NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF HEALTH SCIENCES

COURSE CODE: EHS302

COURSE TITLE: GENERAL PATHOLOGY

COURSE GUIDE

EHS 302
GENERAL PATHOLOGY

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INTRODUCTION

EHS 302 titled "General Pathology" is a three (3) Units course with five (5) Modules and fourteen (14) Units. General pathology involves all aspects of pathology. It deals with the diagnosis and management of disease by use of every component of laboratory medicine and every diagnostic technique, including examination of the patient. General pathologists have a very broad understanding of the pathophysiology of disease, the diagnostic value of individual tests and also of the laboratory and its workings.

WHAT YOU WILL LEARN IN THIS COURSE

In this course, you have the course units and a course guide. The course guide will tell you what the course is all about. It is general overview of the course materials you will be using and how to use those materials. It also helps you to allocate the appropriate time to each unit so that you can successfully complete the course within the stipulated time limit.
The course guide also helps you to know how to go about your Tutor-Marked Assignment which will form part of your overall assessment at the end of the course. Also, there will be regular tutorial classes that are related to this course, where you can interact with your facilitator and other students. Please, I encourage you to attend these tutorial classes.

COURSE AIM

The course aims to give you an understanding on pathology.

COURSE OBJECTIVES

To achieve the aim set above, there are objectives. Each unit has a set of objectives presented at the beginning of the unit. These objectives will guide you on what to concentrate / focus on while studying the unit. Please read the objective before studying the unit and during your study to check your progress.

The Comprehensive Objectives of the Course are given below. By the end of the course/after going through this course, you should be able to:

- Define the term pathology.

WORKING THROUGH THIS COURSE

To successfully complete this course, you are required to read each study unit, read the textbooks materials provided by the National Open University.

Reading the referenced materials can also be of great assistance.
Each unit has self-assessment exercises which you are advised to do and at certain periods during the course you will be required to submit your assignment for the purpose of assessment.

There will be a final examination at the end of the course. The course should take you about 17 weeks to complete.

This course guide will provide you with all the components of the course, how to go about studying and how you should allocate your time to each unit so as to finish on time and successfully.

THE COURSE MATERIALS

The main components of the course are:

- The Study Guide
- Study Units
- Reference / Further Readings
- Assignments
- Presentation Schedule

STUDY UNIT

The study units in this course are given below:

Module 1 Concept and Scope of Pathology

Unit 1 Concept and Scope of Pathology
Unit 2 Causes and Classification of Diseases

Module 2 Cytology: Organ Damage and Sequel

Unit 1 Organ Damage and Sequel
Unit 2 Inflammation
Unit 3 Types and Mechanism

Module 3 Infection

Unit 1 Types and Causes of Infection
Unit 2 Body defense mechanism

Module 4 Growth Disorders

Unit 1 Growth Disorders
Unit 2 Types of Growth Disorders
Unit 3 Classification of Growth Disorders

Module 5 System Pathology

Unit 1 System Pathology
Unit 2 Febrile Conditions (Fever) and Cardiovascular Diseases
Unit 3 Diseases of the respiratory system
Unit 4 Inflammatory Joint Diseases

There are activities related to the lecture in each unit which will help your progress and comprehension of the unit. You are required to work on these exercises which together with the TMAs will enable you to achieve the objectives of each unit.

PRESENTATION SCHEDULE

There is a time-table prepared for the early and timely completion and submissions of your TMAs as well as attending the tutorial classes. You are required to submit all your assignments by the stipulated time and date. Avoid falling behind the scheduled time.

ASSESSMENT

There are three aspects to assessment of this course.
The first one is the self-assessment exercises. The second is the tutor marked assignments and the third is the written examination or the examination to be taken at the end of the course.

Do the exercises or activities in the unit by applying the information and knowledge you acquired during the course. The tutor-marked assignments must be submitted to your facilitator for formal assessment in accordance with the deadlines stated in the presentation schedule and the assignment file.

The work submitted to your tutor for assessment will account for 30% of your total course work.

At the end of this course, you have to sit for a final or end of course examination of about a three hour duration which will account for 70% of your total course mark.

TUTOR-MARKED ASSIGNMENT

This is the continuous assessment component of this course and it accounts for 30% of the total score. You will be given Three (3) TMAs by your facilitator to answer. All of the three TMAs must be answered before you are allowed to sit for the end of course examination.

These answered assignments are to be returned to your facilitator.

You're expected to complete the assignments by using the information and material in your readings, references and study units.

Reading and researching into you references will give you a wider view point and give you a deeper understanding of the subject.

1. Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you are not able to complete your assignment, make sure you contact your facilitator before the assignment is due to discuss the possibility of an extension. Request for extension will not be granted after the due date unless in exceptional circumstances.
2. Make sure you revise the whole course content before sitting for the examination. The self-assessment activities and TMAs will be useful for this purpose and if you have any comment please do before the examination. The end of course examination covers information from all parts of the course.

COURSE MARKING SCHEME

Assignment	Marks
Assignments 1 – 3	Three assignments, each will count for 10% making a total of 30% of course marks.
End of course examination	70% of overall course marks
Total	100% of course materials.

FACILITATORS/TUTORS AND TUTORIALS

Sixteen (16) hours are provided for tutorials for this course. You will be notified of the dates, times and location for these tutorial classes.

As soon as you are allocated a tutorial group, the name and phone number of your facilitator will be given to you.

These are the duties of your facilitator: He or she will mark and comment on your assignment. He will monitor your progress and provide any necessary assistance you need. He or she will mark your TMAs and return to you as soon as possible.

(You are expected to mail your tutored assignment to your facilitator at least two days before the schedule date).

Do not delay to contact your facilitator by telephone or e-mail for necessary assistance if: you do not understand any part of the study in the course material; you have difficulty with the self-assessment activities; or you have a problem or question with an assignment or with the grading of the assignment.

It is important and necessary you attend the tutorial classes because this is the only chance to have face to face contact with your facilitator and to ask questions which will be answered instantly. It is also a period where you can mention any problem encountered in the course of your study.

SUMMARY

General pathology involves all aspects of pathology. It deals with the diagnosis and management of disease by use of every component of laboratory medicine and every diagnostic technique, including examination of the patient. General pathologists have a very broad understanding of the pathophysiology of disease, the diagnostic value of individual tests and also of the laboratory and its workings. They use their expertise in macroscopic pathology, histopathology (surgical pathology), cytopathology, chemical pathology, haematology, microbiology, immunopathology, molecular pathology and autopsy pathology in the diagnosis and management of patients and in offering expert opinion to clinicians as to the choice of biopsy/specimen, taking into account the clinical setting and its limitations in the interpretation of results.

At the end of this unit, you should be able to:
Explain the concept of pathology

The list of questions expected to be answered is not limited to the above list. Finally, you are expected to apply the knowledge you have acquired during this course to your practical life.

I wish you success in this course.

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MAIN COURSE

MODULE 1 CONCEPT AND SCOPE OF PATHOLOGY

Unit 1 Concept and Scope of Pathology
Unit 2 Causes and Classification of Diseases

UNIT 1 CONCEPT AND SCOPE OF PATHOLOGY

CONTENTS

1.0 INTRODUCTION

General pathology involves all aspects of pathology. It deals with the diagnosis and management of disease by use of every component of laboratory medicine and every diagnostic technique, including examination of the patient. General pathologists have a very broad understanding of the pathophysiology of disease, the diagnostic value of individual tests and also of the laboratory and its workings.

2.0 OBJECTIVE

By the end of this course, you will be able to:

- define Pathology
- differentiate between Pathology and General Pathology

3.0 MAIN CONTENT

3.1 Definition of Pathology

Pathology is the medical specialty concerned with the study of the nature and causes of diseases. Pathologists are specialist medical practitioners who study the cause of disease and the ways in which diseases affect our bodies by examining changes in the tissues and in blood and other body fluids. Some of these changes show the potential

to develop a disease, while others show its presence, cause or severity or monitor its progress or the effects of treatment.

3.2 Definition of General Pathology

General pathology involves all aspects of pathology. It deals with the diagnosis and management of disease by use of every component of laboratory medicine and every diagnostic technique, including examination of the patient. General pathologists have a very broad understanding of the pathophysiology of disease, the diagnostic value of individual tests and also of the laboratory and its workings. They use their expertise in macroscopic pathology, histopathology (surgical pathology), cytopathology, chemical pathology, haematology, microbiology, immunopathology, molecular pathology and autopsy pathology in the diagnosis and management of patients and in offering expert opinion to clinicians as to the choice of biopsy/specimen, taking into account the clinical setting and its limitations in the interpretation of results.

4.0 CONCLUSION

In this unit you, learnt about the definition of Pathology. Also the definition of general Pathology was also learnt.

5.0 SUMMARY

Pathology is the medical specialty concerned with the study of the nature and causes of diseases. Pathologists are specialist medical practitioners who study the cause of disease and the ways in which diseases affect our bodies by examining changes in the tissues and in blood and other body fluids. Some of these changes show the potential to develop a disease, while others show its presence, cause or severity or monitor its progress or the effects of treatment.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Pathology.
2. Differentiate between Pathology and General Pathology.

7.0 REFERENCES/FURTHER READING

"Definition of -path in English". *Oxford English Dictionary*. *OED*. *Archived from the original on 17 October 2013*. Retrieved *12 October* 2013.

Robbins, Stanley (2010). *Robbins and Cotran Pathologic Basis of Disease* (8th ed.). Philadelphia: Saunders/Elsevier. ISBN 978-1-4160-3121-5.

UNIT 2 CAUSES AND CLASSIFICATION OF DISEASES

CONTENTS

1.0 INTRODUCTION

Classifications of diseases become extremely important in the compilation of statistics on causes of illness (morbidity) and causes of death (mortality). It is obviously important to know what kinds of illnesses and diseases are prevalent in an area and how these prevalence rates vary with time. Classifying diseases made it apparent, for example, that the frequency of lung cancer was entering a period of alarming increase in the mid-20th century. Once a rare form of cancer, it had become the single most important form of cancer in males. With this knowledge a search was instituted for possible causes of this increased prevalence. It was concluded that the occurrence of lung cancer was closely associated with cigarette smoking. Classification of disease had helped to ferret out an important, frequently causal, relationship.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- understand the causes of diseases
- classification of diseases.

