



وزارة التعليم العالي والبحث العلمي
الجامعة التقنية الشمالية
المعهد التقني الدور



الحقيبة التعليمية

القسم العلمي: الإسعاف
الفوري

اسم المقرر: الاحياء
المجهرية

المرحلة / المستوى:
الاول

الفصل الدراسي: الاول

السنة الدراسية: 2023
2024 -



اسم المقرر:	الاحياء المجهرية
القسم:	الإسعاف الفوري
الكلية:المعهد	المعهد التقني الدور
المرحلة / المستوى	الاول
الفصل الدراسي:	الاول
عدد الساعات الاسبوعية:	نظري 30 عملي 30
عدد الوحدات الدراسية:	4
الرمز:	IMA114
نوع المادة	نظري عملي كلهما √
هل يتوفر نظير للمقرر في الاقسام الاخرى	
اسم المقرر النظير	/
القسم	/
رمز المقرر النظير	/
معلومات تدريسي المادة	
اسم مدرس (مدرسي) المقرر:	د. عباس هادي حمادي
اللقب العلمي:	مدرس
سنة الحصول على اللقب	2023
الشهادة :	دكتوراه
سنة الحصول على الشهادة	2022
عدد سنوات الخبرة (تدريس)	13 سنة

الوصف العام للمقرر

- 1- التصنيف والتصنيف العلمي: دراسة التصنيف العلمي والتصنيف الدقيق للكائنات الحية المجهرية بما في ذلك الفروقات بين الأنواع والجناس والفصائل.
- 2- التركيب والبنية الخلوية: فهم البنية والتركيب الدقيق للخلايا الحية المجهرية ومكوناتها مثل الانوية والاعشبة الخلوية والأجهزة الخلوية الأخرى.
- 3- الوظائف والعمليات الحيوية: دراسة وظائف الاحياء المجهرية والعمليات الحيوية التي تتم داخلها مثل التمثيل الغذائي والتنفس والنمو والتكاثر.

الاهداف العامة

- فهم التنوع الحيوي : دراسة وتحليل التنوع الحيوي للكائنات الدقيقة التي لا ترى بالعين المجردة وتعزيز الوعي والتنوع البيولوجي الصغير.
- التفاعل البيئي والتأثيرات البيولوجية: فهم تأثير الاحياء المجهرية على بيئتها والتفاعلات بينها وبين باقي الكائنات الحية والبيئة المحيطة.
- تطوير التقنيات الحديثة: المساهمة في تطوير التقنيات المجهرية والحديثة لتحليل ودراسة الاحياء المجهرية بشكل اكثر دقة وفعالية.

الأهداف الخاصة

- 1- تحليل الوظائف الخلوية: فهم وظائف الأجزاء المكونة للخلية مثل التمثيل الغذائي والتنفس والتكاثر والتفاعلات الخلوية الأخرى.
- 2- تطبيقات الاحياء المجهرية: استخدام الاحياء المجهرية في مجالات البحث العلمي والطب الحيوي والزراعة والتكنولوجيا الحيوية والصناعات الأخرى.
- 3- التقنيات والأدوات المجهرية: التعرف على التقنيات الحديثة المستخدمة في دراسة وتحليل الاحياء المجهرية مثل التصوير المجهرى والتقنيات الجزيئية .

الأهداف السلوكية او نواتج التعلم

- تطوير مهارات التحليل والملاحظة: قدرة الطلاب على استخدام المجهر بشكل فعال لتحليل ودراسة الكائنات الصغيرة والهياكل الدقيقة.
- تحليل البيانات والتفسير والنتائج: القدرة على جمع البيانات الدقيقة من التجارب المجهرية وتحليلها بطريقة نقدية وتفسير النتائج بشكل دقيق.
- التطبيقات العملية والمهارات العلمية: تنمية المهارات العلمية في استخدام الأدوات المجهرية وتطبيق النظريات العلمية في التجارب العملية.

المتطلبات السابقة

- اذكر أي متطلبات سابقة قد يحتاجها الطالب قبل التسجيل في المقرر، مثل مواد دراسية سابقة أو مهارات معينة.

الأهداف السلوكية او مخرجات التعليم الأساسية		
ت	آلية التقييم	
1	الأهداف المعرفية: فهم الأساسيات النظرية وتعريف الأحياء المجهرية وفهم أنواع الميكروبات (بكتيريا، فيروسات، فطريات، طحالب، وغيرها). معرفة دور الميكروبات في البيئة، والزراعة، والصناعة، والصحة.	تقارير، واجبات، امتحانات نظرية شفوية وتحريرية نصف فصلية وفصلية
2	الأهداف المهارية : اكتساب مهارات العمل المختبري. تعلم كيفية استخدام المجهر وتحديد الخلايا الميكروبية. تطوير مهارات التعقيم والزرع الميكروبي. إجراء اختبارات حساسية المضادات الحيوية على البكتيريا.	تقارير، واجبات، امتحانات نظرية شفوية وتحريرية نصف فصلية وفصلية
3	الأهداف الوجدانية : تقدير أهمية الأحياء المجهرية في الحياة اليومية. إدراك دور الميكروبات في صحة الإنسان والبيئة. احترام قواعد الأمان الحيوي والتعامل الصحيح مع المواد الميكروبية.	تقارير، واجبات، امتحانات نظرية شفوية وتحريرية نصف فصلية وفصلية
4	تنمية التفكير التحليلي: القدرة على تقييم المعلومات العلمية المتعلقة بالميكروبات. تطوير القدرة على اتخاذ قرارات مستنيرة بناءً على الأدلة العلمية.	تقارير، واجبات، امتحانات نظرية شفوية وتحريرية نصف فصلية وفصلية

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

الاسلوب او الطريقة	مبررات الاختيار
1. المناقشة	تقديم الخلاصة والفهم للموضوع
2. الالقاء	اكتساب الطالب مهارة تفسير النصوص
3. المحاضرة	محدد وواضح ويطبق بسهولة وهو التقليدي
.	

المحتوى العلمي

عنوان الفصل				الوقت		
التوزيع الزمني	النظري	العملي	العنوان الفرعي	طريقة التدريس	التقنيات	طرق القياس
الأسبوع الأول	2	2	تصنيف الكائنات الحية الدقيقة : فطريات، طحالب، أوليات، بكتيريا، ميكوبلازما، فيروسات، ريكتسيا.	محاضرة	سبورة – لابتوب	
الأسبوع الثاني	2	2	التركيب العام للبكتيريا: التركيب البكتيري، جدار الخلية، كبسولة الغشاء السيتوبلازمي، البروتوبلازم بما في ذلك السيتوبلازم والنواة. مقارنة بين الخلية بدائية النواة والخلية حقيقية النواة.	محاضرة	سبورة – لابتوب	
الأسبوع الثالث والرابع	2	2	الجراثيم البكتيرية: أنواع الجراثيم المقاومة للظروف البيئية تؤثر الظروف البيئية على نمو البكتيريا: درجة حرارة الأكسجين، الرطوبة، PH، الضوء، الضغط الأسموزي، الوسط الزراعي - مراحل نمو البكتيريا: مرحلة التأخر، مرحلة اللوغاريتم، المرحلة الثابتة، مرحلة الانخفاض	محاضرة	سبورة – لابتوب	
الاسبوع الخامس والسادس	2	2	تنشيط نمو البكتيريا: التعقيم والتطهير. التعقيم بالإشعاع والترشيح والتعقيم الكيميائي.	محاضرة	سبورة – لابتوب	
الاسبوع السابع	2	2	البكتيريا الطبية: المكورات العنقودية الذهبية، الصفات العامة، السموم، علاج الأمراض.	محاضرة	سبورة – لابتوب	
الاسبوع الثامن	2	2	البكتريا المسببة s.faecalis s.viridans, s.pyogenesالبنية العامة، الأوساط الزرعية , وسائل الأمراض. بكتريا المسببة الرئوية :- البنية العامة ، الأمراض ، العلاج	محاضرة	سبورة – لابتوب	
الاسبوع التاسع	2	2	مجموعة البكتريا النيسرية: البنية العامة، المكورات السحائية، البنية العامة، المرض. المتفطرة: - أنواع المتفطرة السلية، التركيب العام، الثقافة، المقاومة، الأوساط الزرعية، المسبب المرضي، التعريف، العلاج. المتفطرة الجذامية :- الخصائص العامة ، الأمراض ،	محاضرة	سبورة – لابتوب	

			التشخيص ، العلاج.			
	سبورة – لابتوب	محاضرة	البكتريا المطثية (اللاهوائية): الصفات العامة، المطثية الكزازية: الوصف، عوامل المرض التي تعزز النمو في الجروح، الوقاية والعلاج. كلوستريديوم الفرغينا الغازية: الوصف، المرض، العلاج، التسمم الغذائي، السموم التي تفرز في الأطعمة، الأعراض، العلاج. عضية الجمرة الخبيثة، الوصف، المرض، العلاج	2	2	الاسبوع العاشر والحادي عشر
	سبورة – لابتوب	محاضرة	أنواع البكتيريا المعوية، الأهمية الطبية، الصفات العامة، التعرف على الأوساط الزرعية. البكتيريا المعوية المسببة للأمراض، مجموعة السالمونيلا، السالمونيلا التيفية، السالمونيلا نظيرة التيفية، السالمونيلا تيفيموريوم. أعراض التسمم والعلاج الشيغيلا , مرض , علاج , التسمم الغذائي , الأعراض , البكتريا المتقلبة , الوصف , الأوساط الزراعية	2	2	الأسبوع الثاني عشر والثالث عشر
	سبورة – لابتوب	محاضرة	البروسيلة، التشخيص العامة، المرض، التشخيص، العلاج. البورديتيلا الوصف والتشكل والاوساط الزرعية والمرض والعلاج.	2	2	الأسبوع الرابع عشر
	سبورة – لابتوب	محاضرة	بكتريا الكوليرا، الخصائص العامة، المرض، الصفات العامة، العلاج	2	2	الأسبوع الخامس عشر

المحتوى العلمي

MODULAR UNIT

1

A: Over view

1-Target population:-

- This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute
- This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

2- Central ideas

- 1: General definition of microbiology
- 2: Classification of microorganism

3-Instructions :

- 1: Study the over view carefully .
- 2:Learn briefly the modular unit of this package.
- 4: Perform the pre –test of this unit:

If you get (9) degree or more you will not need to learn this modular unit. in this case you must contact with your teacher to inform him about your results.

But when you get less than (9) degree in this test, you will need to continue learning this modular unit.

5: After you studying this modular unit.

The post –test you must be doing it.

If you get (9) degree or more, you must go to learn the second modular unit.

In case you get less than (9) degree, you must return to the same unit in order to learn and understand the steps which you need.

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit, you should be able to:

- 1-Define microbiology and its scope.
- 2-Classify microorganism according to medical importance.
- 3-Describe the general structure of bacterial cell.

Microbiology

Introduction

Biology is the science deal with living organisms like human, animal, plant and microorganisms, so the microbiology all organisms that are very small or microscopic, and cannot be seen with the naked eye are referred to as microorganisms. Microorganisms are visible under the microscope. Anton van Leeuwenhoek **first** observed microorganisms under the microscope. Microorganisms include bacteria, algae, fungi, protozoa, etc.

Classification is the process by which organisms are grouped into various categories based on morphological and physiological characteristics.

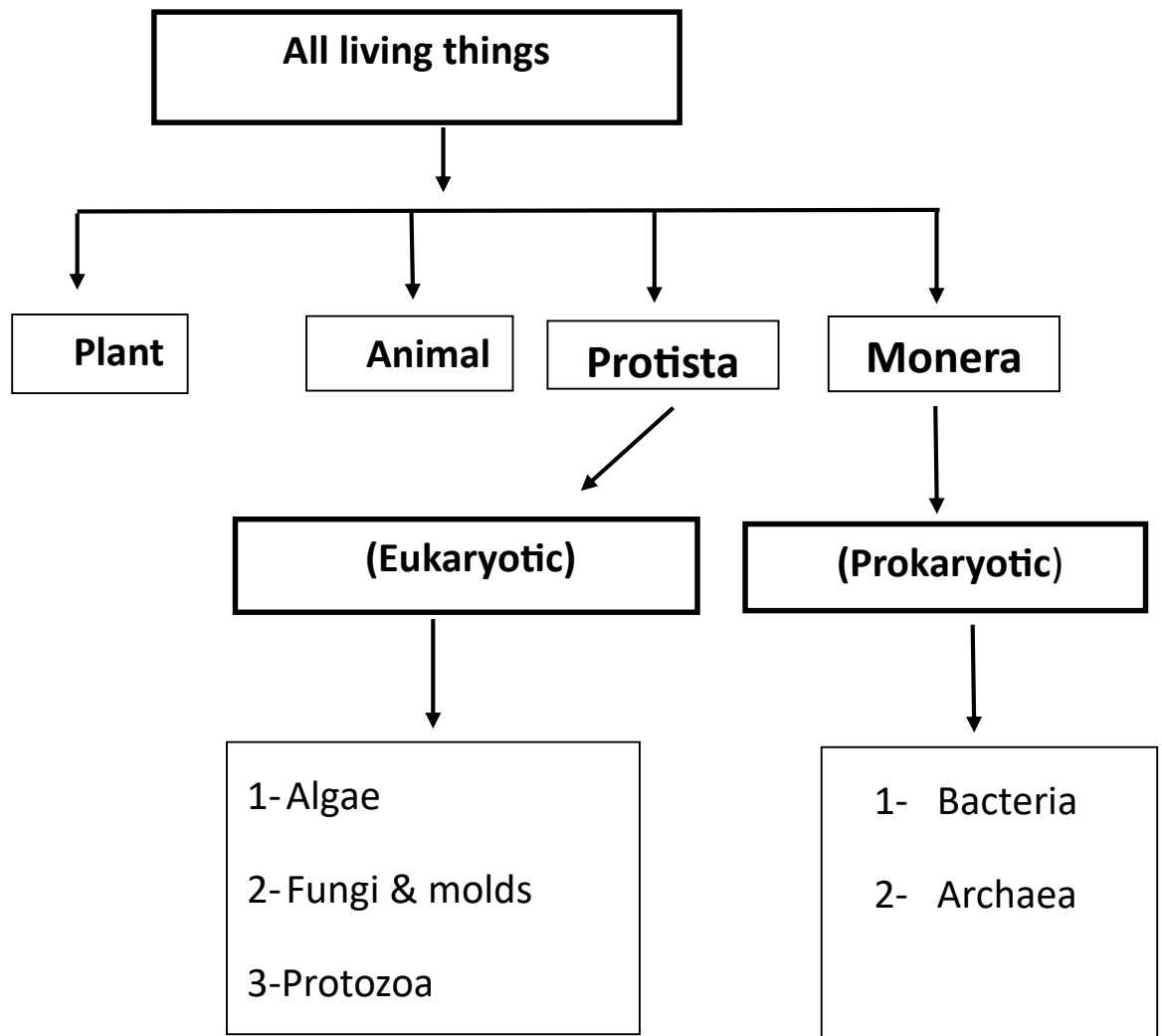
Microorganisms are prokaryotic, such as bacteria, archaea, etc., as well as eukaryotic, such as protozoa, algae, fungi, etc. R.H. Whittaker elucidated the five Kingdom Classification, which was based on the following characteristics:

- ✓ Cell type (**prokaryotic** and **eukaryotic**) and presence of nuclear membrane
- ✓ Presence of cell wall and its constituents
- ✓ Body organization
- ✓ Mode of nutrition
- ✓ Mode of reproduction
- ✓ Phylogenetic relationships

Based on the following characteristics, R. H. Whittaker divided living organisms into five kingdoms. They are as follows:

- Monera – Unicellular prokaryotes
- Protista – Unicellular eukaryotes
- Fungi – Eukaryotic, heterotrophic (saprophytic/ parasitic) and with a cell wall (chitin)
- Plantae – Eukaryotic, autotrophic (photosynthetic) and with a cell wall (cellulose)
- Animalia – Eukaryotic, heterotrophic (holozoic/ saprophytic etc)

CLASSIFICATION OF MICRO-ORGANISMS



Bacteria (Monera)

Bacteria are the most abundant microorganisms and are present almost everywhere. They are classified as **Gram-positive** and **Gram-negative**, based on the **Gram's staining pattern**.

