovirus

Answer: C) Bacteriophage

- **What distinguishes naked viruses from enveloped viruses?**

A) Naked viruses are larger than enveloped viruses.
B) Naked viruses lack a protective capsid.
C) Naked viruses do not have an additional lipid layer around the capsid.
D) Naked viruses can reproduce outside of a host.

Answer: C) Naked viruses do not have an additional lipid layer around the capsid.

- **Which of the following viruses is known for causing liver infections?**

A) Influenza virus
B) Human papillomavirus (HPV)
C) Hepatitis viruses
D) Coronavirus

Answer: C) Hepatitis viruses

- **In which phase of the viral life cycle do some viruses integrate their genetic material into the host cell's DNA?**

A) Lytic cycle
B) Lysogenic cycle
C) Attachment phase
D) Assembly phase

Answer: B) Lysogenic cycle

- **Which of the following viruses is known for causing diseases like chickenpox and shingles?**

A) Orthopoxvirus
B) Human papillomavirus
C) Human herpesvirus
D) Influenza virus

Answer: C) Human herpesvirus

- **What is the genetic material found in retroviruses?**

A) Only DNA
B) Only RNA
C) RNA that converts into DNA
D) DNA that converts into RNA

Answer: C) RNA that converts into DNA

- **Which type of virus requires a "helper" virus to reproduce?**

A) Satellite virus
B) Enterovirus
C) Flavivirus
D) Oncovirus

Answer: A) Satellite virus

- **What do flaviviruses typically have in common?**

A) They are always transmitted through direct contact with blood.
B) They infect bacteria specifically.
C) They are spread primarily by mosquitoes.
D) They cause respiratory infections.

Answer: C) They are spread primarily by mosquitoes.

- **Which of the following is an example of a viral infection that can be asymptomatic?**

A) Influenza
B) Human papillomavirus (HPV)
C) Smallpox
D) Hepatitis C

Answer: B) Human papillomavirus (HPV)

- **Which virus family includes SARS-CoV-2, the virus that causes COVID-19?**

A) Herpesviridae
B) Orthomyxoviridae
C) Coronaviruses
D) Retroviruses

Answer: C) Coronaviruses

- **Which of the following is true about viruses in the lytic cycle?**

A) The virus becomes integrated into the host's DNA.
B) The virus remains dormant and does not produce symptoms.
C) The virus immediately takes over the host cell to produce new viral particles.
D) The virus spreads slowly through exocytosis without killing the host cell.

Answer: C) The virus immediately takes over the host cell to produce new viral particles.

- **What type of virus causes polio and hand, foot, and mouth disease?**

A) Enterovirus
B) Flavivirus
C) Hepatitis virus
D) Herpesvirus

Answer: A) Enterovirus

- **What is the role of the viral capsid?**

A) It replicates the viral DNA.
B) It binds to host cell receptors.
C) It protects the genetic material of the virus.
D) It acts as the main source of energy for the virus.

Answer: C) It protects the genetic material of the virus.

- **Which of the following viruses does not follow a conventional reproduction cycle?**

A) Zika virus
B) Epstein-Barr virus
C) Influenza virus
D) HIV

Answer: D) HIV

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