3.0 MAIN CONTENT

3.1 Causes of Diseases

It is obviously important to know what kinds of illnesses and diseases are prevalent in an area and how these prevalence rates vary with time. Classifying diseases made it apparent, for example, that the frequency of lung cancer was entering a period of alarming increase in the mid-20th

century. Once a rare form of cancer, it had become the single most important form of cancer in males. With this knowledge a search was instituted for possible causes of this increased prevalence. It was concluded that the occurrence of lung cancer was closely associated with cigarette smoking. Classification of disease had helped to ferret out an important, frequently causal, relationship.

The most widely used classifications of disease are:

1. Topographic, by bodily region or system
2. Anatomic, by organ or tissue
3. Physiological, by function or effect
4. Pathological, by the nature of the disease process
5. Etiologic (causal)
6. Juristic, by speed of advent of death
7. Epidemiological
8. Statistical. Any single disease may fall within several of these classifications.

In the topographic classification, diseases are subdivided into such categories as gastrointestinal disease, vascular disease, abdominal disease, and chest disease. Various specializations within medicine follow such topographic or systemic divisions, so that there are physicians who are essentially vascular surgeons, for example, or clinicians who are specialized in gastrointestinal disease. Similarly, some physicians have become specialized in chest disease and concentrate principally on diseases of the heart and lungs.

In the anatomic classification, disease is categorized by the specific organ or tissue affected; hence, heart disease, liver disease, and lung disease. Medical specialties such as cardiology are restricted to diseases of a single organ, in this case the heart. Such a classification has its greatest use in identifying the various kinds of disease that affect a particular organ. The heart is a good example to consider. By the segregation of cardiac disease it has been made apparent that heart disease is now the most important cause of death in the United States and in most other industrialized nations. Moreover, it has become apparent that disease caused by atherosclerosis of the coronary arteries is by far the most important form of heart disease. In making a diagnosis of cardiac disease in an elderly patient, the cardiologist must first determine whether this disease of the coronary arteries is responsible for the heart's failure to function normally.

The physiological classification of disease is based on the underlying functional derangement produced by a specific disorder. Included in this

classification are such designations as respiratory and metabolic disease. Respiratory diseases are those that interfere with the intake and expulsion of air and the exchange of oxygen for carbon dioxide in the lungs. Metabolic diseases are those in which disturbances of the body's chemical processes are a basic feature. Diabetes and gout are examples.
The pathological classification of disease considers the nature of the disease process. Neoplastic and inflammatory diseases are examples. Neoplastic disease includes the whole range of tumours, particularly cancers, and their effect on human beings.

The etiologic classification of disease is based on the cause, when known. This classification is particularly important and useful in the consideration of biotic disease. On this basis disease might be classified as staphylococcal or rickettsial or fungal, to cite only a few instances. It is important to know, for example, what kinds of disease staphylococci produce in human beings. It is well known that they cause skin infections and pneumonia, but it is also important to note how often they cause meningitis, abscesses in the liver, and kidney infections. The sexually transmitted diseases syphilis and gonorrhea are further examples of diseases classified by etiology.

The juristic basis of the classification of disease is concerned with the legal circumstances in which death occurs. It is principally involved with sudden death, the cause of which is not clearly evident. Thus, on a juristic basis some deaths and diseases are classified as medical-legal and fall within the jurisdiction of coroners and medical examiners. A person living alone is found dead in bed—dead of natural causes or killed? Had the person who dropped dead on the street been given some poison that took a short time to act? Much less dramatic, but perhaps more common, are disease and death caused by exposure of the individual to some unrecognized danger to health in working or living conditions. Could the illness or disease be attributable to fumes or dusts in a factory? These are examples of the many types of disease and death that fall properly in this classification.

The epidemiological classification of disease deals with the incidence, distribution, and control of disorders in a population. To use the example of typhoid, a disease spread through contaminated food and water, it first becomes important to establish that the disease observed is truly caused by Salmonella typhi, the typhoid organism. Once the diagnosis is established, it is obviously important to know the number of cases, whether the cases were scattered over the course of a year or occurred within a short period, and what the geographic distribution is. It is critically important that the precise address and activities of the patients be established. Two widely separated locations within the same

city might be found to have clusters of cases of typhoid all arising virtually simultaneously. It might be found that each of these clusters revolved about a family unit including cousins, grandparents, aunts and uncles, and friends, suggesting that in some way personal relationships might be important. Further investigation might disclose that all the infected persons had dined at one time or at short intervals in a specific home. It might further be found that the person who had prepared the meal had recently visited some rural area and had suffered a mild attack of the disease and was now spreading it to family and friends by unknowing contamination of food. This hypothetical case suggests the importance of the etiologic, as well as the epidemiological, classification of disease. Epidemiology is one of the important sciences in the study of nutritional and biotic diseases around the world. The United Nations supports, in part, the World Health Organization, whose chief function is the worldwide investigation of the distribution of disease. In the course of this investigation, many observations have been made that help to explain the cause and provide approaches to the control of many diseases.

The statistical basis of classification of disease employs analysis of the incidence (the numbers of new cases of a specific disease that occur during a certain period) and the prevalence rate (number of cases of a disease in existence at a certain time) of diseases. If, for example, a disease has an incidence rate of 100 cases per year in a given locale and, on the average, the affected persons live three years with the disease, it is obvious that the prevalence of the disease is 300. Statistical classification is an additional important tool in the study of possible causes of disease. These studies, as well as epidemiological, nutritional, and pathological analyses, have made it clear, for example, that diet is an important consideration in the possible causation of atherosclerosis. The statistical analyses drew attention to the role of high levels of fats and carbohydrates in the diet in the possible causation of atherosclerosis. The analyses further drew attention to the fact that certain populations that do not eat large quantities of animal fats and subsist largely on vegetable oils and fish have a much lower incidence of atherosclerosis. Thus, statistical surveys are of great importance in the study of human disease.

4.0 CONCLUSION

Classifying diseases made it apparent, for example, that the frequency of lung cancer was entering a period of alarming increase in the mid-20th century. Once a rare form of cancer, it had become the single most important form of cancer in males. With this knowledge a search was instituted for possible causes of this increased prevalence. It was

concluded that the occurrence of lung cancer was closely associated with cigarette smoking. Classification of disease had helped to ferret out an important, frequently causal, relationship.

5.0 SUMMARY

The statistical analyses drew attention to the role of high levels of fats and carbohydrates in the diet in the possible causation of atherosclerosis. The analyses further drew attention to the fact that certain populations that do not eat large quantities of animal fats and subsist largely on vegetable oils and fish have a much lower incidence of atherosclerosis. Thus, statistical surveys are of great importance in the study of human disease.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the causes of diseases?
2. Attempt the classification of diseases.

7.0 REFERENCES/FURTHER READING

Long, Esmond (1965). *History of Pathology.* New York: Dover. pp. 1+. ISBN 978-0-486-61342-0.

"Commentary on the Chapter Nine of the Book of Medicine Dedicated to Mansur — Commentaria in nonum librum Rasis and regem Almansorem". World Digital Library (in Latin). 1542. Archived from the original on 2014-02-14. Retrieved 2014-03-02.

MODULE 2 CYTOLOGY ORGAN DAMAGE AND SEQUEL

UNIT 1 CYTOLOGY

CONTENTS

1.0 INTRODUCTION

An interest in the effects of disease and trauma is nothing new. People have been seeing pathologists observing the effects of disease since the dawn of recorded history, likely before.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain cytology
- state the history of cytology.

3.0 MAIN CONTENT

3.1 Meaning of Cytology

Cytology is the medical and scientific study of cells. Cytology refers to a branch of pathology, the medical specialty that deals with making diagnoses of diseases and conditions through the examination of tissue samples from the body. Cytologic examinations may be performed on body fluids (examples are blood, urine, and cerebrospinal fluid) or on material that is aspirated (drawn out via suction into a syringe) from the

body. Cytology also can involve examinations of preparations that are scraped or washed (irrigated with a sterile solution) from specific areas of the body. For example, a common example of diagnostic cytology is the evaluation of cervical smears (referred to as the Papanicolaou test or Pap smear). In order for cytologic evaluation to be carried out, the material to be examined is spread onto glass slides and stained. A pathologist then uses a microscope to examine the individual cells in the sample.

An interest in the effects of disease and trauma is nothing new. People have been pathologists observing the effects of disease since the dawn of recorded history, likely before. Egyptian medical texts described infectious diseases (tetanus is an often quoted example) tells of a disease visited upon the Philistines that may well have been bubonic plague. The Iliad describes the surgeon Machaon treating Menaleus' arrow wound. Egyptian physicians described the host reaction to such wounds (suppuration, inflammation) as early as the third millennium BC and may have treated such wounds with antiseptic agents.

4.0 CONCLUSION

In this unit, you learnt the meaning of cytology and brief history of cytology.

5.0 SUMMARY

An interest in the effects of disease and trauma is nothing new. People have been seeing pathologists observing the effects of diseases since the dawn of recorded history, likely before.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Cytology
2. Attempt the history of Cytology.

1. .

7.0 REFERENCES/FURTHER READING

Machevsky, Alberto; Wick, MR (2004). "Evidence-based Medicine, Medical Decision Analysis, and Pathology". Human Pathology. **35** (10): 1179–88. doi:10.1016/j.humpath.2004.06.004. PMID 15492984. Retrieved 21 March 2012.

"Dermatopathology". Archived from the original on 2010-12-07.

UNIT 2 INFLAMATION

CONTENTS

1.0 INTRODUCTION

When something harmful or irritating affects a part of our body, there is a biological response to try to remove it. The signs and symptoms of inflammation can be uncomfortable but are a show that the body is trying to heal itself.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- define inflammation
- state the important of inflammation.

3.0 MAIN CONTENT

Inflammation is a defense mechanism in the body. The immune system recognizes damaged cells, irritants, and pathogens, and it begins the healing process. When something harmful or irritating affects a part of our body, there is a biological response to try to remove it. The signs and symptoms of inflammation can be uncomfortable but are a show that the body is trying to heal itself.