Protozoa

protozoans are classified under the kingdom Protista. On the basis of their **mode of locomotion**, they are classified into four major groups. They are:

- **Amoeboid** – They have pseudopodia, which is used for **movement** and capturing prey. E.g. *Amoeba*, *Entamoeba*, etc.
- **Flagellated** – E.g. *Trypanosoma*, the causative organism of **sleeping sickness**, *Leishmania*, etc.
- **Ciliated** – e.g. *Paramoecium*. Cilia also help in bringing water laden with food inside the cavity of the gullet.
- **Sporozoans** – intracellular parasites, they depend on gliding, twisting, and bending to move. E.g. *Plasmodium*, the causative organism of malaria, *Toxoplasma*, etc.

Fungi

They grow either as single cells, e.g. yeasts, or as colonies of multicellular filaments (hyphae), e.g. moulds. They reproduce by means of spores.

Viruses

These are minute organisms which can only multiply within living cells. Consist in their simplest form of an outer coat of protein and an inner core of nucleic acid which may be either ribonucleic acid (RNA) or desoxyribonucleic acid (DNA).

Rickettsiae

They are small micro-organisms which are in some ways intermediate between viruses and bacteria. They are similar to bacteria in that they contain both RNA and DNA, and reproduce by binary fission; they resemble viruses by being able to multiply only within living cells.

C: Pre- test

Put a circle in front of right sentence

1-Microbiology is the science which deals with the studying of

A-Parasite only

B-Bacteria only

C-Fungi only

D-Very small living organism

2-Microorganism include prokaryote like

A-Fungi

B-Protozoa

C-Insect

D-Bacteria

3-Flagella originate from cytoplasmic membrane its function is

A-Organ of attachment

B-Organ of motility

C-Responsible for heredity

4-Fungi include

A-Mould

B-Yeast

C-Mushrooms

D- 1,2 and3

Compare your answer with the key in the end of learning package.

D:-THE MODULAR UNIT OF THIS PACKAGE

Microbiology :-

The science that dealing with the study of Microorganism .

Microorganism:-

Living forms too small can be seen under the microscope only.

Test 1 – What is the difference between micro biology and microorganism.

Classification of microorganisms

Microorganism of medical importance can be classified in:-

1- Bacteria

2-Reckettsia

3- Virus

4- Mycoplasma

5- Fungi

6- Protozoa

1-2-3 and 4 are Prokaryote

5 and 6 are Eukaryote

Test-2

What is the difference between prokaryote and eukaryote

1-Bacteria :- They are

A- Unicellular

B- Free living without chlorophyll

C- They have both DNA and RNA

2- Rickettsia

A-Smaller than bacteria

B- Contain both DNA and RNA

C- Can not grow on artificial media

3- Virus

A-Can be seen under electron microscope only

B- They have either DNA or RNA

C- Grow and reproduce only in living cells

4- Mycoplasma

A- Smallest microorganism can grow on artificial media

B- They have no cell wall

5- Fungi

Include Mould, Yeast and Mushrooms

The mould is multicellular while yeast is unicellular

Test 3-

Which microorganism can grow on artificial media

E:-Post test

Put a circle in front of right sentence

1-Microbiology is the science which deals with the studying of

A- Very small living organism

B-Bacteria only

C-Fungi only

D- Parasite only

2-Microorganism include prokaryote like

A-Fungi

B-Protozoa

C-Insect

D-Bacteria

3-Flagella originate from cytoplasmic membrane its function is

A-Organ of attachment

B-Organ of motility

C-Responsible for heredity

4-Fungi include

1-Mould

2-Yast

3-Mushroom

4- 1,2 and3

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the first modular unit of learning package

PRE TEST

1-D

2-D

3-B

4-D

POST TEST

1-A

2-D

3-B
4-D

TEST -1

Microbiology :-study of microorganism

Microorganism:-living form too small

TEST -2

Prokaryote have no nucleus membrane
Eukaryote have true nucleus

TEST – 3

Bacteria – Mycoplasma – Fungi

MODULAR UNIT

2

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

General structure of bacterial cell

3-1: Capsule

3-2: Cell wall

3-3: Cytoplasmic membrane

3-4: Cytoplasm

3-5; Mesosome

3-6: Nuclear material

4-Instructions :

4-1: Study the over view carefully .

4-2:Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

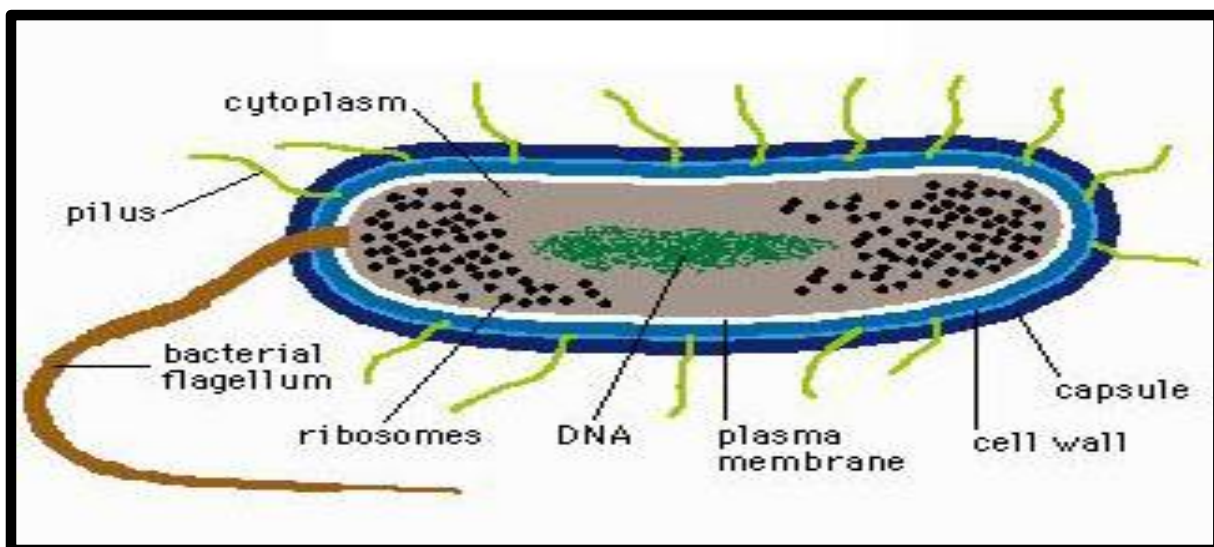
B: Performance objectives

After studying this modular unit, you should be able to:

- 1- Enumerate the general structure of bacterial cell
- 2- Drawing bacterial cell
- 3- Define the structures of bacteria

General Structure of Bacteria

Bacterial Anatomy (Bacteria cell)



Structure of bacteria

Structure of Bacteria

- 1- Cell wall
- 2- Cytoplasmic membrane
- 3- Ribosomes
- 4- Cytoplasm
- 5- Nucleoid
- 6- Flagella
- 7- Capsule
- 8- Pili

1. Cell wall: The layers of cell wall lying outside of the cell membrane.

- a. rigid structure, protect the bacterial cell against physical and chemical treatment.
- b. freely permeable
- c. important in cell division
- d. important in classification of bacteria

Both Gram-positive and Gram-negative bacteria possess cell wall peptidoglycans are unique to prokaryotic organisms.

2. Cytoplasmic membrane: It performs many functions, including biosynthesis, and energy transduction.
 - a. selective permeability
 - b. biosynthesis, and energy transduction.
 - c. cell growth

3. Cytoplasm: The cytoplasm or protoplasm It is gel-like in consistency and includes the prokaryotic chromosome and ribosomes. The cytoplasm also lacks organelles such as mitochondria, Golgi apparatus or endoplasmic reticulum.

4. Nucleus: absence of nuclear membrane and the chromosome in bacteria is typically a single, closed circle DNA some bacteria possess smaller extrachromosomal pieces of DNA called plasmids.

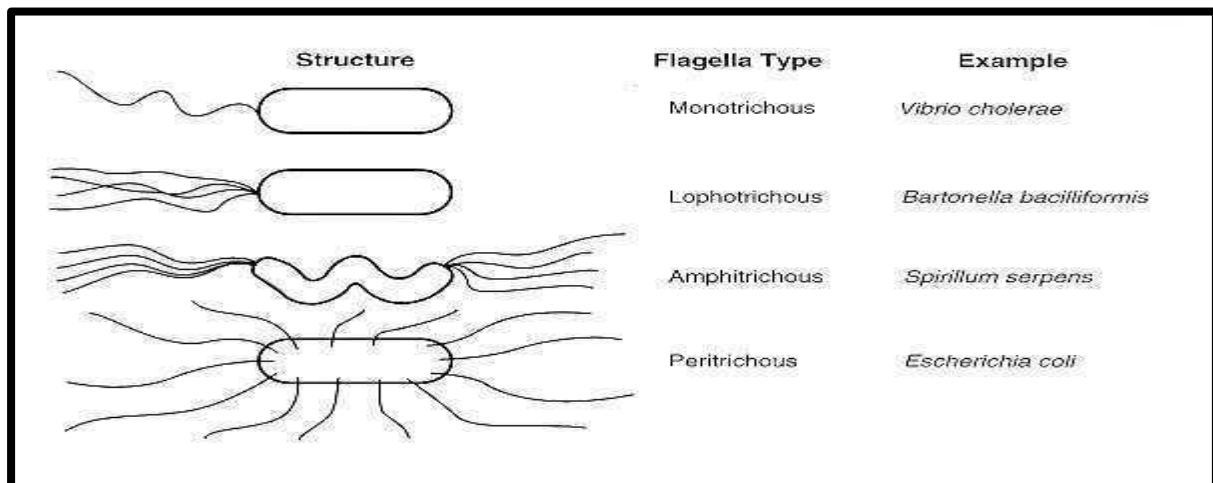
5. Ribosomes: The ribosomes are composed of termed 70'S (Svedberg units) divided in two smaller units to 50s and 30s. They are the sites of protein synthesis

6. Flagella

Almost all motile bacteria possess flagella as the organ of locomotion, Flagella arrangements are:

- 1- Monotrichous – a single flagellum at one pole (also called polar flagellum) E.g. *Vibrio cholera*.
2. Amphitrichous – single flagellum at both poles. E.g. *Campylobacter jejuni*
3. Lophotrichous – two or more flagella at one or both poles of the cell E.g. *Pseudomonas fluorescens*

4. Peritrichous- completely surrounded by flagella E.g. *E. coli*



Typical arrangements of bacterial flagella

7. Capsule

- a. protects the cell wall
- b. having capsule means that the bacteria was virulent.

8- pili

it is smaller than flagella as sex pili.

Morphology of Bacteria: (Shape of Bacteria)

Bacteria can be classified into four basic shapes as under.

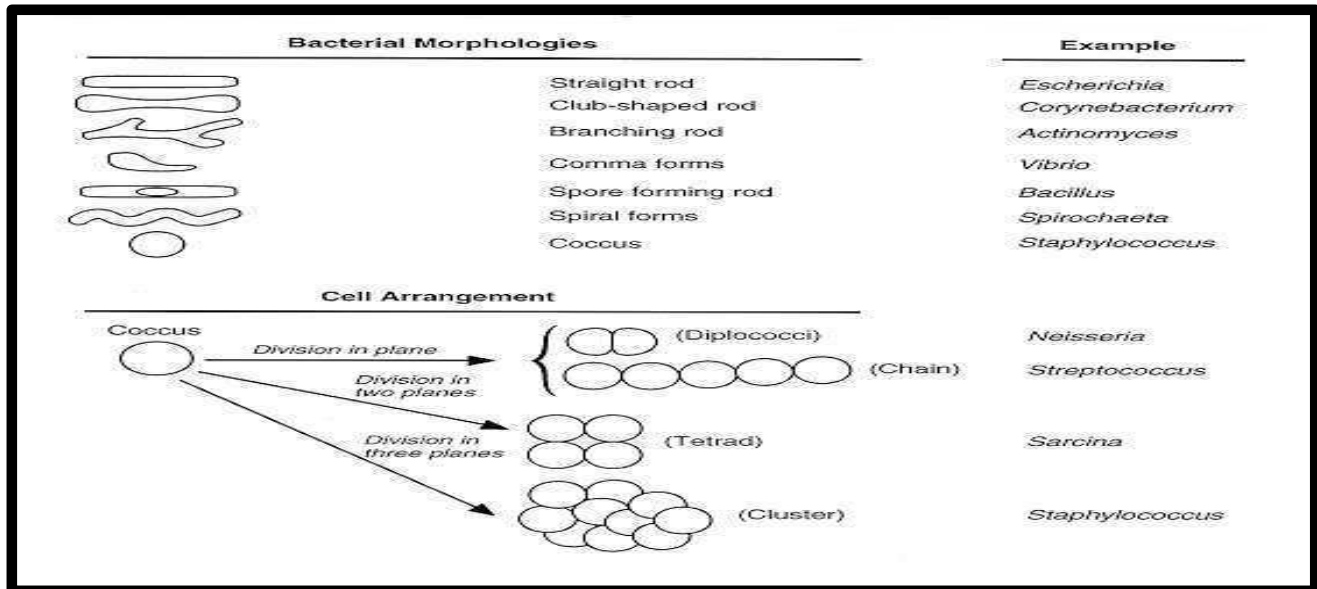
1- Round or spherical form cocci

- a. Diplococci two cocci adhering to each other.
- b. Streptococci if fission continues while they remain attached forming chains
- c. Staphylococci cell division not in one plane and daughter cells remain attached in irregular cluster.
- d. Tetrads aggregate of 4 cocci
- e. Sarcinae aggregate of 8 cocci

2- Rod form –bacilli : the bacilli are not forms as many grouping as cocci, they forming only diplobacilli or streptobacilli.

3- Curved or spiral shaped bacilli, comma shape for ex: *vibrio* spp. as *vibrio cholera*.

4. Filamentous: *Leptothrix*, *Crenothrix*.



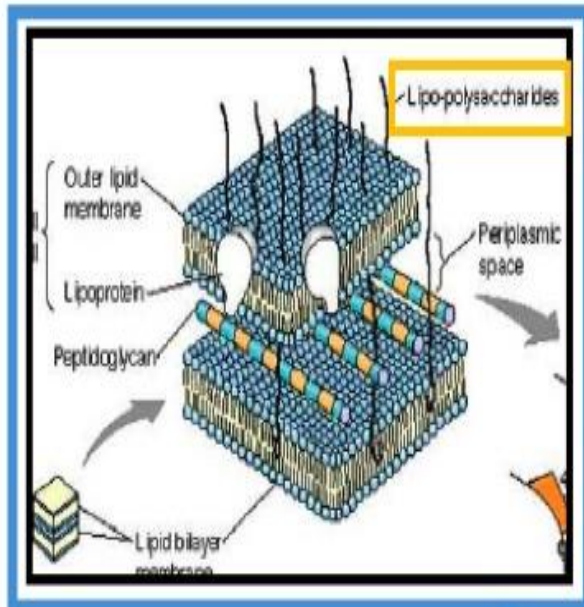
Morphology of bacterial shapes

Gram Positives and Gram Negatives: Key Differences

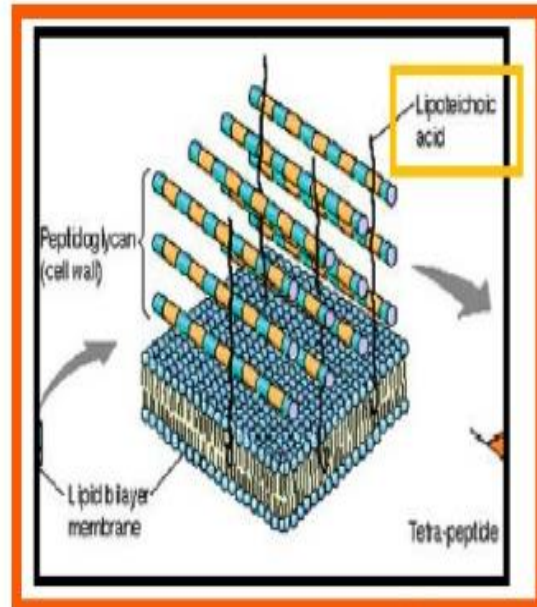
1. Gram positive bacteria have simpler, but thicker walls, with a relatively large amount of peptidoglycan. The walls of Gram negative bacteria are thinner and have less peptidoglycan but are more complex in structure.
2. An outer membrane on the Gram positive cell wall contains **teichoic acids and Lipoteichoic acids** and An outer membrane on the Gram negative cell wall contains **lipopolysaccharides (LPS)** bearing a strong negative charge they are strongly antigenic and toxic. These are toxic substances responsible for making Gram negative organisms more threatening.

Gram negative	Gram positive
1- The walls of Gram negative bacteria are thinner and have less peptidoglycan but are more complex in structure.	1- Gram positive bacteria have thicker walls with relatively large amount of peptidoglycan
2- Gram negative cell wall contains Lipopolysaccharides (LPS), antigenic and toxic substance	2- Cell wall of gram-positive bacteria contains Lipoteichoic acids
3-Lipid High	3-Lipid Low

Gram-negative bacteria



Gram-positive bacteria



C: Pre- test

Put a circle in front of right sentence

1- The protective gelatinous layer outside the cell wall is

- A- Cytoplasmic membrane B- Mesosome
- C- Capsule D- Nuclear material

2- The control of passage nutrient and waste product in and out the cell is by

- A- Cytoplasmic membrane B- Cytoplasm
- C- Capsule D- Cell wall

3- The organ of motility in bacteria

- A- Pili B- Pseudopodia
- C- Cilia D- Flagella

4- The site of respiratory enzyme in bacterial cell is

- A- Mesosome B- Cytoplasm
- C- Cell wall D- Flagella

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF THIS PACKAGE

5-1: Capsule

Protective gelatinous covering layers occurs outside the cell wall .

5-2: Cell wall

A solid supporting structure outside the cell membrane ,composed of carbohydrate ,lipids and protein , it give the shape of the cell.

5-3: Cytoplasmic membrane

Present inside the cell , and semi permeable, it controle the passage of nutrient and west's products in and out the cell.

5-4: Cytoplasm

Consist of organic and inorganic materials dissolve in viscous watery solution , it contains ribosome's , mesosomes , nuclear materials and various granules. Its function is do all cellular activities .

5-5; Mesosome

Inter cellular structure .It is invagination of the cytoplasmic membrane ,its function include site of respiratory enzymes.

5-6: Nuclear material

Contain the DNA inside the cytoplasm. Its function responsible for heredity of cell ,carry genetic character from cell to the others.

5-7: Flagella

Originate from the cytoplasmic membrane , its function is organ of motility.

5-8: Pilli

Structure surround bacterial cell, its function is organ of attachment to other cells.

TEST -1

What is the difference between flagella and pilli

E:-Post test

Put a circle in front of right sentence

1- The organ of motility in bacteria

A- Pilli

B- Pseudopodia

C- Cilia

D- Flagella

2- The site of respiratory enzyme in bacterial cell is

A- Mesosome

B- Cytoplasm

D- Cell wall

D- Flagella

3- The protective gelatinous layer out side the cell wall is

- A- Cytoplasmic membrane B- Mesosome
C- Capsule D- Nuclear material

4- The control of passage nutrient and waste product in and out the cell is by

- A- Cytoplasmic membrane B- Cytoplasm
C- Capsule D- Cell wall

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the second modular unit of learning package

PRE TEST

- 1-C
2-A
3-D
4-A

POST TEST

- 1-D
2-A
3-C
4-A

TEST -1

Flagella

Originate from the cytoplasmic membrane , its function is organ of motility.

Pilli

Structure surround bacterial cell, its function is organ of attachment to other cells.

MODULAR UNIT

3,4

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of the of al dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3-1 Factors influencing the growth of bacteria

3-2 Bacterial growth curve

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- Illustrate the factors that influence on the growth of bacteria like temperature ,oxygen ,moisture pH
- 2- Draw and enumerate bacterial growth curve

Environment condition effect to the growth of bacteria

Factors effecting growth of bacteria

1. Physical factors:

A. Requirement of Oxygen and carbon dioxide:

1- Obligate aerobes:

Need oxygen to grow. E.g. *Pseudomonas aeruginosa*.

2- Obligate anaerobes: not need oxygen. Some are killed by free oxygen. E.g. *Clostridium sp.*

3- Microaerophiles: means little-air- loving. Need large amount of CO₂ and trace amounts of oxygen. E.g. *Treponema pallidum (syphilis)*.

4- Facultative Anaerobe (or facultative aerobe): can use oxygen if available, but can survive without it too. E.g. *Escherichia coli*.

B.pH: there are (3) groups of microorganisms according to pH.

1- Neutrophiles: Most bacteria grow between pH 7.2-7.6.

2- Acidophiles: these grow in an acidic pH (1-5) like lactobacillus.

3- Alkaliphiles: these grow optimally under alkaline condition pH (8-9.5) like vibrio.

C. Temperature: there are (3) groups of microorganisms according to temperature

1- Psychrophiles: grow at an optimal temperature of 0 to 20° C. like water bacteria.

2- Mesophiles: They grow at optimal temperature between (35-37) these include bacteria producing disease.

3- Thermophiles: Which have an optimal temperature of (50-75) °C like bacillus.

D- Moisture:

All actively metabolizing bacteria generally require some water in their respective environments.

E. Osmotic pressure:

Osmotic pressure is the minimum pressure which needs to be applied to a solution to prevent the inward flow of water across a semi-permeable membrane. There are found three types of osmotic pressure

1. Hypotonic 2. Isotonic 3. Hypertonic

Bacteria are usually resistant to changes in osmotic pressure, 0-5% NaCl is added to almost all cultural media to make isotonic.

F. Radiation:

Various forms of radiant energy, such as gamma rays or ultraviolet radiation can cause mutations and/or kill bacteria. Some organisms have protective pigments or enzymes that can repair radiation-caused DNA damage.

2- Chemical factors:

A- Nitrogen

- In amino acids, proteins
- Most bacteria decompose proteins
- A few bacteria use N_2 in nitrogen fixation

B- Sulfur

- In amino acids, thiamine, biotin
- Some bacteria use SO_4^{2-} or H_2S

C- Phosphorus

- In DNA, RNA, ATP, and membranes
- is a source of phosphorus PO_4

d- Carbon

- Structural organic molecules, energy source
- Chemo heterotrophs use organic carbon source

Bacterial Growth Curve:

Lag Phase:

During in this phase adaptation to new environment achieved and necessary enzymes and intermediate metabolites are built up, then increase the metabolic rate and increase size of cell for multiplication to proceed.

Exponential Growth Phase:

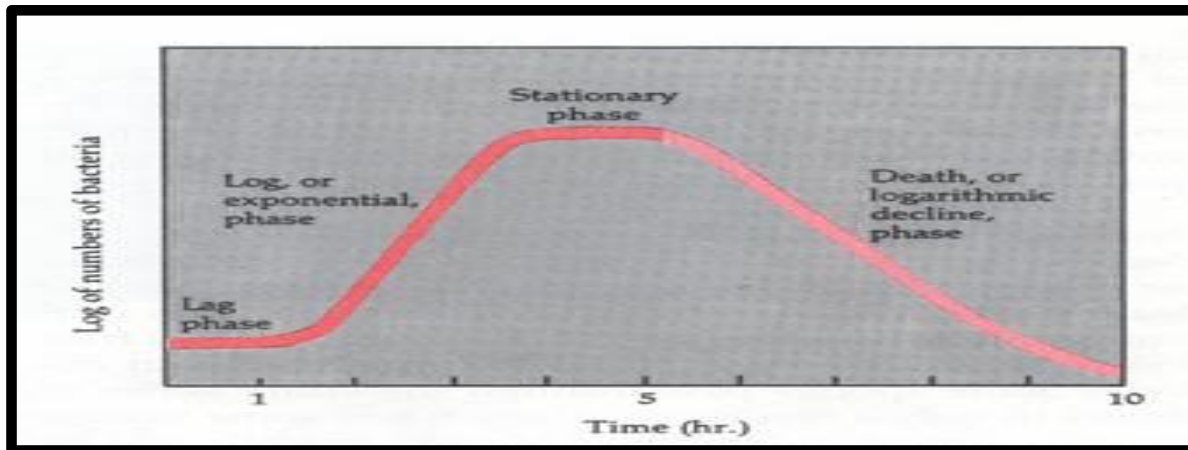
Following lag phase the cells start dividing and their number increases rapidly with time at an exponential growth in numbers, and the growth rate increasing with time.

Stationary Phase:

With the exhaustion of nutrients and build-up of waste and secondary metabolic products, the growth rate has slowed to the point where the growth rate equals the death rate. Effectively, there is no growth in the bacteria population.

Decline or Death Phase:

The living bacteria population decreases with time, due to a lack of nutrients and toxic metabolic by products.



Bacterial Growth Curve

C: Pre- test

Put a circle in front of right sentence

1- Mesophilic bacteria grow between

- A- 50-60c B- 0-25c
C-20-44c D- Non of the above

2- Most pathogenic bacteria grow best at pH

- A- High B- Low
C-7.2 D- All above

3- During the Lag phase the bacteria

- A- Increase in size
B- Have high rate in metabolism
C- Bacteria are more sensitive to antibiotics
D- All above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF THIS PACKAGE

Factors influencing the growth of bacteria

1-Temperature – The temperature at which an organism grows best is called Optimum temperature.

In human parasitic organisms optimum temperature ranges between 30-37c

There are three groups of bacteria as regards the temperature of growth

- a- Psycrophilic bacteria
- b- Mesophilic bacteria
- c- Thermophilic bacteria

Psycrophilic bacteria

These are the organism growing between 0c-25c .

Thy are mostly soil and water bacteria

Mesophilc bacteria

Thy grow between 20c and 44c . This group include bacteria producing diseases

Thermophilic bacteria

Some organism grow between 50c and 60c.

2-oxygen

Bacteria are classified according to its needs to oxygen .

Obligate aerobes

Needs oxygen to grow

Obligate anaerobes

Can not grow in the presence of oxygen.

Facultative anaerobes

Can grow in the presence or absence of oxygen

3- Moisture

Water is essential for the growth of bacteria

4- PH

Most pathogenic bacteria grow best at PH 7.2 – 7.6

5- light

All organisms grow best in the darkness

6- Osmotic pressure

Bacteria grow best in isotonic environment

(0.8_0.9% NaCl)

Test-1

Enumerate the effect of temperature on the growth of bacteria

TEST -2

Explain log phase during bacterial growth curve .