- Inflammation is the body's attempt at self-protection to remove harmful stimuli and begin the healing process.
- Inflammation is part of the body's immune response.
- Infections, wounds, and any damage to tissue would not be able to heal without an inflammatory response.
- Chronic inflammation can eventually cause several diseases and conditions, including some cancers and rheumatoid arthritis.

Inflammation is part of the body's immune response. It can be beneficial when, for example, your knee sustains a blow and tissues need care and protection. However, sometimes, inflammation can persist longer than necessary, causing more harm than benefit.

4.0 CONCLUSION

In this unit you learnt, about the meaning of Inflammation and the important of it.

5.0 SUMMARY

The way a country finances its health care system is a critical determinant for reaching UHC. This is so because they determine whether health services exist and are available and whether people can afford to use health services when they need them. This can be achieved by a well-planned combination of all healthcare financing mechanisms, which include: Tax-based financing, OOPs, donor funding, health insurance exemptions, deferrals and subsidies. The main thrust is how to generate adequate revenue to finance health services from a diversified group of people, without over tasking the formal sector workers. Since in Nigeria, the formal sector workers are the group that their contributions are its tax or agreed deduction can easily be access from source and this constitutes 47% of the working population. The situation is different when informal sector (about 53% of the working population) is considered, due to infective tax collection system, inefficient formula to calculate the amount to collect, and lack of confidence on those that will be mandated to collect the fund.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Inflammation.
2. State the importance of inflammation.

7.0 REFERENCES/FURTHER READING

Lett, D. (July 2007). "National Standards for Forensic Pathology Training Slow To Develop".

CMAJ. **177** (3): 240–1. doi:10.1503/cmaj.070881. PMC 1930175. PMID 17664437.

Carson, Freida L; Christa, Hladik (2009). *Histotechnology: A Self-Instructional Text* (3rd ed.). Hong Kong: American Society for Clinical Pathology Press. p. 2. ISBN 978-0- 89189-581-7.

UNIT 3 TYPES AND MECHANISM OF INFLAMMATIONS

CONTENTS

1.0 1NTRODUCTION

The first stage of inflammation is often called irritation, which then becomes inflammation. Inflammation is followed by the discharging of pus. The granulation stage comes next, and new tissue is formed in the wound. Without inflammation, infections and wounds would never heal.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- know the Mechanism of Inflammations
- State the Types of Inflammations.

3.0 MAIN CONTENT

3.1 Mechanisms of Inflammations

A coordinated series of common effectors mechanism of inflammation contribute to tissue injury, oxidative stress, remodeling of the extracellular matrix, angiogenesis, and fibrosis in diverse target tissues. Its progression involves many inflammatory mediators, modulated by cells of both innate and adaptive immunity. Inflammation participates importantly in host defenses against infectious agents and injury, but it also contributes to the pathophysiology of many chronic diseases. Interactions of cells in the innate immune system, adaptive immune system, and inflammatory mediators orchestrate aspects of the acute and

chronic inflammation that underlie diseases of many organs. Atherosclerosis provides an example of a chronic disease that involves inflammatory mechanisms. Recruitment of blood leukocytes characterises the initiation of this disease. Its progression involves many inflammatory mediators, modulated by cells of both innate and adaptive immunity. The complications of established atheroma, including plaque disruption and thrombosis, also intimately involve inflammation. Mastery of the inflammatory response should aid the development of novel strategies to predict disease susceptibility, target and monitor therapies, and ultimately develop new approaches to the prevention and treatment of chronic diseases associated with aging, such as atherosclerosis.

3.2 Types of Inflammation

- Appendicitis
- Bursitis
- Colitis
- Cystitis
- Dermatitis
- Encephalitis
- Gingivitis
- Meningitis
- Myelitis
- Nephritis
- Neuritis
- Periodontitis
- Pharyngitis
- Phlebitis
- Prostatitis
- RSD/CRPS
- Rhinitis
- Sinusitis
- Tendonitis
- Testiculitis
- Tonsillitis
- Urethritis
- Vasculitis
- Vaginitis

4.0 CONCLUSION

In this unit you learnt about the mechanism and Types of Inflammation.

5.0 SUMMARY

Inflammation aids wound healing, but chronic inflammation can cause conditions such as asthma or rheumatoid arthritis. Our immediate reaction to a swelling is to try and decrease it. However, it is important to remember that inflammation is an essential part of the healing process. The first stage of inflammation is often called irritation, which then becomes inflammation. Inflammation is followed by the discharging of pus. The granulation stage comes next, and new tissue is formed in the wound. Without inflammation, infections and wounds would never heal.

Innate immunity: when a person is born, certain defenses in the immune system are naturally present in the body. This is known as innate immunity. It is different from adaptive immunity, which we develop after an infection or vaccination when the body "learns" to fight a specific infectious agent. Innate immunity is generally nonspecific, while adaptive immunity is specific to a particular pathogen. Inflammation is one example of an innate immune response.

6.0 TUTOR-MARKED ASSIGNMENT

1 Explain the mechanism of Inflammation.
2 State the types of Inflammation.

7.0 REFERENCES/FURTHER READING

""Laboratory Medicine Specialist in EFCC Newsletter May 2011 (Page 5)"(PDF). Archived (PDF) From the Original on 2014-04-27.Carson, Freida L; Christa Hladik (2009*). Histotechnology: A Self- Instructional Text* (3rd ed.). Hong Kong: American Society for Clinical Pathology Press. P. 2. ISBN 978-0-89189-581-7.

MODULE 3 INFECTION

UNIT 1 TYPES AND CAUSES OF INFECTION

CONTENTS

1.0 INTRODUCTION

Some infections are mild and barely noticeable, but others are severe and life-threatening, and some are resistant to treatment. Infection can be transmitted in a variety of ways.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- define infection
- state the types of infection.

3.0 MAIN CONTENT

3.1 Meaning of Infection

An infection happens when a foreign organism enters a person's body and causes harm. The organism uses that person's body to sustain itself, reproduce, and colonize. These infectious organisms are known as pathogens. Examples of pathogens include bacteria, viruses, fungi, and prions. Pathogens can multiply and adapt quickly.

Some infections are mild and barely noticeable, but others are severe and life-threatening, and some are resistant to treatment. Infection can be transmitted in a variety of ways. These include skin contact, bodily fluids, contact with feces, airborne particles, and touching an object that an infected person has also touched. How an infection spreads and its effect on the human body depend on the type of agent. The immune system is an effective barrier against infectious agents, but colonies of pathogens may grow too large for the immune system to fight. At this stage, infections become harmful. Many pathogens give off toxins that trigger negative responses from the body.

3.2 Types of Infection

Bacteria, viruses, fungi, protozoa and parasites are different types of pathogen. They vary in their size, shape, function, genetic content, and how they act on the body. For example, viruses are smaller than bacteria, and they can enter a host and take over cells. However, bacteria can survive without a host. Treatment will depend on the type of pathogen.

Viral infections
Viral infections are caused by a virus. Millions of types of viruses are thought to exist, but only 5,000 types have been identified. Viruses contain a small piece of genetic code. They are protected by a coat of protein and fat. Viruses invade a host and attach themselves to a cell. As they enter the cell, they release genetic material. The genetic material forces the cell to replicate, and the virus multiplies. When the cell dies, it releases new viruses, and these go on to infect new cells.

Not all viruses destroy their host cell. Some of them change the function of the cell. In this way, viruses such as human papillomavirus (HPV) or Epstein-Barr virus (EBV) can lead to cancer by forcing cells to replicate in an uncontrolled way. They can also target certain age groups, such as infants or young children. A virus may remain dormant for a period before multiplying again. The person with the virus can appear to have recovered but may get sick again when the virus reactivates.

Here are some examples of viral infections:

- the common cold, mainly caused by the rhinovirus, coronavirus, and adenovirus
- encephalitis and meningitis, caused by enteroviruses and the herpes viruses
- warts and skin infections, caused by the human papillomaviruses (HPV) and herpes simplex virus (HSV).

- gastroenteritis, caused by the rotaavirus
  Other viral conditions include:
- Zika virus
- human immunodeficiency virus (HIV)
- hepatitis C
- polio
- influenza
- Dengue fever
- H1N1 swine flu
- Ebola
- Middle East respiratory syndrome (MERS-CoV)

Antiviral medications help in some cases. They can either prevent the virus from reproducing or boost the host's immune system. Antibiotics are not effective against viruses. Using antibiotics against a virus will not stop the virus, and it increases the risk of antibiotic resistance. Most treatment aims to relieve symptoms while the immune system combats the virus without assistance from medicine.

Bacterial infections
Bacteria are single-celled microorganisms known as prokaryotes.
There are estimated to be at least one nonillion bacteria on Earth. A nonillion is a one followed by 30 zeros. Much of Earth's biomass is made up of bacteria.

Bacteria take three main shapes:

- Spherical: These are usually the simplest to treat and are known as cocci.
- Rod-shaped: These are called bacilli.
- Spiral: Coiled bacteria are known as spirilla. If the coil of a spirillus is particularly tight, they are known as spirochetes.

Bacteria can live in almost any kind of environment, from extreme heat to intense cold, and some can even survive in radioactive waste. There are trillions of strains of bacteria, and few of these cause diseases in humans. Some of them live inside the human body without causing harm, for example in the gut or airways. Some "good" bacteria attack "bad" bacteria and prevent them from causing sickness.

4.0 CONCLUSION

In this unit, students had learnt so far the meaning and types of infections.

5.0 SUMMARY

An infection happens when a foreign organism enters a person's body and causes harm. The organism uses that person's body to sustain itself, reproduce, and colonize. These infectious organisms are known as pathogens. Examples of pathogens include bacteria, viruses, fungi, and prions. Pathogens can multiply and adapt quickly. Some infections are mild and barely noticeable, but others are severe and life-threatening, and some are resistant to treatment. Infection can be transmitted in a variety of ways. These include skin contact, bodily fluids, contact with feces, airborne particles, and touching an object that an infected person has also touched. How an infection spreads and its effect on the human body depend on the type of agent. The immune system is an effective barrier against infectious agents, but colonies of pathogens may grow too large for the immune system to fight. At this stage, infections become harmful. Many pathogens give off toxins that trigger negative responses from the body.

6.0 TUTOR-MARKED ASSIGNMENTS

1. What is Infection?
2. List and explain the types of Infections.

7.0 REFERENCES/FURTHER READING

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UNIT 2 BODY DEFENSE MECHANISM

1.0 INTRODUCTION

Inflammation is a defense mechanism in the body. The immune system recognizes damaged cells, irritants, and pathogens, and it begins the healing process. Inflammation is part of the body's immune response. Infections, wounds, and any damage to tissue would not be able to heal without an inflammatory response.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- know the important of bacteria and fungi
- understand viral infections.

3.0 MAIN CONTENT

3.1 Important Bacteria and Fungi

Bacteria cause a wide range of diseases in humans and other animals. Plant diseases caused by bacteria are commercially important worldwide for agriculture. In addition, bacterial plant pathogens are difficult to control because of the shortage of chemical control agents for bacteria.
Fungi are one of the most important groups of organisms on the planet. This is easy to overlook, given their largely hidden, unseen actions and growth. They are important in an enormous variety of ways.

- **Recycling**
  Fungi, together with bacteria, are responsible for most of the recycling which returns dead material to the soil in a form in which it can be reused. Without fungi, these recycling activities

would be seriously reduced. We would effectively be lost under piles many meters thick, of dead plant and animal remains.

- **Mycorrhisae and plant growth**
  Fungi are vitally important for the good growth of most plants, including crops, through the development of mycorrhizal associations. As plants are at the base of most food chains, if their growth was limited, all animal life, including human, would be seriously reduced through starvation.

- **Food**
  Fungi are also important directly as food for humans. Many mushrooms are edible and different species are cultivated for sale worldwide. While this is a very small proportion of the actual food that we eat, fungi are also widely used in the production of many foods and drinks. These include cheeses, beer and wine, bread, some cakes, and some soya bean products. While a great many wild fungi are edible, it can be difficult to correctly identify them. Some mushrooms are deadly if they are eaten. Fungi with names such as 'Destroying Angel' and 'Death Cap' give us some indication that it would not be a terribly good idea to eat them! In some countries, collecting wild mushrooms to eat is a popular activity. It is always wise to be totally sure that what you have collected is edible and not a poisonous look-a-like.

- **Medicines**
  Penicillin, perhaps the most famous of all antibiotic drugs, is derived from a common fungus called Penicillium. Many other fungi also produce antibiotic substances, which are now widely used to control diseases in human and animal populations. The discovery of antibiotics revolutionised health care worldwide.
  Some fungi which parasitise caterpillars have also been traditionally used as medicines. The Chinese have used a particular caterpillar fungus as a tonic for hundreds of years. Certain chemical compounds isolated from the fungus may prove to be useful treatments for certain types of cancer.

  A fungus which parasitises Rye crops causes a disease known as Ergot. The fungus can occur on a variety of grasses. It produces small hard structures, known as sclerotia. These sclerotia can cause poisoning in humans and animals which have eaten infected material. However, these same sclerotia are also the source of a powerful and important drug which has uses in childbirth.

- **Biocontrol**
  Fungi such as the Chinese caterpillar fungus, which parasitise insects, can be extremely useful for controlling insect pests of crops. The spores of the fungi are sprayed on the crop pests. Fungi have been used to control Colorado potato beetles, which can devastate potato crops. Spittlebugs, leaf hoppers and citrus rust mites are some of the other insect pests which have been controlled using fungi. This method is generally cheaper and less damaging to the environment than using chemical pesticides.

- **Crop diseases**
  Fungal parasites may be useful in biocontrol, but they can also have enormous negative consequences for crop production. Some fungi are parasites of plants. Most of our common crop plants are susceptible to fungal attack of one kind or another. Spore production and dispersal is enormously efficient in fungi and plants of the same species crowded together in fields are ripe for attack. Fungal diseases can on occasion result in the loss of entire crops if they are not treated with antifungal agents.

- **Animal disease**
  Fungi can also parasitise domestic animals causing diseases, but this is not usually a major economic problem. A wide range of fungi also live on and in humans, but most coexist harmlessly. Athletes foot and Candida infections are examples of human fungal infections.

- **Food spoilage**
  It has already been noted that fungi play a major role in recycling organic material. The fungi which make our bread and jam go mouldy are only recycling organic matter, even though in this case, we would prefer that it didn't happen! Fungal damage can be responsible for large losses of stored food, particularly food which contains any moisture. Dry grains can usually be stored successfully, but the minute they become damp, moulds are likely to render them inedible. This is obviously a problem where large quantities of food are being produced seasonally and then require storage until they are needed.

3.2 Viral Infections

Viruses cause familiar infectious diseases such as the common cold, flu and warts. They also cause severe illnesses such as HIV/AIDS, smallpox, and Ebola. Viruses are like hijackers. They invade living,

normal cells and use those cells to multiply and produce other viruses like themselves.

Tuberculosis

Infection of other organs can cause a wide range of symptoms. Tuberculosis is spread through the air when people who have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease. Active infection occurs more often in people with HIV/AIDS and in those who smoke. Tuberculosis (TB) is an infectious disease usually caused by Mycobacterium tuberculosis (MTB) bacteria. Tuberculosis generally affects the lungs, but can also affect other parts of the body. Most infections do not have symptoms, in which case it is known as latent tuberculosis. About 10% of latent infections progress to active disease which, if left untreated, kills about half of those affected. The classic symptoms of active TB are a chronic cough with blood-containing sputum, fever, night sweats, and weight loss. It was historically called "Consumption" due to the weight loss. Infection of other organs can cause a wide range of symptoms.

Tuberculosis is spread through the air when people who have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease. Active infection occurs more often in people with HIV/AIDS and in those who smoke. Diagnosis of active TB is based on chest X-rays, as well as microscopic examination and culture of body fluids. Diagnosis of latent TB relies on the tuberculin skin test (TST) or blood tests.

Prevention of TB involves screening those at high risk, early detection and treatment of cases, and vaccination with the bacillus Calmette-Guérin (BCG) vaccine. Those at high risk include household, workplace, and social contacts of people with active TB. Treatment requires the use of multiple antibiotics over a long period of time. Antibiotic resistance is a growing problem with increasing rates of multiple drug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB).

Presently, one-quarter of the world's population is thought to be infected with TB. New infections occur in about 1% of the population each year. In 2017, there were more than 10 million cases of active TB which resulted in 1.6 million deaths. This makes it the number one cause of death from an infectious disease. More than 95% of deaths occurred in developing countries, and more than 50% in India, China, Indonesia, Pakistan, and the Philippines. The number of new cases each year has decreased since 2000. About 80% of people in many Asian and African countries test positive while 5–10% of people in the United States

population test positive by the tuberculin test. Tuberculosis has been present in humans since ancient times.

Candidiasis
Candidiasis is a yeast infection caused by *Candida albicans*. In people with HIV, the virus that causes AIDS, candidiasis commonly affects the skin and mucous membranes such as the mouth, throat, esophagus and vagina. Candidiasis also can occur in healthy people, but it does not usually cause disease.

4.0 CONCLUSION

In this unit, students had learnt the important of Bacteria and Fungi. Also students learnt about viral infections.

5.0 SUMMARY

It has already been noted that fungi play a major role in recycling organic material. The fungi which make our bread and jam go mouldy are only recycling organic matter, even though in this case, we would prefer that it didn't happen! Fungal damage can be responsible for large losses of stored food, particularly food which contains any moisture. Dry grains can usually be stored successfully, but the minute they become damp, moulds are likely to render them inedible. This is obviously a problem where large quantities of food are being produced seasonally and then require storage until they are needed.

6.0 TUTOR-MARKED ASSIGNMENT

1. State the importance of Bacteria and Fungi.
2. Explain some viral infections.

7.0 REFERENCES/FURTHER READING

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MODULE 4 GROWTH DISORDERS

UNIT 1 GROWTH DISORDERS

CONTENTS

1.0 INTRODUCTION

Cancer is a disease caused by genetic changes leading to uncontrolled cell growth and tumor formation. These factors act, at least partly, by altering the function of genes within cells. Typically, many such genetic changes are required before cancer develops.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- define growth disorders
- differentiate between hyperplasia and hypertrophy.

3.0 MAIN CONTENT

3.1 Growth Disorders

Human growth starts at conception and proceeds through various identifiable developmental stages. The process of growth depends on both genetic and environmental factors that combine to determine an individual's eventual height. The genetic control of structural growth is becoming increasingly clear. Many genes have been identified that are

required for normal development and function of the pituitary in general, and that control the growth hormone/insulin-like growth factor axis in particular. Mutations of these genes have been shown to be responsible for abnormal growth in humans and animals.

Growth hormone (GH) has been used to treat short children since the 1950's. Initially only those children with the most pronounced growth failure due to severe growth hormone deficiency (GHD) were considered appropriate candidates, but with time children with growth failure from a range of conditions have been shown to benefit from GH treatment. GH has also been used to treat several catabolic processes, including cystic fibrosis, inflammatory bowel disease and AIDS wasting.

Growth failure may be due to genetic mutations, acquired disease and/or environmental deficiencies. Growth failure may result from a failure of hypothalamic growth hormone-releasing hormone (GHRH) production or release, from (genetic or sporadic) mal-development of the pituitary somatotropes, secondary to ongoing chronic illness, malnutrition, intrinsic abnormalities of cartilage and/or bone such as osteochondrodysplasias, and from genetic disorders affecting growth hormone production and responsiveness. Children without any identifiable cause of their growth failure are commonly labeled as having idiopathic short stature. Growth disorders are problems that prevent children from developing normal height, weight, sexual maturity or other features. Very slow or very fast growth can sometimes signal a gland problem or disease. The pituitary gland makes growth hormone, which stimulates the growth of bone and other tissues.

3.1.1 Hyperplasia

Hyperplasia, or hypergenesis, is an increase in the amount of organic tissue that results from cell proliferation. It may lead to the gross enlargement of an organ, and the term is sometimes confused with benign neoplasia or benign tumor. Hyperplasia is a common preneoplastic response to stimulus. Microscopically, cells resemble normal cells but are increased in numbers. Sometimes cells may also be increased in size (hypertrophy). Hyperplasia is different from hypertrophy in that the adaptive cell change in hypertrophy is an increase in the size of cells, whereas hyperplasia involves an increase in the number of cells.