E:-Post test

Put a circle in front of right sentence

1- Mesophilic bacteria grow between

A- 50-60c

B- 0-25c

C-20-44c

D- Non of the above

2- Most pathogenic bacteria grow best at pH

A- High

B- Low

C-7.2

D- All above

3- During the Lag phase the bacteria

A- Increase in size

B- Have high rate in metabolism

C- Bacteria are more sensitive to antibiotics

D- All above

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

- 1-C
- 2-C
- 3-A

POST TEST

- 1-C
- 2-C
- 3-A

TEST -1

Psycrophilic bacteria

These are the organism growing between 0c-25c .
Thy are mostly soil and water bacteria

Mesophilc bacteria

Thy grow between 20c and 44c . This group include bacteria producing diseases

Thermophilic bacteria

Some organism grow between 50c and 60c.

TEST-2

Log phase

- 1-bacteria have high rate in metabolism.
- 2-multiplication of cells and increase in the number of bacteria.
- 3-Bacteria are more sensitive to antibiotics

MODULAR UNIT

5,6

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3-1 – sterilization and disinfection

3-2 – thermal physical sterilization.

3-3- not thermal physical sterilization

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

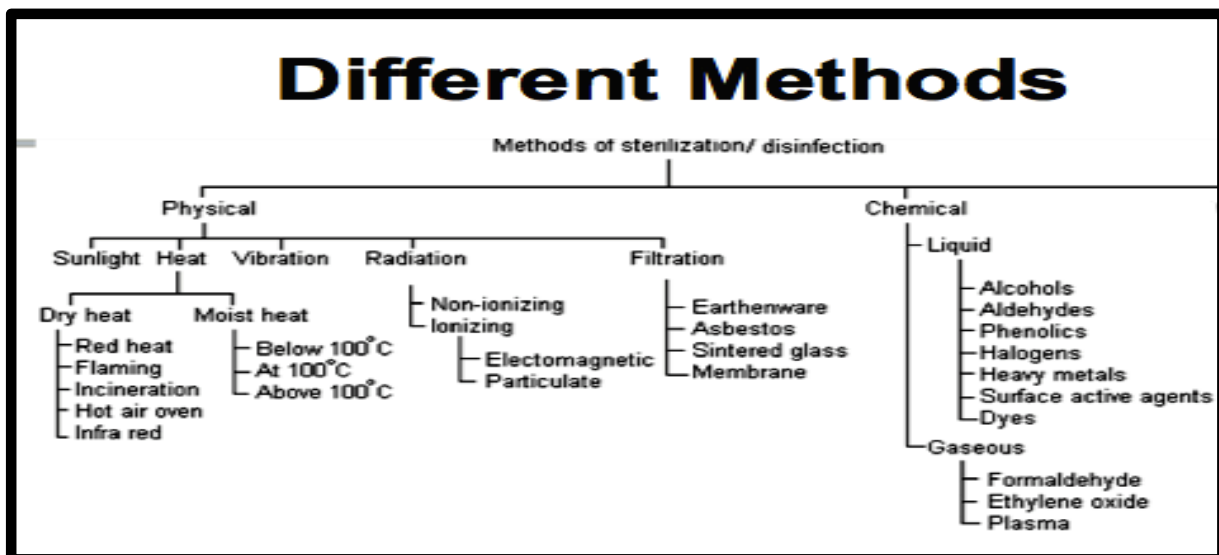
After studying this modular unit ,you should be able to:

- 1- define sterilization and disinfection.
- 2- enumerate methods of thermal physical sterilization .
- 3- enumerate methods of not thermal physical sterilization.

Sterilization and Disinfection

Sterilization: is defined as the process of elimination from all the living microorganisms, including bacterial vegetative or spore state are killed

Disinfection: is the process of elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects. Sterilization and disinfection can be achieved by physical or chemical methods.



Physical Methods of Sterilization

1-Sunlight: The activity of sunlight is mainly due to the presence of ultra violet rays in it. It is responsible for spontaneous sterilization in natural conditions. The sunlight is more effective in killing germs due to combination of ultraviolet rays and heat.

2-Heat: heat is considered to be most reliable method of sterilization. heat acts by oxidative effects as well as denaturation and coagulation of proteins.

Dry heat

- A. Red heat: it is used to sterilize metallic objects by holding them in flame till they are red hot e.g. needles, forceps, spatulas ... etc.
- B. Flaming: The material is passed over flame without allowing it to become red hot e.g. mouth of culture tubes, flasks, glass slid.
- C. Incineration: This is excellent method for rapidly destroying material e.g. experimental dead animals and pathological materials... etc.
- D. Hot air oven: This the best method for sterilizing all glass, syringes, Petri dishes, test tubes, flask, pipettes, scalpels, scissors, swab forceps.
- E. Infrared radiation: to sterilize metal instruments and glass syringes.

2. Moist heat

- ❖ At temperature below 100 °C
 - a. pasteurization of milk temp. Employed is either 65°C for 30 min or 72 for 15-20 sec.
- ❖ At temperature of 100°C
 - a. Tyndallization: which placed the substance at boiling point 100°C for (15-20) min each on 3 successive days, used for sterilizing items that cannot withstand pressurized heating, such as plant seeds.
 - b. Boiling: For needles and instruments boil in water for (10-30) min. is sufficient to sterilize
 - c. Steam at 100°C: Is used to sterilize culture media which may decompose if subjected to higher temp. Like (Gelatin agar)
- ❖ At temperature above 100°C: we used Autoclave to sterilized inoculated media.
- 3. Filtration: For sterilize the fluids that do not stand heating e.g. plasma, vitamins, carbohydrates solutions and antibiotics
- 4- Radiation:
 - a. Ultraviolet radiation and lamps: It is chief bactericidal factor present in sunlight, used to kill bacteria.
 - b. X-rays and other ionizing radiation: They are useful for sterilization of disposable material like disposable syringes and adhesive dressing ... etc.

5- Ultrasonic and sonic vibrations: They are bactericidal causing mechanical agitation and rupture of bacteria.

B- Chemical methods

A- Liquids

1- Acids and alkaline: They are inhibitory to the growth of bacteria. *Microbacteria* are more resistant to acid than alkaline

2- Metallic ions: HgCl_2 and AgNO_3 prevent the growth on many bacteria in concentration less than 1 ppm.

3- Inorganic materials: They are much less toxic to bacteria such as fluoride inhibits many enzymes of bacteria.

4- Halogens: Iodine is used chiefly for skin – Chlorine for water.

5- Oxidizing agents: They are weak antiseptic e.g. H_2O potassium permanganate.

6- Formaldehyde: It is highly lethal (irritant water soluble) to kill all kinds of microorganisms and spores.

7- Phenol group: It is used for sterilizing surgical instrument; Lysol and cresol are used generally in 3% solution.

8- Soap and detergents: Bacteriostatic for many kinds of bacteria and some acid fast organism.

9- Alcohol: Ethyl alcohol is most effective in 70% solution than 100% alcohol. It doesn't kill spores.

10- Dyes: Gentian violet and malachite green etc... are active against gram + bacteria.

B- Gaseous

1- Gaseous disinfectants: SO_2 , chlorine, and formalin vapor have been used as gaseous disinfectant –propylene glycol is powerful disinfectant.

C: Pre- test

Put a circle in front of right sentence

1- sterilization the platinum wire of the loop by

A- oven

B- flaming

C- infra red radiation

D- Non of the above

2- pasteurization can kill most pathogenic bacteria at

A- 65c

B- 100c

C- 40c

D- All above

3- sterilization by filtration is useful for

A- biological solution

B- solid media

C- Bacteria sensitive to antibiotics

D- All above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF THIS PACKA

Sterilization and disinfection

Sterilization – killing all kinds of life pathogenic and non pathogenic organisms.

Disinfection- killing pathogenic microorganisms.

Physical sterilization – sterilization methods in which no chemical substances is used

Include-

1-thermal methods

2-not thermal method

Thermal method

A- Dry heat

1-Inciniration- Burning to get rid of contaminated clothes and materials and used Petri dishes.

2- flaming – sterilization the platinum wire of the loop and mouth of tubes.

3- hot air oven- 160c-220c. sterilization glass ware, swabs.

4- infra – red radiation – if this radiation used in closed container it will rise the temperature to 180c .sterilize syringes .

B – Moist heat

This is much efficient than dry heat method , because the moist heat penetrate easier and kill the living material inside it.

1 – boiling – boiling water kill bacteria

Ex – sterilization of syringes for 10 minutes by boiled water.

2 – Pasteurization – to kill most of the pathogenic bacteria 65c for 1\2hour or 72c for 15 minute.

3 – tyndalization – Expose the material to temperature below boiling (60 – 70c)fore 1\2 hour for 3 days in the first day the temperature kill the vegetative cells only (not the spore) when the material cool to the room temperature the spore convert to vegetative cell which will die during heating in the second day . the heating in the third day is to be sure to get astral material.

4 –Steam under pressure

(AUTOCLAVE)

Atm	temp	time
15\binch	121c	20 minute
30\binch	134c	5 minute

Test-1

Enumerate methods used in thermal physical sterilization

2 – not thermal method

1- radiation

A – ultra violet radiation – it has lethal effect on bacteria because it is absorbed in the nucleic acid of the bacteria also forms ozone gas (O₃) in the air and hydrogen peroxide H₂O₂ in the water which kill bacteria it is used to sterilize laboratories and operation rooms. It can not penetrate the glasses.

B- Ionizing radiation –ex Gamma – rays it penetrate deeper than ultra violet it is used to sterilize syringes and threads which is used in the operation .

2 – filtration - by using filters which has a very small pores which prevent the passage of bacteria through it . it is used for sterilization media and biological solution which effected by thermal method .

TEST -2

What is the difference between ultra violet radiation and ionizing radiation

C: post- test

Put a circle in front of right sentence

1- sterilization the platinum wire of the loop by

- | | |
|------------------------|---------------------|
| A- oven | B- flaming |
| C- infra red radiation | D- Non of the above |

2- pasteurization can kill most pathogenic bacteria at

- | | |
|--------|--------------|
| A- 65c | B- 100c |
| C- 40c | D- All above |

3- sterilization by filtration is useful for

- A- biological solution
- B- solid media
- C- Bacteria sensitive to antibiotics
- D- All above

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the 5th modular unit of learning package

PRE TEST

- 1-B
- 2-A
- 3-A

POST TEST

- 1-B
- 2-A
- 3-A

TEST -1

Dry heat

1-Incineration- Burning to get rid of contaminated clothes and materials and used Petri dishes.

2- flaming – sterilization the platinum wire of the loop and mouth of tubes.

3- hot air oven- 160c-220c. sterilization glass ware, swabs.

4- infra – red radiation – if this radiation used in closed container it will rise the temperature to 180c .sterilize syringes .

B – Moist heat

This is much efficient than dry heat method , because the moist heat penetrate easier and kill the living material inside it.

1 – boiling – boiling water kill bacteria

Ex – sterilization of syringes for 10 minutes by boiled water.

2 – Pasteurization – to kill most of the pathogenic bacteria 65c for 1\2hour or 72c for 15 minute.

3 – tyndalization – Expose the material to temperature below boiling (60 – 70c)

Three times

TEST-2

ultra violate radiation – it has lethal effect on bacteria because it is absorbed in the nucleic acid of the bacteria also forms ozone gas (O₃) in the air and hydrogen peroxide H₂O₂ in the water which kill bacteria it is used to sterilize laboratories and operation rooms. It can not penetrate the glasses.

Ionizing radiation –ex Gamma – rays it penetrate deeper than ultra violet it is used to sterilize syringes and threads which is used in the operation .

MODULAR UNIT

7

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3-1 – medical bacteria

Genus staphylococcus

3 -2- species

3 -3-toxine secreted

3 -4- pathogenicity

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- describe the general characters of staphylococcus .
- 2- enumerate of three species
- 3 – describe the pathogenicity.
- 4 – what is the treatment

Staphylococcus

• General Characters:

- 1- They are G +, Ovoid or spheroidal, Non motile arranged in groups usually form irregular clusters, facultative anaerobic.
- 2- On the culture media they form colonies and produced pigment White, yellow or golden yellow in color, their hemolytic capacity is variable.
- 3- They are catalase positive, oxidase negative, ferment glucose

• Classification:

A- On the basis of pigment production 3 types of staphylococci are identified.

- 1- *Staphylococcus aureus* produce golden yellow colonies and are pathogenic.
- 2- *Staphylococcus albus* produce white colonies and are nonpathogenic.
- 3- *Staphylococcus citreus* produce lemon yellow colonies and are nonpathogenic.

B- On the of pathogenicity based on the synthesis of the Coagulase-positive strains:

- 1- Pathogenic species Coagulase-positive strains like *Staphylococcus aureus*
- 2- Non pathogen species Coagulase-Negative strains like *Staphylococcus epidermides*.

• Toxins:

1. Production of toxins Exfoliative toxins A and B (super antigen) Toxic epidermal necrosis (scalded skin syndrome) is caused blistering skin lesions in neonates and young

2. Toxic shock syndrome toxin (TSST) is associated with retained sanitary tampons, which support the multiplication of toxin-producing strains of *S. aureus*. The toxin causes a range of symptoms including fever, diarrhoea, scarlet-fever –type desquamates rash and hypotension
3. Haemolysin: *Staph. aureus* produces at least 3 types of haemolysin known as Alpha, Beta and gamma. Alpha haemolysis rabbit and sheep red cell rapidly.
4. Leucocidin: Leucocidin is closely associated with delta lysis damage polymorphonuclear leucocyte.
5. Fibrinolysin *Staph. aureus* produces staphylokinase during the later stages of growth which causes lysis of fibrin.
6. Enterotoxin: The toxin is responsible for manifestation of *Staph.* food poisoning –nausea, vomiting and diarrhea within 6 hours of taking contaminated food

Table (1): Various enzymes and protein produced by staphylococci

Product	Physiological action
B-lactamase	Breaks down penicillin
Catalase	Converts hydrogen peroxide into water
Coagulase	binds to prothrombin in the host to form a complex called staphylothrombin in which a clot is formed
DNAse	Destroys DNA
Hyaluronidase	enzymes capable of breaking down hyaluronate initiate infections at the skin or mucosal surfaces
Lipase	Break down Lipid molecules
Protein A	Is antiphagocytic by competing with neutrophils for the Fc protein of specific opsonins
Proteases	Break down proteins

Clinical Manifestations

Staphylococci can cause many forms of infection include:

- A. Cutaneous lesions: Furuncles, styes, boils, abscess, carbuncles, impetigo, pemphigus.