3.1.2 Hypertrophy

Hypertrophy is the increase in the volume of an organ or tissue due to the enlargement of its component cells. It is distinguished from hyperplasia, in which the cells remain approximately the same size but increase in number. Although hypertrophy and hyperplasia are two distinct processes, they frequently occur together, such as in the case of the hormonally-induced proliferation and enlargement of the cells of the uterus during pregnancy. Eccentric hypertrophy is a type of hypertrophy where the walls and chamber of a hollow organ undergo growth in which the overall size and volume are enlarged. It is applied especially to the left ventricle of heart. Sarcomeres are added in series, as for example in dilated cardiomyopathy (in contrast to hypertrophic cardiomyopathy, a type of concentric hypertrophy, where sarcomeres are added in parallel).

3.1.3 Dystrophy

Dysplasia is a term used in pathology to refer to an abnormality of development or an epithelial anomaly of growth and differentiation (epithelial dysplasia). The terms hip dysplasia, fibrous dysplasia, and renal dysplasia refer to an abnormal development, at macroscopic or microscopic level. Myelodysplastic syndromes, or dysplasia of blood-forming cells, show increased numbers of immature cells in the bone marrow, and a decrease in mature, functional cells in the blood.

3.1.4 Dystrophy and Malnutrition

Dystrophy is the degeneration of tissue, due to disease or malnutrition, most likely due to heredity. Malnutrition. If undernutrition occurs during pregnancy, or before two years of age, it may result in permanent problems with physical and mental development. Extreme undernourishment, known as starvation, may have symptoms that include: a short height, thin body, very poor energy levels, and swollen legs and abdomen.

3.1.5 Tumour

Tumours are groups of abnormal cells that form lumps or growths. They can start in any one of the trillions of cells in our bodies. Tumours grow and behave differently, depending on whether they are cancerous (malignant), non-cancerous (benign) or precancerous.

3.1.6 Aetiology

Cancer is a disease caused by genetic changes leading to uncontrolled cell growth and tumor formation. These factors act, at least partly, by

altering the function of genes within cells. Typically many such genetic changes are required before cancer develops.

3.2 Types of Tumors

Different types of malignant tumor are made up of specific types of cancer cells, including:

Carcinoma: These tumors are formed from epithelial cells. ...
Sarcoma: These tumors start in connective tissue, such as cartilage, bones, fat, and nerves.

3.2.1 Benign Tumors

Benign tumors are abnormal growths that are no longer under normal regulation. They grow slowly, resemble normal cells, and are not cancerous. They grow only in one place and cannot spread or invade other parts of the body. They can however become harmful if they press on vital organs. Examples of benign tumors include skin moles, lipomas, hepatic adenomas.

3.2.2 Malignant Tumors

These tumors are composed of embryonic, primitive, or poorly differentiated cells. They grow in a rapid, disorganized manner that is harmful to the body. They can also invade surrounding tissues and are become metastatic, initiating the growth of similar tumors in distant organs.

4.0 CONCLUSION

You have learnt about some growth disorders and their explanation.

5.0 SUMMARY

Hypertrophy is the increase in the volume of an organ or tissue due to the enlargement of its component cells. It is distinguished from hyperplasia, in which the cells remain approximately the same size but increase in number. Although hypertrophy and hyperplasia are two distinct processes, they frequently occur together, such as in the case of the hormonally-induced proliferation and enlargement of the cells of the uterus during pregnancy.

Eccentric hypertrophy is a type of hypertrophy where the walls and chamber of a hollow organ undergo growth in which the overall size and volume are enlarged. It is applied especially to the left ventricle of heart. Sarcomeres are added in series, as for example in dilated cardiomyopathy (in contrast to hypertrophic cardiomyopathy, a type of concentric hypertrophy, where sarcomeres are added in parallel).

6.0 TUTOR-MARKED ASSIGNMENT

1. Define growth disorders.
2. Differentiate between hyperplasia and hypertrophy.

7.0 REFERENCES/FURTHER READING

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UNIT 2 TYPES OF GROWTH DISORDER

CONTENTS

1.0 INTRODUCTION

Growth Hormone Deficiency (GHD) in childhood commonly has no identifiable cause (idiopathic), and adult-onset GHD is commonly due to pituitary tumours and their treatment or to cranial irradiation. A more complete list of causes includes:

- mutations of specific genes (e.g GH1)
- congenital diseases such as Prader-Willi syndrome, Turner syndrome, or short stature homeobox gene (SHOX) deficiency
- congenital malformations involving the pituitary (e.g., septo-optic dysplasia, posterior pituitary ectopia)
- chronic renal insufficiency
- intracranial tumors in or near the sella turcica, especially craniopharyngioma
- damage to the pituitary from radiation therapy to the head (e.g. for leukemia or brain tumors), from surgery, from trauma, or from intracranial disease (e.g. hydrocephalus)
- autoimmune inflammation (hypophysitis)
- ischemic or hemorrhagic infarction from low blood pressure (Sheehan syndrome) or hemorrhage pituitary apoplexy.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- know the types of growth disorder.

3.0 MAIN CONTENT

3.1 Types of Growth Disorder

There are a variety of rare diseases which resemble Growth Hormones deficiency, including the childhood growth failure, facial appearance, delayed bone age, and low IGF levels. However, Growth Hormones testing elicits normal or high levels of GH in the blood, demonstrating that the problem is not due to a deficiency of Growth Hormones but rather to a reduced sensitivity to its action. Insensitivity to Growth Hormones is traditionally termed Laron dwarfism, but over the last 15 years many different types of Growth Hormones resistance have been identified, primarily involving mutations of the Growth Hormones binding protein or receptors.

Types of growth disorders

- Childhood Growth Hormone Deficiency.
- Small for Gestational Age.
- Noonan Syndrome.
- Turner Syndrome.
- Adult Growth Hormone Deficiency.
- Prader-Willi Syndrome.
- Idiopathic Short Stature.

4.0 CONCLUSION

Growth Hormone Deficiency in childhood commonly has no identifiable cause (idiopathic), and adult-onset Growth Hormone Deficiency is commonly due to pituitary tumours and their treatment or to cranial irradiation.

5.0 SUMMARY

There are a variety of rare diseases which resemble Growth Hormones Deficiency, including the childhood growth failure, facial appearance, delayed bone age, and low IGF levels. However, Growth Hormones testing elicits normal or high levels of Growth Hormones in the blood, demonstrating that the problem is not due to a deficiency of Growth Hormones but rather to a reduced sensitivity to its action.

6.0 TUTOR-MARKED ASSIGNMENT

1. List five types of Growth Disorder.

7.0 REFERENCES/FURTHER READING

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UNIT 3 CLASSIFICATION OF GROWTH DISORDER

CONTENTS

1.0 INTRODUCTION

The incidence of idiopathic GHD in infants is about 1 in every 3800 live births, and rates in older children are rising as more children survive childhood cancers which are treated with radiotherapy, although exact rates are hard to obtain. The incidence of genuine adult-onset GHD, normally due to pituitary tumors, is estimated at 10 per million. Like many other 19th century medical terms which lost precise meaning as they gained wider currency, "midget" as a term for someone with severe proportional shortness acquired pejorative connotations and is no longer used in a medical context. Notable modern pop cultural figures with growth hormone deficiency include actor and comedian Andy Milonakis, who has the appearance and voice of an adolescent boy despite being in his early 40s. Argentine footballer Lionel Messi was diagnosed at age 10 with growth hormone deficiency and was subsequently treated.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- know the classification growth disorder.

3.0 MAIN CONTENT

3.1 Classification of Growth Disorder

Growth hormone deficiency can be congenital or acquired in childhood or adult life. It can be partial or complete. It is usually permanent, but sometimes transient. It may be an isolated deficiency or occur in association with deficiencies of other pituitary hormones. The

term hypopituitarism is often used interchangeably with GH deficiency but more often denotes GH deficiency plus deficiency of at least one other anterior pituitary hormone. When GH deficiency (usually with other anterior pituitary deficiencies) is associated with posterior pituitary hormone deficiency (usually diabetes insipidus), the condition is termed panhypopituitarism.

4.0 CONCLUSION

Notable modern pop cultural figures with growth hormone deficiency include actor and comedian Andy Milonakis, who has the appearance and voice of an adolescent boy despite being in his early 40s. Argentine footballer Lionel Messi was diagnosed at age 10 with growth hormone deficiency and was subsequently treated.

5.0 SUMMARY

Growth hormone deficiency can be congenital or acquired in childhood or adult life. It can be partial or complete. It is usually permanent, but sometimes transient. It may be an isolated deficiency or occur in association with deficiencies of other pituitary hormones.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the term hypopituitarism .

7.0 REFERENCES/FURTHER READING

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MODULE 5 SYSTEM PATHOLOGY

UNIT 1 SYSTEM PATHOLOGY

CONTENTS

1.0 INTRODUCTION

The rapid advances in high-throughput analytical technologies and the vertiginous growth in computational power greatly facilitate systems-level integration of empirical bottom-up data. The laws governing the dynamics of large assemblies of parts, for example those used in ecology, help us to understand the large quantities of heterogeneous data as a single interacting system, and make it possible to generate rules derived from the capacities present in the system. Using both top-down and bottom-up approaches to describe a system can yield a coherent picture of how behavior is generated and informed. Causality in pathobiology can be thought of as being generated by the complementary activity and interaction of bottom-up capacities with top-down laws. Studying frequencies of point mutations in cancer genes (bottom-up) and using metapopulation statistics to model and interpret the empirical data (top-down) sheds light on the process of tumor formation that can be further understood by agent based modeling techniques.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- what is system pathology?
- describe system pathology using up and down approaches.

3.0 MAIN CONTENT

3.1 Systems Pathology

Systems Pathology seeks to integrate all levels of functional and morphological information into a coherent model that enables the understanding of perturbed physiological systems and complex pathologies in their entirety. The rapid advances in high-throughput analytical technologies and the vertiginous growth in computational power greatly facilitate systems-level integration of empirical bottom-up data. The laws governing the dynamics of large assemblies of parts, for example those used in ecology, help us to understand the large quantities of heterogeneous data as a single interacting system, and make it possible to generate rules derived from the capacities present in the system. Using both top-down and bottom-up approaches to describe a system can yield a coherent picture of how behavior is generated and informed. Causality in pathobiology can be thought of as being generated by the complementary activity and interaction of bottom-up capacities with top-down laws. Studying frequencies of point mutations in cancer genes (bottom-up) and using metapopulation statistics to model and interpret the empirical data (top-down) sheds light on the process of tumor formation that can be further understood by agent based modeling techniques.

Having recognized that the study of the isolated parts deciphers the logic of chemistry but has difficulty in explaining the complex behavior seen in disease, a number of disciplines have combined their assets to consider how the integrated interactions govern the logic of life and disease. Concepts and techniques from cybernetics, engineering, statistical mechanics, theoretical and applied mathematics (e.g., graph theory and machine learning), and computer sciences have melded together to treat complexity and integrate and process diverse streams of massive information. Systems in organismal pathology are comprised of a large number of interacting parts that can give rise to a coordinated behavior in the absence of a high level controller. They constitute examples of complex adaptive systems characterized by the capacity to generate control and order that is not predetermined but that emerges from the nonlinear spatiotemporal interaction of subsystems operating

across levels of organization. This then produces a nested integration across subsystems and scales that is open to the input of the changes in the environment that surrounds the organism. It is this openness to the environment external to the system and the succession of adaptive changes to a varying environment, that explain why history is such an important constant in the study of disease and biology in general.

Pathology broadly defined consists of the study of the causes and effects of disease. As most of the biomedical sciences, it has developed as an observational science as well as an experimental discipline. Particularly in the domain of experimental pathology, the passage, some would say translation, from systems biology to systems pathology has been relatively easy and natural. As it has always been the case, disease has also served as a good model for physiology and much about normalcy has been learned from disturbed systems that constitute diseased states.

More and more evidence accumulates in the literature indicating that descriptive simple sets of high-throughput data do not provide the insights necessary for the deep understanding needed to inform effective medical intervention and prediction. For example, in many instances, gene expression analysis does not produce biomarkers that support robust decisions about the recovery of ventricular function after myocardial infarction. However in patients with myocardial infarctions, informative predictive patterns are found in the integrated biological activity levels of specific pathways, rather than in individual genes. It is the perturbations at the pathway level that are informative, and furthermore the pathways of interest are not always intuitively obvious. Signaling pathways implicated in antigen dependent B-cell activation and the synthesis of leucine provide differential prognostic patterns that perform an effective computational classification of patients, and it is the integration of the outcomes generated by different pathway based analysis models that improve the performance of the prediction of ventricular dysfunction after infarction. The value of molecular network based approaches and modeling is also demonstrated in studies showing how the interplay of inflammation proteins can support clinical decision making in patients with myocardial infarction.

Doing clinical investigation in human subjects at the systems level is already possible, is exciting, and possibly forecasts the way medicine will be practiced. At the same time, there is little doubt that a systems-level analysis of disease is best implemented and tested in experimental organismal models. Using animal models of disease, preclinical models, we learn much about how to measure the dynamics of the system and how to gain access to some specific, clinically relevant, aspects of complexity. For example, recent studies indicate that tumors are

composed of many diverse tumor-cell subclones , each tumor with an evolution that is likely to result from its unique population dynamics. The speculative scenario that individual patient outcomes may depend on the interactions among different subclones with the tumor stroma, with the immune system of the host and with the therapeutic interventions introduced by a team of physicians clearly calls for systems-level treatment of clinical oncology questions.

Modeling the natural history of a tumor and their response to different modalities of therapeutic intervention requires the generation of in vivo preclinical models with sufficient complexity to provide guidance on how to begin using systems-level investigation in the clinic. A recent review by Halder and Mills illustrates how the increasing sophistication of a "simple" model for cancer, Drosophila, advances clinically relevant knowledge. Advances in genetic engineering allow for efficient generation of complex genotypes in defined cell populations of the fly. Given that we now know the extent of genomic complexity in tumor cells, the ability to generate complex combinations of genetic alterations in a given cell lineage enables us to design a more faithful model of the complex genome of tumor cells. The gain in fidelity of the preclinical model can then be translated into a gain of effectiveness in the clinic following the iterative process depicted in Figure 1. Studies in organismal models can inform what data we collect, how we collect them, and together with modeling of disease states in silico, accelerate drug development, diagnosis, and detection of disease. Whether tumor modeling is ready for use in the clinic still remains an open question, but the time has come to begin to ponder it.

At the cellular level of organization, we are also gaining the capabilities to practice investigative systems pathology. At the single cell level the molecular processes governing cell function and fate span relatively large time scales. A response to calcium occurs within a few seconds, activation of the kinase pathway in about 15 min, NFkb in about 100 min, STAT signaling in 120 min, and transit through the cell cycle in about 18 h. Many cellular functions, such as transcriptional processes, exhibit oscillatory behavior. If these processes occur in a heterogeneous cell population and out of phase, and the techniques used to measure them do so in the entire population, what is measured is an average, and relying on an average behavior leads to an erroneous picture of the dynamics. Asynchronous behavior such as launching a transcription program can also be masked when measured across a population. Eventually, analytical and computational methods will integrate multi-parameter measurements and mathematical simulation in a way that allows a definition of the dynamic mechanisms that control many of the biological processes from measurements collected in single cells. In

some instances, the dynamics of gene expression in response to a signal can be best appreciated when in situ technologies are used to reveal patterns of nascent mRNA synthesis in the nucleus of the cells. In this way the temporal dynamics of the pattern of activation can be defined in the heterogeneous population. Techniques that can measure single cell dynamics are therefore of paramount interest and will contribute greatly to our understanding of the pathophysiology of disease.

The current biomedical literature clearly indicates that we are in a position to envision the integration of information stemming from molecular high-throughput studies (omics), cellular dynamic studies and organismal scale studies to characterize a specific disease at the systems level. This capacity for multi-scale modeling will hopefully lead to a more precise predictive and preventive medicine, although the issues in reducing the systems approach to medical practice remain daunting.

4.0 CONCLUSION

Students had learnt about system pathology and how to described System pathology using up and down approach.

5.0 SUMMARY

Doing clinical investigation in human subjects at the systems level is already possible, is exciting, and possibly forecasts the way medicine will be practiced. At the same time, there is little doubt that a systems-level analysis of disease is best implemented and tested in experimental organismal models. Using animal models of disease, preclinical models, we learn much about how to measure the dynamics of the system and how to gain access to some specific, clinically relevant, aspects of complexity. For example, recent studies indicate that tumors are composed of many diverse tumor-cell subclones , each tumor with an evolution that is likely to result from its unique population dynamics. The speculative scenario that individual patient outcomes may depend on the interactions among different subclones with the tumor stroma, with the immune system of the host and with the therapeutic interventions introduced by a team of physicians clearly calls for systems-level treatment of clinical oncology questions.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is system approach?
2. Explain system using up and down approaches.

7.0 REFERENCES/FURTHER READING

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UNIT 2 FEBRILE CONDITIONS (FEVER) AND CARDIOVASCULAR DISEASES

CONTENTS

1.0 INTRODUCTION

Fever, also known as pyrexia and febrile response, is defined as having a temperature above the normal range due to an increase in the body's temperature set point. There is not a single agreed-upon upper limit for normal temperature with sources using values between 37.5 and 38.3 °C (99.5 and 100.9 °F). The increase in set point triggers increased muscle contractions and causes a feeling of cold. This results in greater heat production and efforts to conserve heat. When the set point temperature returns to normal, a person feels hot, becomes flushed, and may begin to sweat.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- describe what is febrile condition is?
- state the categories of diseases of the heart.

3.0 MAIN CONTENT

3.1 Meaning of Febrile Condition

Rarely a fever may trigger a febrile seizure. ... A fever can be caused by many medical conditions ranging from non-serious to life-threatening. This includes viral, bacterial and parasitic infections such as the common cold, urinary tract infections, meningitis, malaria and appendicitis among others.

Fever, also known as pyrexia and febrile response, is defined as having a temperature above the normal range due to an increase in the body's temperature set point. There is not a single agreed-upon upper limit for normal temperature with sources using values between 37.5 and 38.3 °C (99.5 and 100.9 °F). The increase in set point triggers increased muscle contractions and causes a feeling of cold. This results in greater heat production and efforts to conserve heat. When the set point temperature returns to normal, a person feels hot, becomes flushed, and may begin to sweat. Rarely a fever may trigger a febrile seizure. This is more common in young children. Fevers do not typically go higher than 41 to 42 °C (105.8 to 107.6 °F).

A fever can be caused by many medical conditions ranging from non-serious to life-threatening. This includes viral, bacterial and parasitic infections such as the common cold, urinary tract infections, meningitis, malaria and appendicitis among others. Non-infectious causes include vasculitis, deep vein thrombosis, side effects of medication, and cancer among others. It differs from hyperthermia, in that hyperthermia is an increase in body temperature over the temperature set point, due to either too much heat production or not enough heat loss.

Treatment to reduce fever is generally not required. Treatment of associated pain and inflammation, however, may be useful and help a person rest. Medications such as ibuprofen or paracetamol (acetaminophen) may help with this as well as lower temperature. Measures such as putting a cool damp cloth on the forehead and having a slightly warm bath are not useful and may simply make a person more uncomfortable. Children younger than three months require medical attention, as might people with serious medical problems such as a compromised immune system or people with other symptoms. Hyperthermia does require treatment. Fever is one of the most common medical signs. It is part of about 30% of healthcare visits by children and occurs in up to 75% of adults who are seriously sick. While fever is a useful defense mechanism, treating fever does not appear to worsen outcomes. Fever is viewed with greater concern by parents and healthcare professionals than it usually deserves, a phenomenon known as fever phobia.

Disorders of blood cells

People may be affected by many different types of blood conditions and blood cancers. Common blood disorders include anemia, bleeding disorders such as hemophilia, blood clots, and blood cancers such as leukemia, lymphoma, and myeloma.