- B. Deep infection: Acute osteomyelitis, tonsillitis, pharyngitis, sinusitis, pneumonia, pulmonary abscess, breast abscess, endocarditis and renal abscess.
- C. Staphylococcal food poisoning: It is results when food contaminated with enterotoxin produced by Staphylococci is consumed e.g. meat, fish, milk and milk products. Diarrhea and vomiting set in within 6 hours of taking contaminated food.

Treatment:

The antibiotic of choice for the treatment of *S. aureus* infection is flucloxacillin, or erythromycin if the patient is allergic to penicillin. Methicillin-resistant strains of *S. aureus* (MRSA) are resistant to flucloxacillin and often to a range of other antibiotics, limiting treatment to vancomycin and teicoplanin

C: Pre- test

Put a circle in front of right sentence

1- staphylococcus is arranged in

- A- pair B- chain
- C- cluster D- Non of the above

2- the toxin leucocidin lyses of

- A- WBC B- RBC
- C- bacteria D- All above

3 – deep infection with staphylococcus include

- A- boil B - carbuncles
- C – endocarditis D- All above

Compare your answer with the key in the end of the learning package .

This Package

Medical bacteria

Genus staphylococcus

General characters

- 1 – gram positive
- 2 – cocci
- 3 – arranged in cluster
- 4 – non spore former
- 5 – non motile
- 6 – catalase positive

Species

staphylococcus aureus

staphylococcus albus

staphylococcus epidermids

staphylococcus aureus

found on anterior nasal mucosa in throat ,stool and skin.

Toxin secreted by staphylococcus aureus

- 1 – haemolysin : lysis of RBC
- 2 – leucocidin : lysis of WBC
- 3 – entero toxin : food poisoning

Pathogenicity:

- 1 – cutaneous lesion
 - boil
 - abscess
 - carbuncle
 - impetigo
- 2 – deep infection
 - acute osteomyelitis

- tonsillitis
- pharyngitis
- Endocarditis
- sinusitis

3 – staphylococcus food poisoning

Result from eating food contaminated with staphylococcus enterotoxin

Treatment

Pencillin, benzyle pencillin, cephalosporin, erythromycin, clindomycin, cloxacyclin

Test-1

Enumerate the pathogenicity of staphylococcus aureus

C: post- test

Put a circle in front of right sentence

1- staphylococcus is arranged in

- | | |
|------------|---------------------|
| A- pair | B- chain |
| C- cluster | D- Non of the above |

2- the toxin leucocidin lyses of

- | | |
|-------------|--------------|
| A- WBC | B- RBC |
| C- bacteria | D- All above |

3 – deep infection with staphylococcus include

- | | |
|------------------|----------------|
| A- boil | B - carbuncles |
| C – endocarditis | D- All above |

Compare your answer with the key in the end of the learning package.

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

- 1-c
- 2-a
- 3-c

POST TEST

1-c

2-a

3-c

TEST -1

1 – cutaneous lesion

- boil

- abscess

- carbuncle

- impetigo

2 – deep infection

- acute osteomyelitis

- tonsillitis

- pharyngitis

-Endocarditis

- sinusitis

3 – staphylococcus food poisoning

Result from eating food contaminated with staphylococcus enterotoxin

MODULAR UNIT

8

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3 -1 genus streptococcus

3 -2- species

3 -3-toxine secreted

3 -4- pathogenicity

3 -5 treatment

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- describe the general characters of streptococcus
- 2- enumerate of three species
- 3 – describe the pathogenicity.
- 4 – what is the treatment

"Streptococcus"

General characters:

They are Gram positive cocci arranged in chains, non-motile and non-spore former. Facultative Anaerobes .**Catalase negative**. They require media enriched with blood, serum or for their growth. They are important human pathogens causing pyogenic infection with a characteristic tendency to spread. They are also responsible acute rheumatic fever and glomerulonephritis

Classification of streptococcus: Several system of classification have been employed

A. Morphology

1- Morphological classification: Attempt to classify streptococci in to long chain (pathogenic strain) and short chain (nonpathogenic) forming cocci is not a satisfactory method of classification..

B. Cultural character

- 1- obligate anaerobe (peptostreptococci).
- 2- facultative anaerobes can be classified on the base of hemolytic in property in the blood agar plate.

C. Biocimical reaction

Fermentation is used in differentiating different species of streptococci e.g. mannitol is fermented by entrococci

D. Antigenic structures

Aerobic streptococci producing beta hemolysis are divide in to Lancefield group. A,B,C,D,.

Streptocoocci pyogenes (Group A):

Is one of the most important bacterial pathogens. The different serotypes produce.

- 1- Extracellular enzymes that break down host molecules. Like C5a peptidase cleaves a potent neutrophil chemotaxin called C5a, The C5a peptidase is

necessary to minimize the influx of neutrophils early in infection as the bacteria are attempting to colonize the host's tissue

2- Streptokinases, enzymes that activate a host-blood factor that dissolves blood clots.

3- Capsules and M protein that help retard phagocytosis. The main antigen is called M-protein (fimbriae ag). It attaches to mucous membranes anywhere in the body. M-protein helps inhibit phagocytosis.

4-Toxin production:

1- Hemolysis: They are toxic substances. Divided in two types:

- a. Streptolysin O, which is oxygen labile, heat labile, strongly antigenic. beta-hemolytic property
- b. Streptolysin S is oxygen stable, non-antigenic. beta-hemolytic. A potent cell poison affecting many types of cell including neutrophils, platelets, and sub-cellular organelles

2- Erythrogenic toxin is heat stable toxin. In small doses if injected intradermal causes erythema in susceptible persons.

Diseases:

1. Pharyngitis (tonsillitis or Strep. Throat)

Is the primary site of invasion causing sore throat. It may be localized in tonsils (tonsillitis) or may involve pharynx (pharyngitis) with vomiting and fever.

2. Skin infection

It may cause infection of skin e.g. wound, burns, lymphangitis and cellulitis

3. Scarlet Fever (Strep. throat with rash)

S. pyogenes produce streptococcal pyrogenic exotoxins originally called erythrogenic toxins, are produced by lysogenic strains of streptococci. Cause skin allergy and rash

4. Impetigo (also due to *S. aureus*)

Yellowish blisters and very contagious.

Cannot differentiate from *S. aureus* impetigo unless a culture is done.

5. Erysipelas

It is a spreading infection of the skin. Usually on the face and legs.

Erysipelas is a diffuse infection involving superficial lymphatic. The involved skin becomes red swollen.

6. Necrotizing fasciitis

Deep infection of the subcutaneous tissue. Characterized by extensive destruction of muscle and fat, Systemic toxicity, multi-organ failure, and death (50%) are classic, Fasciitis must be treated not only with aggressive drug therapy, but also surgical debridement of necrotic tissue is necessary.

7. Others

Bronchi-pneumonia and Septicemia

Autoimmune Diseases that follow Streptococcal Infections

A. Rheumatic Fever

It is a chronic disease of the heart and valves. Swollen and aching joints and fever are typical. Sometimes chest pain and myocarditis also present

- **How is the damage of autoimmune disease caused? There are 2 theories:**
 - a. The antigen (glyco-protein) found on *S. pyogenes* is similar to the antigen (flag) found in the human heart. There is an autoimmune cross-reaction.
 - b. The strep. Toxin causes damage and alteration of the heart tissue making it antigenic to the immune system.

B. Acute Glomerulonephritis

Inflammation of the kidney tubules (also it is not a result of direct bacterial attack). It is caused by autoimmune cross-reaction following Strep. skin and /or infection. The antibodies attack the kidney tubules.

- **Laboratory diagnosis:**

Hematological investigations:

- 1- Total leucocyte count may show considerable increase.
- 2- Differential leucocyte count show increase in neutrophil count.
- 3- Erythrocytes sedimentation rate (ESR) is raised especially in rheumatic disease.

Bacteriological method: Most important specimens are throat swab, nasopharyngeal swab, pus swab, sputum, cerebrospinal fluid, blood etc...

- a. Smear from above material after Gram's staining show Gram positive cocci arranged in chains.
- b. Culture: Specimen is cultured on blood agar or crystal violet blood agar media with loop.

After overnight incubation at 37°C colonies are studied. These are small (pin point), raised colonies showing beta haemolysis.

Serological test: The titer of antistreptolysin O in? Patient serum in dilution above 1:200 is an indication of streptococcal infection.

Skin test is known by the name Dick test.

Dick test: It is done to find out susceptibility of a person to scarlet fever. 0.2 ml erythrogenic toxin is injected intradermal on the fore arm and same amount of heated inactivated toxin on the other forearm. A bright red rash appears within 6 hours and becomes maximum in 24 hours and this fades away. Control forearm doesn't show any reaction. A positive reaction means no immunity to scarlet fever.

Treatment

- Penicillin or erythromycin is the drug of choice.

C: Pre- test

Put a circle in front of right sentence

1- streptococcus pyogens is arranged in

A- pair

B- chain

C- cluster

D- Non of the above

2- the toxin streptolysin responsible for lyses

A- WBC

B- RBC

C- bacteria

D- All above

3 – complication after infection with streptococcus pyogens includes

A- boil

B - carbuncles

C – rheumatic fever

D – all above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF

This Package

Genus streptococcus

Species

1 – streptococcus pyogenes

(B – hemolytic streptococcus on blood agar)

2 – streptococcus pneumonia

3 – streptococcus viridans

(both cause alfa hemolysis on blood agar)

4 – streptococcus fecalis

(cause gamma hemolysis on blood agar)

1 – streptococcus pyogenes

General characters

1 – gram positive

- 2 – cocci
- 3 – arranged in chain
- 4 – non spore former
- 5 – non motile
- 6 – catalase negative
- 7 – usually capsulated

Toxin secreted by streptococcus pyogenes

- A – streptolysin S and O which is responsible for hemolysis of RBC
- B – erythrogenic toxin : responsible for the rash observed in scarlet fever.

Occurrence :

Healthy human beings may carry streptococcus pyogenes in the throat and nose.

Pathogenicity

It causes

- Suppurative disease (disease with pus formation)
- Acute tonsillitis
- Pharyngitis
- Otitis media
- Meningitis
- Respiratory tract infection
- Skin infection after burns or wounds, impetigo
- Non suppurative disease :
- Complication after infection with suppurative disease :
- Acute glomerulonephritis
- Rheumatic fever
- Scarlet fever

Treatment:

Penicillin , erythromycin , cephalosporins

Streptococcus pneumonia (pneumococci)

General characters

- 1- gram positive
- 2- lanceolated diplococci
- 3- non motile
- 4- non spore former
- 5- capsulated

Pathogenicity

Lobular pneumonia
Broncho pneumonia

Treatment

Pencillin ,erythromycin ,lincomycin

Test-1

Enumerate the pathogenicity of streptococcus pyogenes

C: post- test

Put a circle in front of right sentence

1- streptococcus pyogens is arranged in

- A- pair B- chain
- C- cluster D- Non of the above

2- the toxin streptolysin responsible for lyses

- A- WBC B- RBC
- C- bacteria D- All above

3 – complication after infection with streptococcus pyogens includes

- A- boil B - carbuncles
- C – rheumatic fever D – all above

Compare your answer with the key in the end of the learning package.

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

1-B

2-B

3-C

POST TEST

1-B

2-B

3-C

TEST -1

It causes

Suppurative disease (disease with pus formation)

Acute tonsillitis

Pharyngitis

Otitis media

Meningitis

Respiratory tract infection

Skin infection after burns or wounds, impetigo

Non suppurative disease :

Complication after infection with suppurative disease :

Acute glomerulonephritis

Rheumatic fever

Scarlet fever

MODULAR UNIT

9

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3 -1-neisseria meningitides

3 -2-neisseria gonorrhea

3 -3-mycobacterium tuberculosis

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- describe the general characters of neisseria and mycobacterium
- 2- enumerate of the species
- 3 – describe the pathogenicity.
- 4 – what is the treatment

Neisseria

General character:

They are G-ve, aerobic, non-sporulation, non-motile, oxidase positive cocci arranged in pairs. The genus contains about 30 species. Two important pathogens are:

- a. *N. meningitidis* inhabits the human nasopharynx responsible for meningitis
 - b. *N. gonorrhea* normally colonizes mucosal surfaces. Humans are the only host and transmission is via sexual contact *responsible for the disease gonorrhea*
- There are four types of *N. gonorrhea* based on the presence of fimbriae; T1, T2, T3 and T4.
 - *N. meningitidis* is serotyped by the antigenic character of its capsular polysaccharide; several groups including A,B,C, 29E, W-135 and Y are recognized

Biochemical reactions:

They are catalase and oxidase +ve. Glucose and maltose are fermented producing acid and no gas.

The virulence of Pathogenesis:

- Fimbriae (pili) are very important of the gonococcus to attach to host cells. *N. gonorrhoeae* lacking fimbriae are a virulent.
- A substance called Protein I makes up 66% of the outer membrane protein of *N. gonorrhoeae*. This protein is antigenic and is used as the basis of some serological tests.
- *N. gonorrhoeae* produce cytotoxic substances that damage ciliated epithelial cells in fallopian tubes; the LPS endotoxin may be partly responsible.
- *N. gonorrhoeae* also produce an extracellular protease that cleaves a proline- threonine bond in immunoglobulin IgA. This causes loss of antibody activity.
- The virulence of *N. meningitidis* is associated with its antiphagocytic capsule.
- The meningococcal LPS is as toxic as *Escherichia* or *Salmonella* and causes suppression of leukotriene B4 (a chemo kinetic/chemotactic factor) synthesis in PMNs.

Pathogenesis of *N. gonorrhea*:

Gonorrhea is usually acquired by sexual contact. Gonococci adhere to columnar epithelial cells, penetrate them, and multiply on the basement membrane. Adherence is facilitated through pili and opa proteins. Gonococcal lipopolysaccharide stimulates the production of tumor necrosis factor, which causes cell damage. **In male** it starts as acute urethritis with mucous purulent discharge, dysuria (painful urination) and Epididymitis. **In female** it starts as Petechiae (small, purplish, hemorrhagic spots), Pustules, Tenosynovitis (inflammation of tendon sheath), Septic arthritis, Cervicitis; Vaginitis; Pelvic Inflammatory Disease (PID) and Disseminated Gonococcal Infection (DGI)

Pathogenesis of *N. Meningitidis* :

Neisseria Meningitidis is non-motile and is transferred among people via direct contact with bodily fluids in which the bacteria has inhabited

N. Meningitidis can be the cause of three major diseases. These three are **nasopharyngitis, meningococcal septicemia, and meningococcal meningitis**. Nasopharyngitis is usually a very short illness and sometimes there aren't even any symptoms. If the *N. Meningitidis* bacteria colonize in the nasopharynx and spread into the blood stream, the disease becomes known as Meningococcal Septicemia. If the **bacteria** may enter the central nervous system causes meningitis.

Organisms are internalized into phagocytic vacuoles, avoid intracellular killing, Replicate intracellular and migrate to sub epithelial space where excess membrane fragments are released. Hyper production of endotoxin (lipid A of LOS) into surrounding environment

most clinical manifestations including diffuse vascular damage (e.g., endothelial damage, vasculitis (inflammation of vessel walls), thrombosis (clotting), disseminated intravascular coagulation (DIC)

Diagnosis:

A. *N. gonorrhea*

- microscopically in **purulent urethral discharge** sample
- **Susceptible to drying and cooling**, so **immediate culture** of specimen onto **pre-warmed selective** (e.g., modified Thayer-Martin, Martin-Lewis agars) and **non-selective media** (chocolate blood agar) with **moist atmosphere containing 5% carbon dioxide**
- **Some strains inhibited** by vancomycin (in many selective agars) and toxic substances like fatty acids and trace metals in protein hydrolysates and agar found in nonselective media

B. *N. Meningitidis*

- **Microscopically cerebrospinal fluid (CSF)** sample
- Transparent, non-pigmented non-hemolytic colonies on **chocolate blood agar** with **enhanced growth in moist atmosphere with 5% CO₂**
- Oxidase-positive
- Acid production from glucose and maltose but not from other sugars

C: Pre- test

Put a circle in front of right sentence

- 1- the pathogenicity of neisseria meningitides is
A- pharyngitis B- tonsillitis
C- tuberculosis D- Non of the above

2- the shape of neisseria gonorrhea is

- A- cluster B- chain
C- diplococci D- All above

3 – the culture media which is use for mycobacterium tuberculosis is

- A- nutrient agar B – blood agar
C – mackonky agar D – non of above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF This Package

Genus neisseria

Species

1 – neisseria meningitides

2 – neisseria gonorrhea

3 – neisseria catarrhalis
(normal commensal of respiratory tract)

neisseria meningitides

General characters

- 1 – gram negative
- 2 – oval or spherical
- 3 – arranged in pairs
- 4 – non spore former
- 5 – aerobic
- 6 – it requires blood or serum agar and 8-10 % Co₂

Pathogenicity

It causes

Cerebrospinal meningitides and meningococcal septiceamia

Treatment

Penicillin , gentamycin

Neisseria gonorrhea

General characters

Gram negative

Cocci

Bean shape diplococci

Aerobic

Require 5-10% CO₂ and an enriched media

Pathogenicity

Gonorrhea and may cause pharyngitis and conjunctivitis.

Treatment

Penicillin , tetracycline , sulphonamids

Test-1

Enumerate the pathogenicity of neisseria

C: post- test

Put a circle in front of right sentence

1- the pathogenicity of neisseria meningitides is

A- pharyngitis

B- tonsillitis

C- tuberculosis

D- None of the above

2- the shape of neisseria gonorrhea is

A- cluster

B- chain

C- diplococci

D- All above

3 – the culture media which is used for mycobacterium tuberculosis is

A- nutrient agar

B – blood agar

C – MacConkey agar

D – none of above

Compare your answer with the key in the end of the learning package.

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

- 1-D
- 2-C
- 3-D

POST TEST

- 1-D
- 2-C
- 3-D

TEST -1

It causes

Cerebrospinal meningitides and meningococcal septiceamia
Gonorrhoeae and may cause pharyngitis and conjunctivitis

MODULAR UNIT 10,11

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

Genus clostridium

3 -1-clostridium tetani, clostridium perfringes (clostridium welchii), clostridium botulinum

3 -2-general characters

3 -3-toxin secreted

3 -4-treatment

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9)degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- describe the general characters of clostridium tetani
- 2- enumerate of the species
- 3 – describe the pathogenicity.
- 4 – what is the treatment

Clostridium

General character:

The genus clostridium consists of G+ve , anaerobic, spore forming, spindle- rod shape and highly pleomorphic bacilli, spores are wider than bacillary bodies. The genus contain bacteria causing 3 major diseases of man, **tetanus, gas gangrene and food poisoning**. Some pathogens. E.g. *clostridium welchii* and *clostridium tetani* are found normally in human and animal intestine. Clostridia are motile with peritrichous flagella, except, *C. welchii* and *C. tetani* type VI . *C. welchii* and *C. butyricum* are capsulated while others are not so pathogenic. Clostridia form powerful exotoxins. The gas gangrene clostridia are toxigenic and in vivo causing even septicemia.

Clostridium perfringens

It is normal inhabitant of the large intestine of man and animals. It is found in feces and contaminates of skin

Morphology:

It is an plump G+ve bacillus with straight parallel sides, rounded or truncated ends about 4-6 μ X1.

They may occur singly or in chains. It is pleomorphic- filaments and involution forms are common. It is capsulated a non-motile spores are central or sub terminal.

Antigenic structures:

C.perfringens is differential into 6 types (A, b, c, d, e, f) on the basis of toxin produced by the strains. Toxins are antigenic and antitoxic sera are routine typing of strain.

Biochemical reaction:

Glucose, maltose, lactose and sucrose are fermented with production of acid and gas. In litmus milk they produce acid with gas. Milk is disrupted due to vigorous production of gas. This is called storm clot. Indole is negative and H₂S is formed abundantly.

Toxin:

C.perfringens produces at least 12 distinct toxins besides many other enzymes and biological active soluble substances according to kind and amount of toxins produced. The most important toxin (**alpha or lecithianse toxin**) that destruction lecithin (phospholipid) material found in cytoplasmic membrane of the cell and cause gas gangrene, which is necrosis, putrefaction of tissues, and gas production due to this bacteria production H₂S gas .The gases form bubbles in muscle (crepitus) and the characteristic smell in decomposing tissue. After rapid and destructive local spread (which can take hours), systemic spread of bacteria and bacterial toxins may result in death.

Clostridium tetani

Morphology:

It is slender-long, slightly curved, G+ve. And occurring singly or in chain. It shows considerable variation in length. It is non-capsulated and motile. Spores are spherical, terminal and bulging giving the bacilli **tennis rackets** or **drumstick** appearance. *C. tetani* is found as spores in soil or in the gastrointestinal tract of animals.*C. tetani* produces a tow biological toxin, **Tetanolysin** which causes **lysis of RBCs** and **tetanospasmin**, and is the causative agent of **tetanus** Tetanospasmin (Neurotoxin) released in the wound is absorbed into the circulation and reaches the ends of motor neurons all over the body. Toxin blocks inhibitory impulses, by interfering with the release of **neurotransmitters** so will be cause **Spastic paralysis** or cause disease know

lock Jaw

Antigenic

Eleven strains of *C. tetani* have been identified, which differ primarily in flagella antigens and in their ability to produce tetanospasmin the genes for

toxin production are encoded on a plasmid which is present in all toxigenic strains, and all strains that are capable of producing toxin produce identical toxins.

Immunity

Active Immunization:

Usually two injections 1 ml each of tetanus toxoid or the older (diphtheria, tetanus, pertussis) (**DPT**) vaccine is given intramuscularly at the interval of 6 weeks. Third in action is given after 6-12 months. A full course of immunization confers for 10 years.

Passive Immunization:

It is emergency procedure to be used only on. It is by giving anti tetanus serum (ATS). The recommended in 18001 or in ta-muscularly as early as possible after wounding.

C: Pre- test

Put a circle in front of right sentence

1- the pathogenicity of clostridium tetani is

- | | |
|-----------------|----------------|
| A- phyrgitis | B- tonsillitis |
| C- tuberculosis | D- tetanus |

2- clostridium tetani is

- | | |
|-------------------|--------------|
| A- grame negative | B- aerobic |
| C- spore former | D- All above |

3 – the neurotoxin cause

- | | |
|------------------|------------------|
| A- muscle spasm | B – tonsillitis |
| C – lyses of RBC | D – non of above |

4- the pathogenicity of clostridium perfringes is

- | | |
|-----------------|-----------------|
| A- phyrgitis | B- gas gangrene |
| C- tuberculosis | D- tetanus |

5- clostridium botulinum is

- | | |
|------------------|--------------|
| A- gram negative | B- aerobic |
| C- spore former | D- All above |

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF This Package

Genus Clostridium

Species

1 – clostridium tetani

2 – clostridium perfringes

3 – clostridium botulinum

1 – clostridium tetani

General characters

1 – grame positive

2 – anaerobic

3 – spore former

Toxins secreted

- **haemolysin** (tetanolysin) – this toxin lyses RBC
- **neurotoxin**(tetanospasmin) – this toxin cause muscle spasim,the disease which is cause by clostridium tetani is tetanus by contamination of wounds and contamination of umbilical cord.

treatment

1-tetanus antitoxine

2-pencilline to prevent further toxins formation

Test-1

Enumerate the toxin that formation by clostridium tetani

C: post- test

Put a circle in front of right sentence

1- the pathogenicity of clostridium tetani is

A- pharyngitis B- tonsillitis

C- tuberculosis D- tetanus

2- clostridium tetani is

A- gram negative B- aerobic

C- spore former D- All above

3 – the neurotoxin cause

A- muscle spasm B – tonsillitis

C – lyses of RBC D – non of above

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

1-D

2-C

3-A

POST TEST

1-D

2-C

3-A

TEST -1

- **haemolysin** (tetanolysin) – this toxin lyses RBC
- **neurotoxin**(tetanospasmin) – this toxin cause muscle spasim,the disease which is cause by clostridium tetani is tetanus by contamination of wounds and contamination of umbilical cord.

2 – clostridium perfringes (clostridium welchii)

General characters

- 1 – gram positive
- 2 – anaerobic
- 3 – spore former
- 4 – capsulated

Toxins secreted

- Alfa-toxin :-is responsible for toxemia in human gas gangrene

treatment

- 1- surgical remove of necrotic (dead)muscle
- 2-increase O₂ concentration in the tissues and give antibiotics like penicillin and metronidazole .

Test 1

Enumerate the general characters of clostridium perfringes

3- Clostridium botulinum

General characters

- 1 – gram positive
- 2 – anaerobic
- 3 – spore former

Toxin secreted

neurotoxin
which cause muscle spasm .

pathogenicity

it cause botulism :- a severe form of food poisoning after eating contaminated food.

Treatment

Giving antitoxin

C: post- test

Put a circle in front of right sentence

1- the pathogenicity of clostridium perfringes is

- | | |
|-----------------|-----------------|
| A- pharyngitis | B- gas gangrene |
| C- tuberculosis | D- tetanus |

2- clostridium botulinum is

- | | |
|------------------|--------------|
| A- gram negative | B- aerobic |
| C- spore former | D- All above |

3 – the neurotoxin cause

- | | |
|------------------|------------------|
| A- muscle spasm | B – tonsillitis |
| C – lyses of RBC | D – non of above |

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

1-B

2-C

3-A

POST TEST

1-B

2-C

3-A

TEST -1

General characters

- 1 – gram positive
- 2 – anaerobic
- 3 – spore former
- 4 – capsulated

MODULAR UNIT

12,13

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

Enteric group of bacteria

- 3 -1-Escherichia coli
- 3 -2-klebsiella
- 3 -3-salmonella
- 3 -4-shigella

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit :

If you get (9) degree or more you will not need to learn this modular unit . in this case you must contact with your teacher to inform him about your results.

But when you get less than (9) degree in this test ,you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

- 1- describe the general characters of enteric group of bacteria
- 2 – describe the pathogenicity of enteric group of bacteria.

Enterobacteriaceae

General character:

They are G-ve rods, All motile with peritrichate flagella except *Shigella* and *Klebsiella* are flagellated , non-spore forming, non-acid fast, All ferment sugar with or without formation of gas, All reduce nitrates into nitrites form, catalase positive, All are oxidase negative, facultative anaerobes, normal part of the gut flora found in the intestines of humans and other animals, while others are found in water or soil, or are parasites Enterobacteriaceae members is

- *Escherichia*, *Salmonella*, *Shigella*, *Klebsiella*, *Proteus*, *Enterobacter*, *Yersinia*, etc.

Virulence and Antigenic Factors of Enterobacteriaceae

- Ability to colonize, adhere, produce various toxins and invade tissues
- Some possess plasmids that may mediate resistance to antibiotics
- Many enterics possess antigens that can be used to identify groups
- O antigen – somatic, heat-stable antigen located in the cell wall
- H antigen – flagellar, heat labile antigen
- K antigen – capsular, heat-labile antigen K antigen is called the Vi (virulence) antigen in *Salmonella typhi*.

Taxonomy of Enterobacteriaceae:

- Differentiation is based on biochemical reactions and differences in antigenic structure
- Over 30 genera and 120 species
- More than 95% of clinically significant strains fall into 10 genera and less than 25 species

Clinical Manifestations

A. Some members of the *Enterobacteriaceae* are **true pathogens**

- *Salmonella* spp.
- *Shigella* spp.
- *Yersinia* spp.
- Certain strains of *Escherichia coli*

B. Most members of the *Enterobacteriaceae* are **opportunistic** or cause secondary infections of wounds, the urinary and respiratory tracts, and the circulatory system

Types of Infectious Disease

- **Intestinal (diarrheal) infection**
- **Extra intestinal infection**
 - Urinary tract infection (primarily cystitis and prostatitis and pyelonephritis)
 - Respiratory (nosocomial pneumonia)
 - Wound (surgical wound infection)
 - Bloodstream (gram-negative bacteremia)
 - Central nervous system (neonatal meningitis)
 - Spontaneous bacterial peritonitis (Usually in patients with liver ailments)
 - Endocarditis (Vascular endocardia surface inflammation)

Escherichia coli

It lives only in human or animal intestine. Detection of *E. coli* in drinking water is taken as evidence of recent pollution with human or animal excreta. Wide range of infection including meningitis, , urinary tract, wound, bacteremia and **Gastrointestinal Infections include:**

- **Enteropathogenic (EPEC)** – Diarrhea with large amounts of mucous without blood or pus occurs along with vomiting, malaise and low grade fever.
- **Enterotoxigenic (ETEC)** – “traveler’s diarrhea”; watery diarrhea without blood
- **Enteroinvasive (EIEC)** – produce dysentery with bowel penetration

- **Enterohemorrhagic (EHEC serotype 0157:H7)** – associated with hemorrhagic diarrhea and hemolytic-uremic syndrome (HUS)
- **Enteroaggregative (EaggEC)** – cause diarrhea by adhering to the mucosal surface of the intestine; watery diarrhea

Biochemical reaction:

It ferment lactose, glucose, sucrose, maltose and mannitol with acid and gas. Indol and methyl red is positive (v-p) and citrate is negative. Urease is not hydrolysed. H₂S is not produce.