Body fluids (Oedema)
Fluid regularly leaks into body tissues from the blood. The lymphatic system is a network of tubes throughout the body that drains this fluid (called lymph) from tissues and empties it back into the bloodstream. Fluid retention (oedema) occurs when the fluid isn't removed from the tissues.

The two broad categories of fluid retention include generalised oedema, when swelling occurs throughout the body, and localised oedema, when particular parts of the body are affected.

The wide range of causes includes the body's reaction to hot weather, a high salt intake, and the hormones associated with the menstrual cycle. However, it's recommended that you see your doctor rather than self-treat, because oedema can be symptomatic of serious medical conditions such as heart, kidney or liver disease.

The heart and selected diseases of the respiratory system
Diseases and conditions of the respiratory system fall into two categories: viruses, such as influenza, bacterial pneumonia, enter virus respiratory virus; and chronic diseases, such as asthma and chronic obstructive pulmonary disease (COPD). Red blood cells collect the oxygen from the lungs and carry it to the parts of the body where it is needed, according to the American Lung Association. During the process, the red blood cells collect the carbon dioxide and transport it back to the lungs, where it leaves the body when we exhale.

The human body needs oxygen to sustain itself. A decrease in oxygen is known as hypoxia and a complete lack of oxygen is known as anoxia, according to the National Institutes of Health. These conditions can be fatal; after about four minutes without oxygen, brain cells begin dying, according to NYU Langone Medical Center, which can lead to brain damage and ultimately death. In humans, the average rate of breathing depends on age. A newborn's normal breathing rate is about 40 times each minute and may slow to 20 to 40 times per minute when the baby is sleeping, according to the Children's Hospital of Philadelphia.

For adults, the average resting respiratory rate for adults is 12 to 16 breaths per minute, according to Johns Hopkins Medicine. Physical exertion also has an effect on respiratory rate, and healthy adults can average 45 breaths per minute during strenuous exercise.

4.0 CONCLUSION

You have learnt about fever and the diseases of the heart.

5.0 SUMMARY

A fever can be caused by many medical conditions ranging from non-serious to life-threatening. This includes viral, bacterial and parasitic infections such as the common cold, urinary tract infections, meningitis, malaria and appendicitis among others. Non-infectious causes include vasculitis, deep vein thrombosis, side effects of medication, and cancer among others. It differs from hyperthermia, in that hyperthermia is an increase in body temperature over the temperature set point, due to either too much heat production or not enough heat loss.

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6.0 TUTOR-MARKED ASSIGNMENT

1. What is Fever?
2. List the categories of the heart diseases.

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UNIT 3 DISEASES OF THE RESPIRATORY SYSTEM

CONTENTS

1.0 INTRODUCTION

As we breathe, oxygen enters the nose or mouth and passes the sinuses, which are hollow spaces in the skull. Sinuses help regulate the temperature and humidity of the air we breathe. The trachea, also called the windpipe, filters the air that is inhaled, according to the American Lung Association. It branches into the bronchi, which are two tubes that carry air into each lung. (Each one is called a bronchus.) The bronchial tubes are lined with tiny hairs called cilia. Cilia move back and forth, carrying mucus up and out. Mucus, a sticky fluid, collects dust, germs and other matter that has invaded the lungs. We expel mucus when we sneeze, cough, spit or swallow.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state the diseases of the respiratory system?
- state the parts of the respiratory system.

3.0 MAIN CONTENT

3.1 Diseases of the Respiratory System

Diseases and conditions of the respiratory system fall into two categories: viruses, such as influenza, bacterial pneumonia, enterovirus respiratory virus; and chronic diseases, such as asthma and chronic obstructive pulmonary disease (COPD). According to Dr. Neal Chaisson, who practices pulmonary medicine at the Cleveland Clinic,

there is not much that can be done for viral infections but to let them run their course. "Antibiotics are not effective in treating viruses and the best thing to do is just rest," he said.

3.1.1 Asthma

Asthma is a chronic inflammation of the lung airways that causes coughing, wheezing, chest tightness or shortness of breath, according to Tonya Winders, president of the Allergy & Asthma Network. These signs and symptoms may be worse when a person is exposed to their triggers, which can include air pollution, tobacco smoke, factory fumes, cleaning solvents, infections, pollens, foods, cold air, exercise, chemicals and medications.

3.1.2 Lung Cancer

Lung cancer is often associated with smoking, but the disease can affect non-smokers as well. Every year, about 16,000 to 24,000 Americans die of lung cancer, even though they have never smoked. In 2018, the American Cancer Society estimates there will be about 234,030 new cases of lung cancer (121,680 in men and 112,350 in women) and around 154,050 deaths from lung cancer (83,550 in men and 70,500 in women).

3.2 Parts of the Respiratory System

As we breathe, oxygen enters the nose or mouth and passes the sinuses, which are hollow spaces in the skull. Sinuses help regulate the temperature and humidity of the air we breathe. The trachea, also called the windpipe, filters the air that is inhaled, according to the American Lung Association. It branches into the bronchi, which are two tubes that carry air into each lung. (Each one is called a bronchus.) The bronchial tubes are lined with tiny hairs called cilia. Cilia move back and forth, carrying mucus up and out. Mucus, a sticky fluid, collects dust, germs and other matter that has invaded the lungs. We expel mucus when we sneeze, cough, spit or swallow.

The bronchial tubes lead to the lobes of the lungs. The right lung has three lobes; the left lung has two, according to the American Lung Association. The left lung is smaller to allow room for the heart, according to York University. Lobes are filled with small, spongy sacs called alveoli, and this is where the exchange of oxygen and carbon dioxide occurs. The alveolar walls are extremely thin (about 0.2 micrometers). These walls are composed of a single layer of tissues

called epithelial cells and tiny blood vessels called pulmonary capillaries.

Blood passes through the capillaries. The pulmonary artery carries blood containing carbon dioxide to the air sacs, where the gas moves from the blood to the air. Oxygenated blood goes to the heart through the pulmonary vein, and the heart pumps it throughout the body.

The diaphragm, a dome-shaped muscle at the bottom of the lungs, controls breathing and separates the chest cavity from the abdominal cavity, the American Lung Association noted. When a breath it taken, it flattens out and pulls forward, making more space for the lungs. During exhalation, the diaphragm expands and forces air out.

3.3 Gastro-Intestinal Tract, Bones and Joints

Intestinal problems, such as polyps and cancer, infections, celiac disease, Crohn disease, ulcerative colitis, diverticulitis, malabsorption, short bowel syndrome, and intestinal ischemia. Gastroesophageal reflux disease (GERD), peptic ulcer disease, and hiatal hernia.

Diseases of bones and joints
Bone and joint disease. Treatments for osteoporosis and inflammatory diseases such as rheumatoid arthritis, ankylosing spondylitis, Sjogren's syndrome and lupus are all being developed using animal experiments.

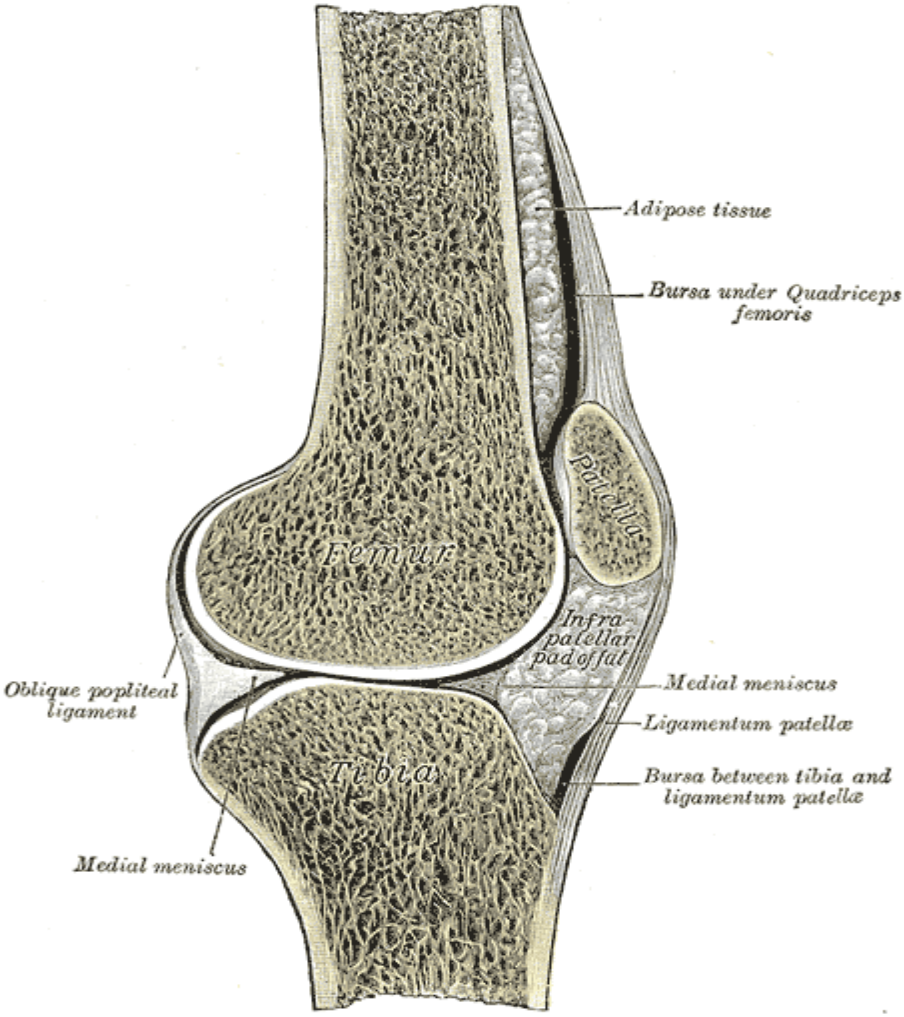

Fig.1. Bone from gray's anatomy
Source: Whiting and Stuart (2006)

Treatments for osteoporosis and inflammatory diseases such as rheumatoid arthritis, ankylosing spondylitis, Sjogren's syndrome and lupus are all being developed using animal experiments. These diseases and their complications affect millions of people.