- **Virulence factors**
- **Toxins**
- **Enterotoxins** – produced by enterotoxigenic strains of *E. coli* (ETEC). Causes a movement of water and ions from the tissues to the bowel resulting in **watery diarrhea**. There are two types of enterotoxin:
 - **LT** – is **heat labile** and binds to specific Gm₁ gangliosides on the epithelial cells of the small intestine where it ADP-ribosylates Gs which stimulates adenylate cyclase to increase production of cAMP.
 - Increased cAMP alters the activity of sodium and chloride transporters producing an ion imbalance that results in fluid transport into the bowel.
 - **ST** – is **heat stable** and binds to specific receptors to stimulate the production of cGMP with the same results as with LT.
 - Both enterotoxins are composed of five beta subunits (for binding) and 1 alpha subunit (has the toxic enzymatic activity).

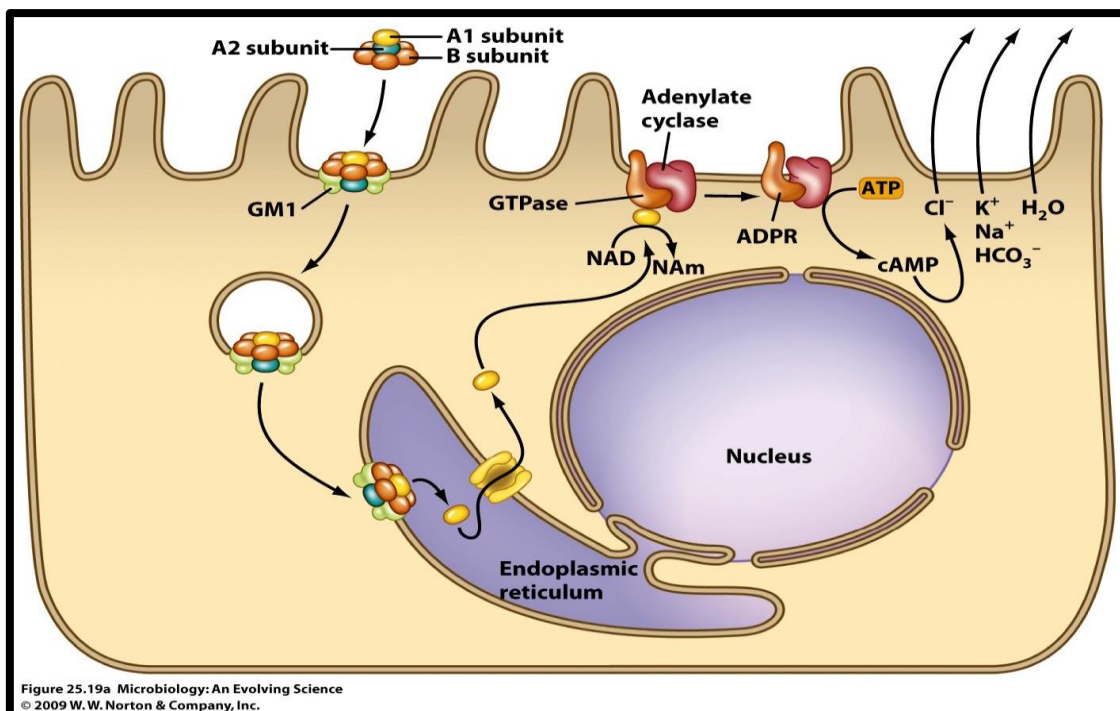


Figure 25.19a Microbiology: An Evolving Science
© 2009 W. W. Norton & Company, Inc.

Klebsiella

They are found in the mucosa of upper respiratory tract intestine and genitourinary tract. They are non-motile, capsulated growing on ordinary media forming large mucoid colonies of varying degree of stickiness. They have been classified into 3 species on the bases of biochemical reaction.

K. pneumoniae (ferments sugar)

K. ozaenae causes foul smelling nasal discharge.

K. rhinoscleromatis causes rhinoscleroma

Biochemical reaction:

They form acid and gas from glucose (except *proteus rettgeri*). They are MR+ve and VP –ve. They are non lactose fermenter. H₂S product in *proteus*. Citrate is +ve in *proteus rettgeri*.

• Virulence factors

- Capsule
- Adhesions
- Iron capturing ability

Clinical significance

- Causes pneumonia, mostly in immunocompromised hosts.
- Permanent lung damage is a frequent occurrence (rare in other types of bacterial pneumonia)
- A major cause of nosocomial infections such as septicemia and meningitis

Salmonella and Shigella

General characteristic:

Salmonella and *shigella* rod form ,gram negative , non-spore forming facultative aerobic ,catalase positive and oxidase negative, do not ferment lactose but which do ferment other carbohydrates, producing acid but not gas and *shigella* non motile but *salmonella* motile ,Antigenic structures is Somatic O and H (flagella) antigens and Vi antigen which is a capsular antigen but *shigella* not have H antigen

Salmonella:

Salmonella typhi causes **typhoid fever**

S. paratyphi is caused **paratyphoid fever**

S. enteritidis caused **food poisoning**

S. choleraesuis, from swine, can cause severe blood poisoning in humans *S.*

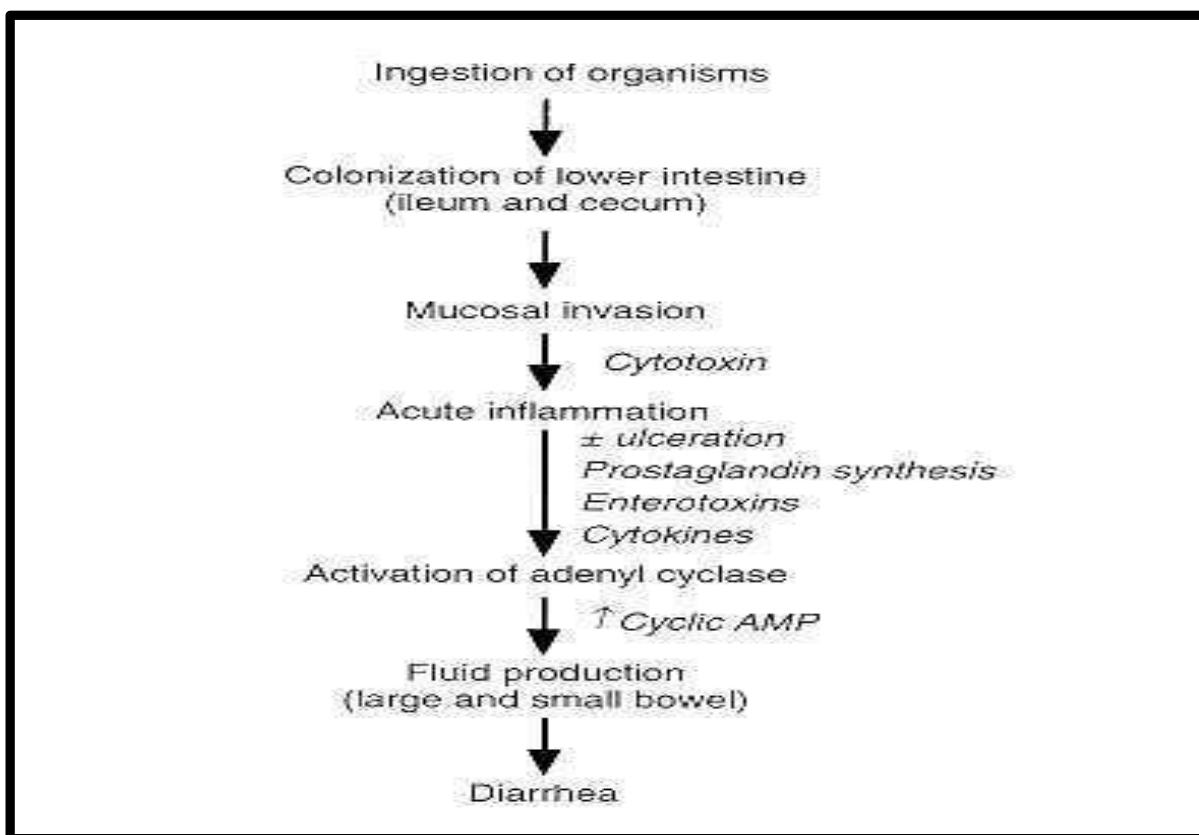
gallinarum causes fowl typhoid

Virulence factors

- Endotoxin – may play a role in intracellular survival
- Capsule (for *S. typhi* and some strains of *S. paratyphi*)
- Adhesions – both fimbrial and non-fimbrial
- Type III secretion systems and effector molecules – 2 different systems may be found:
- One type is involved in promoting entry into intestinal epithelial cells
- The other type is involved in the ability of *Salmonella* to survive inside macrophages

Pathogenesis

Pathogenic salmonellae ingested in food survive passage through the gastric acid barrier and invade the mucosa of the small and large intestine and produce toxins. Invasion of epithelial cells stimulates the release of proinflammatory cytokines which induce an inflammatory reaction. The acute inflammatory response causes diarrhea and may lead to ulceration and destruction of the mucosa. The **bacteria** can disseminate from the intestines to cause systemic disease. three clinical forms recognize of salmonellosis: (1) gastroenteritis, (2) septicemia, and (3) enteric fevers .



Scheme of the Pathogenesis of *Salmonella* enterocolitis and diarrhea

Food poisoning

Salmonella food poisoning is spread from the feces of infected people or animals through food or beverages. Common foods contaminated with *Salmonella* bacteria include undercooked eggs and poultry. *Salmonella* food poisoning results in irritation and inflammation of the digestive tract, which leads to symptoms such as abdominal pain, nausea, fever, diarrhea and acute – gastroenteritis.

Immunity

1. (T.A.B) vaccine which contain (1000) million *salmonella typhi*, (500) million *salmonella paratyphi A* and *salmonella paratyphi B*
2. Parenteral VICPS polysaccharides capsular vaccine

Shigella

All species cause bacillary dysentery Humans are only known reservoir

- *S. dysenteriae* (Group A)
- *S. flexneri* (Group B)
- *S. boydii* (Group C)
- *S. sonnei* (Group D)

Virulence factors

- Shiga toxin – is produced by *S. dysenteriae* and in smaller amounts by *S. flexneri* and *S. sonnei*.
- Acts to inhibit protein synthesis by inactivating the 60S ribosomal subunit by cleaving a glycosidic bond in the 28S rRNA constituents.
- This plays a role in the ulceration of the intestinal mucosa, it has three activates **neurotoxic**, **cytotoxic**, **enterotoxin**

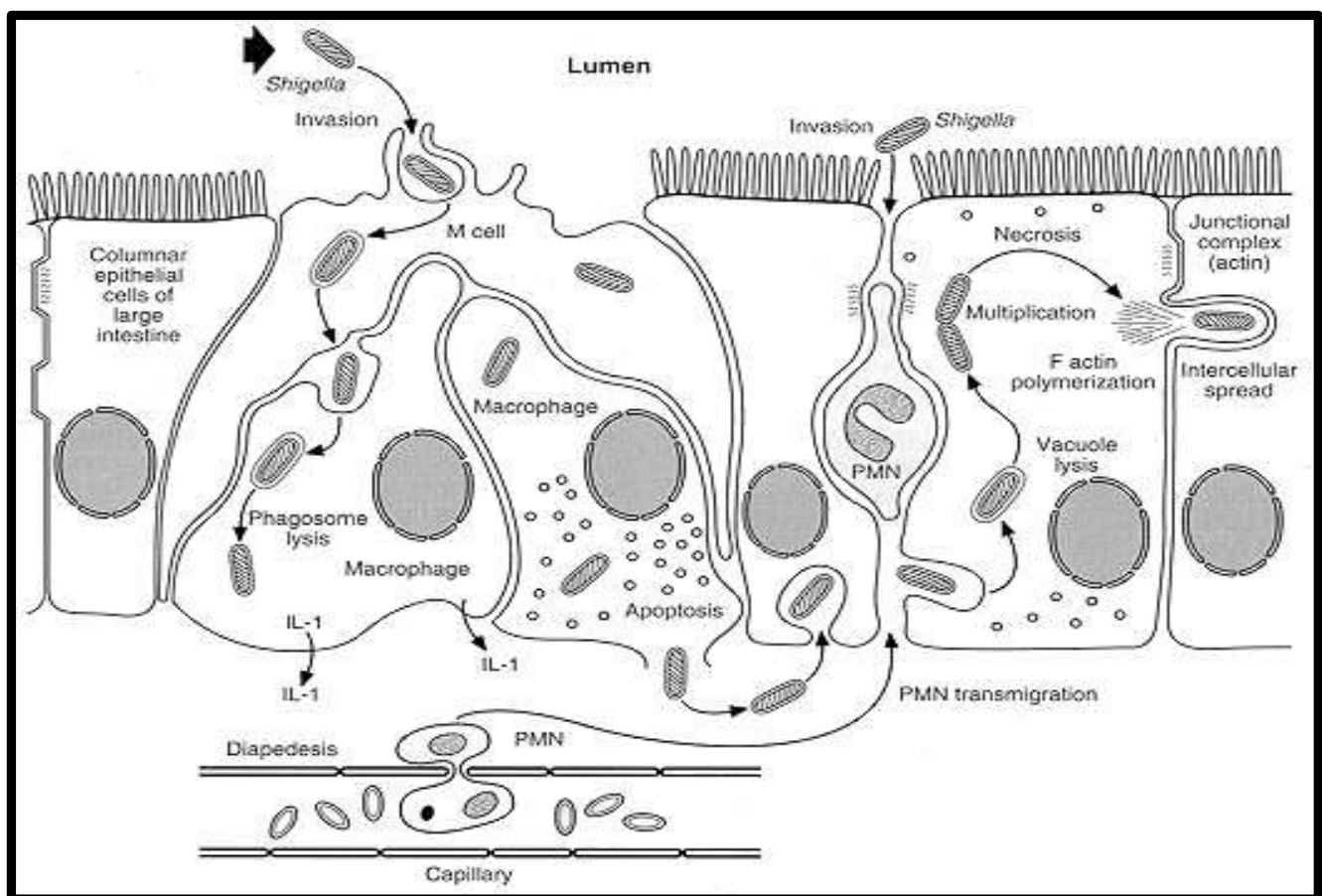
Pathogenicity

The organisms are initially ingested by membranous (M) cells that are associated with lymphoid microfollicles in the colon. After transcytosis through the M cell, the bacteria are deposited into the subepithelial space where they are phagocytosed by macrophages. The macrophage phagosome is subsequently degraded, and the intracellular shigellae cause release of IL-1 that evokes an influx of polymorphonuclear leukocytes (PMN). Eventually the infected macrophages undergo apoptosis (programmed cell death), and the bacteria are released onto the basolateral surface of adjacent colonic enterocytes. In addition, PMN transmigration through the epithelium disrupts tight junctions, allowing shigellae to migrate into the subepithelial space. The bacteria infect

enterocytes by induced endocytosis, and the endocytic vacuoles are subsequently degraded. The intercellular shigellae attach to actin in the enterocyte junctional complex, multiply, and spread to contiguous enterocytes by induced actin polymerization. Ultimately, the infected enterocytes die, and the resulting necrosis of the epithelium, in conjunction with the continuing inflammatory response, constitutes the lesions of shigellosis. Shigellosis has two basic clinical presentations: **(1) watery diarrhea associated with vomiting and mild to moderate dehydration, and (2) dysentery characterized by a small volume of bloody, mucous stools, and abdominal pain**

Treatment

Sulfonamides, ampicillin, tetracyclines and chloramphenicol.



Histopathology of acute colitis following peroral infection with *shigellae*

C: Pre- test

Put a circle in front of right sentence

1- the pathogenicity of Escherichia coli is

A- pharyngitis

B- gas gangrene

C- tuberculosis

D- urinary tract infection

2- klebsiella is

A- gram negative

B- lactose fermented

C- non motile

D- All above

3 – shigella cause

A- muscle spasm

B – tonsillitis

C – lyses of RBC

D – bacillary dysentery

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF This Package

Enteric group of bacteria

Different microorganism is present in the intestinal tract of man.

Enteric group includes following bacteria

1- Escherichia coli

1 – gram negative

2 – motile

3 – lactose fermented

4 – non capsulated

pathogenicity

gastroenteritis (children under 2 year)

urinary tract infection

2- klebsiella

General characters

1 – gram negative

2 – non motile

3 – lactose fermented

4 - capsulated

Pathogenicity

Respiratory tract infection

Urinary tract infection

4 – salmonella

General character

Gram negative

Motile

Non lactose fermented

Pathogenicity

Enteric fever

Septicemia

Food poisoning

5 – shigella

Gram negative

non Motile

Non lactose fermented

Pathogenicity

Bacillary dysentery

C: post- test

Put a circle in front of right sentence

1- the pathogenicity of Escherichia coli is

A- pharyngitis

B- gas gangrene

C- tuberculosis

D- urinary tract infection

2- klebsiella is

A- gram negative

B- lactose fermented

C- non motile

D- All above

3 – shigella cause

A- muscle spasm

B – tonsillitis

C – lyses of RBC

D – bacillary dysentery

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

1-D

2-D

3-D

POST TEST

- 1-D
- 2-D
- 3-D

MODULAR UNIT

14

A: Over view

1-Target population:-

This learning package has been designed to the first year student in the immediate ambulance department of al-dour technical institute

2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3 -1 - brucellae

4-Instructions :

4-1 Study the over view carefully .

4-2 Learn briefly the modular unit of this package.

4-3: Perform the pre –test of this unit:

If you get (9) degree or more you will not need to learn this modular unit. in this case you must contact with your teacher to inform him about your results.

But when you get less than (9) degree in this test, you will need to continue learning this modular unit.

4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more, you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

1 – describe the general character and pathogenicity of brucellae.

Brucell is a genus of Gram-negative bacteria, named after David Bruce (1855– 1931). They are nonencapsulated, nonmotile, facultatively intracellular, cause of brucellosis, which is a zoonosis transmitted by ingesting contaminated food (such as unpasteurized milk products), direct contact with an infected animal, or inhalation of aerosols. Transmission from human to human, for example through sexual intercourse or from mother to child, is rare.

The many names of brucellosis include:

- ❖ Malta fever.
- ❖ Undulant fever.
- ❖ Mediterranean fever.
- ❖ Rock fever.
- ❖ Gastric fever.
- ❖ Contagious abortion.

Symptoms include acute undulating fever, headache, night sweats, and anorexia. Later complications may include arthritis, spondylitis, neurobrucellosis, liver abscess formation, and endocarditis, the latter potentially fatal.

Diagnosis: *Brucella* can be isolated from a blood culture or from bone marrow on Castaneda medium after an incubation of up to six weeks, as they are slow- growing. On Gram stain, they appear as dense clumps of Gram-negative coccobacilli. In recent years, PCR method is used.

Differentiating *Brucella* from *Salmonella* is based on urease test, since it is

positive for *Brucella* and negative for *Salmonella*.

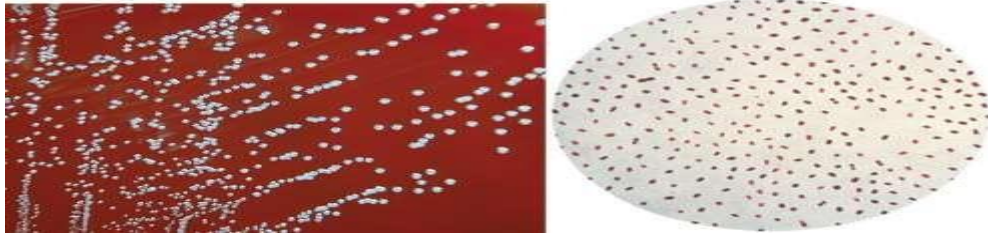
Oxidase and catalase tests are positive for most *Brucella*.

Serum agglutination with a titer > 1:160 supports the diagnosis of brucellosis. ELISA is the second-most common serologic method. The sensitivity of the ELISA is 100%. The prognosis for brucellosis before the use of antibiotics had a mortality of 2%, mainly due to endocarditis, and morbidity was high, especially with *B. melitensis*.

Test		<i>B. melitensis</i>	<i>B. abortus</i>	<i>B. suis</i>	<i>B. neotomae</i>	<i>B. ovis</i>	<i>B. canis</i>
Need to CO ₂		-	+	-	-	+	-
production of H ₂ S		-	+	+	+	-	-
Growth on basic fushin 0.002%		+	+	-	-	+	-
Growth on thionin 0.004%		-	-	+	-	+	+
Growth on thionin 0.002%		+	-	+	+	+	+
Destroy with Tb phage		-	+	-	-	-	-

Species	Host
<i>B. melitensis</i>	goats and sheep
<i>B. abortus</i>	cattle
<i>B. canis</i>	dogs
<i>B. suis</i>	pigs
<i>B. ovis</i>	sheep
<i>B. neotomae</i>	desert woodrat

Biochemical Test of *Brucella melitensis*



C: Pre- test

1- brucella is

A- gram negative

B- coccobacilli

C- non motile

D- All above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF This Package

2 _ brucellae

Morphology

Coccobacilli

Gram negative

non Motile

non spore former

urease positive

diagnostic and laboratory test

specimens – blood for culture in thionine – tryptose agar

incubated for several days

Disease

Clinical finding

malaise

fever

weakness

aches and sweat

lymph nodes enlarge

deep pain particularly in vertebral bodies

treatment

tetracycline and streptomycin

TEST 1 –

Write the disease of brucellae

C: post- test

Put a circle in front of right sentence

1- brucella is

A- gram negative

B- coccobacilli

C- non motile

D- All above

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the modular unit of learning package

PRE TEST

1-B

POST TEST

1-B

TEST -1

Disease

Clinical finding

malaise

fever

weakness

aches and sweat

lymph nodes enlarge

deep pain particularly in vertebral bodies

MODULAR UNIT

15

1-Target population:-

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2- Rationale

This unit will aid those who want to learn the basic microbiological concepts and also intended for students who have little or no science background.

3-Central ideas

3 -1 - cholera

4-Instructions :

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4-4: After you studying this modular unit .

The post –test you must doing it .

If you get (9) degree or more ,you must go to learn the second modular unit.

In case you get less than (9) degree ,you must return to the same unit in order to learn and understand the steps which you need .

After you complete the studying, perform the post- test examination for checking.

B: Performance objectives

After studying this modular unit ,you should be able to:

1 _ describe the general characters and pathogenicity of cholera

Vibrio is a genus of Gram-negative bacteria possessing a curved rod shape (comma shape), several species of which can cause foodborne infection, usually associated with eating undercooked seafood. Typically found in saltwater, *Vibrio* spp. are facultative anaerobes that positive for oxidase test and do not form spores. All members of the genus are motile and have polar flagella with sheaths, growing on alkaline media but not acidic like **TCBS (Thiosulfate Citrate Bile salts Sucrose) agar** and they have (H flagella with O somatic antigen) . The most species Associated with Human Disease include :

V. cholerae (the causative agent of cholera)

V. parahaemolyticus

V. vulnificus.

***Vibrio* spp. (Family Vibrionaceae) Associated with Human Disease**

Virulence Factors Associated with *Vibrio cholerae*

Species	Source of Infection	Clinical Disease
<i>V. cholerae</i>	Water, food	Gastroenteritis
<i>V. parahaemolyticus</i>	Shellfish, seawater	Gastroenteritis, wound infection, bacteremia
<i>V. vulnificus</i>	Shellfish, seawater	Bacteremia, wound infection, cellulitis
<i>V. alginolyticus</i>	Seawater	Wound infection, external otitis
<i>V. hollisae</i>	Shellfish	Gastroenteritis, wound infection, bacteremia
<i>V. fluvialis</i>	Seafood	Gastroenteritis, wound infection, bacteremia
<i>V. damsela</i>	Seawater	Wound infection
<i>V. metschnikovii</i>	Unknown	Bacteremia
<i>V. mimicus</i>	Fresh water	Gastroenteritis, wound infection, bacteremia
<i>V. furnissii</i> *	Seawater	Gastroenteritis
<i>V. cincinnatiensis</i> *	Unknown	Bacteremia, meningitis
<i>V. carchariae</i> *	Seawater	Wound (shark bite)

Virulence Factor	Biologic Effect
Cholera toxin	Hypersecretion of electrolytes and water
Coregulated pilus	Adherence to mucosal cells
Accessory colonization	Adhesin factor
Hemagglutination-protease (mucinase)	Induces intestinal inflammation and degradation of tight junctions
Siderophores	Iron sequestration
Neuraminidase	Increase toxin receptors

Pathogenesis

Cholera is transmitted by the fecal-oral route. Vibrios are sensitive to acid, and most die in the stomach. Surviving virulent organisms may adhere to and colonize the small bowel, where they secrete the potent cholera enterotoxin (CT, also called “cholera toxin”). This toxin binds to the plasma membrane of intestinal epithelial cells and releases an enzymatically active subunit that causes a rise in cyclic adenosine 5'-monophosphate (cAMP) production. The resulting high intracellular cAMP level causes massive secretion of electrolytes and water into the intestinal lumen. cholera is **watery diarrhea**. As more fluid is lost, stool changes to **rice-water stools**, **Odor similar to fish odor** and **Speckled with mucus**. Cholera toxin leads to profuse loss of fluids and electrolytes (sodium, potassium, bicarbonate) Hypokalemia (low levels of K in blood), increase in protein in the blood and decrease in urine and cause Cardiac arrhythmia and renal failure. Death attributable to Hypovolemic shock (due to abnormally low volume of circulating fluid (plasma) in the body) and Metabolic acidosis (pH shifts toward acid side due to loss of bicarbonate buffering capacity)

Diversity and evolution

Two serogroups of *V. cholerae*, **O1 and O139**, cause outbreaks of cholera. O1 causes the majority of outbreaks, while O139 – first identified in Bangladesh in

1992 – is confined to South-East Asia identified by 1) absence of agglutination in O group 1 specific antiserum; 2) by agglutination in O group 139 specific antiserum; and 3) by the presence of a capsule.

Many other serogroups of *V. cholerae*, with or without the cholera toxin gene (including the nontoxigenic strains of the O1 and O139 serogroups), can cause a cholera-like illness. Only toxigenic strains of serogroups O1 and O139 have caused widespread epidemics.

V. cholerae O1 has 2 biotypes, classical and El Tor, and each biotype has 2 distinct serotypes, Inaba and Ogawa. The symptoms of infection are indistinguishable. These organisms may be identified by agglutination in O group 1-specific antiserum directed against the lipopolysaccharide component of the cell wall and by demonstration of their enterotoxigenicity have only a mild illness. In recent years, infections with the classical biotype of *V. cholerae* O1 have become rare and are limited to parts of Bangladesh and India. Recently, new variant strains have been detected in several parts of Asia and Africa. Observations suggest that these strains cause more severe cholera with higher case fatality rates.

Prevention & Control

- Immunization
 - Active Immunity induced by:
- attenuated *V. cholerae*
- Toxoid (not good antigen)

A.Oral

- Sodium chloride (3.5 g/L)
- + Potassium chloride (1.5 g/L)
- + Rice flour (30-80g/L)
- + Trisodium citrate (2.9 g/L)

B.Intravenous (IV)

- Doxycycline or tetracycline (Tet resistance may be developing) of secondary value
 - Preventing contamination of food and water e.g. boiling water, covering food
 - Education
 - Personal and domestic hygiene
- Prevention of contamination of water supplies

C: Pre- test

Put a circle in front of right sentence

1 – cholera grow at

A- alkaline Ph

B-acidic Ph

C-natural Ph

D-non of above

Compare your answer with the key in the end of the learning package .

D:-THE MODULAR UNIT OF This Package

1 – cholera

morphology

Gram negative

Thin

Curved (comma) shaped

Motile

Non lactose ferment

Grow at alkaline Ph

Pathogenicity

it cause cholera , disease transmitted by contaminated water ,milk
fruits, Cholera produce exotoxin

C: post- test

TEST 1 –

Write the pathogenicity of cholera

Compare your answer with the key in the end of the learning package .

KEY OF ANSWER

For the modular unit of learning package

PRE- TEST

1-A

POST TEST

TEST -1

it cause cholera , disease transmitted by contaminated water,milk ,fruits.

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