Osteoporosis and related conditions
Osteoporosis is a common condition of elderly men and women. It is caused by lack of load-bearing exercise, ageing, and oestrogen deficiency. As oestrogen is manufactured in fat, it affects thin people more. Bones become thin, as there is a shortage of the organic scaffolding that holds calcium. Women patients can be treated with oestrogens, and both sexes are advised to take load-bearing exercise such as walking and running, but this is often not feasible and sufferers have to cope with spinal deformity (the dowager's hump), increased risk of fractures, and pain.

Animal testing on sheep showed that 20 minutes a day of mild vibration to their back legs for a year was harmless and significantly increased their bone density, and this finding could be used to improve the bone structure of osteoporotic patients. animal experiments have identified a gene, Alox15, which produces an enzyme affecting skeletal development in mice. It seems to stimulate a pathway that favours more fat deposition but less bone formation, and an experimental drug that blocks the pathway reduces bone loss.

Amylin, a hormone made by the same pancreatic B-cells that produce insulin, prevents bone loss, and explains why people with early-onset diabetes are susceptible to osteoporosis, a finding that has therapeutic implications. Amylin-deficient mice have lowered bone weight. In 2003 it was suggested that there is an immunological component to osteoporosis, at least in mice. Oestrogen-related bone loss is associated with too many T-cells in the blood, and this is associated with oestrogen deficiency. T-cells produce tumour necrosis factor, which increase the number of osteoclasts, cells that break down bone (bone undergoes a constant cycle of formation and breakdown, but until recently no-one knew how this was regulated). In turn, T-cell regulation is kicked off by an immune system protein called interferon gamma4.

Rickets

Hypophosphataemia is an inherited form of rickets found in boys. It is caused by excessive phosphate excretion by the kidney, and a similar disease occurs in mice. Researchers have found that indomethacin, a widely-used anti-inflammatory painkiller, prevents this phosphate loss, and the drug is already being tested in children with the disease.

Osteoarthritis

Osteoarthritis is a common condition in older people and is the most common reason for hip and knee replacement. It also causes painful swelling of the fingers. It has a genetic component and is more common in women. The earliest indication of the disease is a gradual loss of large molecules called proteoglycans from the surface of the joint cartilage resulting in a decrease in the mechanical strength of cartilage. At the same time, other cells proliferate and form clusters. Then cracks in the cartilage gradually develop and the cracks are filled with fibrous tissue, probably as a result of unsuccessful attempts by the cartilage cells to repair the cracks. Finally, bony structures, called osteophytes, are formed at the periphery of the joint. The end result is loss of joint function.

Using naturally occurring mutant mice with a defective collagen gene, animal experiments have identified a signalling molecule involved in osteoarthritis.

Although the causes of osteoarthritis are diverse, mutations in two types of collagens, type IX and XI, are linked to early-onset osteoarthritis. Mice with a mutation in type XI collagen have age-related osteoarthritis and scientists found that these mice had increased amounts of the protein called DDR2 in their knee joint cartilage. Inhibitors of DDR2 signalling may be useful as arthritis drugs. In March 2005, two research groups showed that shutting down a single gene can prevent cartilage destruction in a genetically modified mouse with osteoarthritis. During the human disease, the cartilage in the joints gradually breaks down and a key component of cartilage called aggrecan, which helps the tissue bear load and resist compression, is chewed up by enzymes of the ADAMTS or aggrecanase family. Mice that lack a part of one such enzyme, ADAMTS5 (aggrecanase-2), are largely protected from cartilage destruction. The studies are the first to show that mutations in a single gene can halt cartilage degradation, and suggest that drugs designed to inhibit the human form of ADAMTS5 might help fight osteoarthritis.

4.0 CONCLUSION

You have learnt about the diseases of the respiratory systems and the parts of respiratory systems.

5.0 SUMMARY

Osteoporosis is a common condition of elderly men and women. It is caused by lack of load-bearing exercise, ageing, and oestrogen deficiency. As oestrogen is manufactured in fat, it affects thin people more. Bones become thin, as there is a shortage of the organic scaffolding that holds calcium. Women patients can be treated with oestrogens, and both sexes are advised to take load-bearing exercise such as walking and running, but this is often not feasible and sufferers have to cope with spinal deformity (the dowager's hump), increased risk of fractures, and pain.

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fat deposition but less bone formation, and an experimental drug that blocks the pathway reduces bone loss.

6.0 TUTOR-MARKED ASSIGNMENT

1. List the diseases of the respiratory system.
2. List the parts of the respiratory system.

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UNIT 4 INFLAMMATORY JOINT DISEASE

CONTENTS

1.0 INTRODUCTION

As we breathe, oxygen enters the nose or mouth and passes the sinuses, which are hollow spaces in the skull. Sinuses help regulate the temperature and humidity of the air we breathe. The trachea, also called the windpipe, filters the air that is inhaled, according to the American Lung Association. It branches into the bronchi, which are two tubes that carry air into each lung. (Each one is called a bronchus.) The bronchial tubes are lined with tiny hairs called cilia. Cilia move back and forth, carrying mucus up and out. Mucus, a sticky fluid, collects dust, germs and other matter that has invaded the lungs. We expel mucus when we sneeze, cough, spit or swallow.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state the diseases of inflammatory joint disease
- state the diseases of the kidney.

3.0 MAIN CONTENT

3.1 Inflammatory Joint Disease

The inflammatory joint diseases include rheumatoid arthritis, ankylosing spondylitis, Sjogren's syndrome, and lupus. There are some features and treatments that are common to all of these conditions. With the exception of ankylosing spondylitis, women are more often affected than men. Skin and other organs are often affected, and the conditions

are now understood as being caused by autoimmunity – that is, the body attacking itself. All of these conditions have a genetic component.

Modifying the immune response
Both types of immune cells, called B-cells and T-cells, take part in the attack on oneself that forms the autoimmune response. As these are also essential for fighting off infection, it is hard to damp them down without doing harm. In 2001 scientists found a molecule that does that in mice, and which works on both types of immune cell. Another promising line of research comes from understanding and modifying T-cells, the white blood immune cells that attack joints inappropriately. This can be prevented in mice by blocking the cells' response to low oxygen levels by inactivating a protein called HIF-1, a finding that could lead to the development of new treatment. Another approach consists of making a 'magic bullet' that carries a toxic drug, doxorubicin, and targets only those T-cells that attack the joints.

Research on mice explains why the severity of inflammation varies between individuals. Different types of a protein called RAGE (receptor for advanced glycation end-products) exist in joints, and RAGE binds to other proteins called S100/calgranulins. Inflammation can be greatly decreased by preventing this binding. RAGE may also be associated with other autoimmune genes.

Protection and prevention
A natural constituent of cannabis, cannabidiol, which has no effect on mood or consciousness, may be useful for treating inflammatory joint disease; scientists have found that it protects mice from severe joint damage by suppressing key parts of their immune response.

3.1.1 Rheumatoid Arthritis

One line of research comes from studying the joints of patients with rheumatoid arthritis (RA), which have excessive amounts of an enzyme called synoviolin. When mice were genetically engineered to overproduce this enzyme they got the disease, and when they were engineered to under produce it, they were protected from RA. Overproduction also impaired a process called apoptosis, whereby damaged or unwanted cells self-destruct. A study in rats found that a drug, M40403, mimicking superoxide dismutase (SOD), a naturally occurring compound in the body, halved the damaged to joints and reduced the amount of inflammation by over 70%.

Injection of an antibody called anti-CD40 controls progression of the disease in mice with RA, and reduced pain and swelling. The antibody

normally boosts the immune system, so the discovery is puzzling. Another gene that makes interleukin-13, when injected into mouse joints, reduced inflammation in RA mice and prevented it in normal mice. About 1 in 40 RA patients has a mutation in a gene called ZAP-70. Mice with this mutation have a type of T-cell that is normally lost during development, and suffer from RA, so studying them might help some patients.

One of the more important discoveries in recent years is the finding, in 2001, that injections of a hormone called vasoactive intestinal peptide or VIP prevented joint swelling and destruction in mice, and the benefit stayed for some time after stopping injections. This treatment is now being studied in human RA patients. The most effective therapy in mice, to date, is the discovery in 2004 of an experimental agent that blocks the CD139 protein on the surface of T-cells and thereby decreases the production of destructive antibodies that damage the joint. Clinical trials are awaited with interest.

3.1.2 Ankylosing Spondylitis

Ankylosing spondylitis is an inflammatory disease of the tendons that link the vertebrae together. These gradually become ossified and the spine collapses, causing deformity. Patients often suffer additional arthritis in their arms and legs, and have disease in other organ systems. The disease is strongly genetic, but often triggered by infections. Mice with a defective copy of a gene called ank have a similar disease and it has now been discovered that this defective gene causes a shortage of a chemical, pyrophosphate in the joints. Humans have a similar gene, and the finding may lead to new approaches to treatment.

3.1.3 Lupus

Lupus affects skin, joint, blood vessels and other organs and tissues. It has a genetic component, is often triggered by viruses, and can be life threatening. A similar disease occurs in a strain of mice, and recently – from 2003 onwards – this has generated results that have greatly increased the understanding of human disease. There is a strain of mice with lupus, and these have been shown to lack an enzyme called Dnase1, which removes rubbish from cells. Removal of an immune-system signalling protein, SLAM-associated protein, or SAP, also causes lupus. In 2001 a lupus-causing gene was identified in mice. It causes a fault in an enzyme called alpha-mannosidase II. Scientists now need to know more about how these substances interact.

Scientists have used gene therapy to prevent the development of lupus in mice by boosting levels of an immune system component. A receptor gene known as Fc acts like a gatekeeper, helping to maintain a healthy immune system instead of one that turns on itself, as is the case in autoimmune diseases. In mice and in humans with lupus, production of the Fc receptor is reduced. Gene therapy reversed this and prevented the disease in a lupus-susceptible strain of mice, but not in untreated mice. The scientists expect their finding to apply to humans, since there seemed to be no serious adverse effects from the therapy in mice.

A protein molecule that interferes with the site where antibodies act reduces the mortality in mice with genetic lupus from 80% down to 10%, and virtually eliminates kidney damage, and a tranquilliser-like drug, Bz-423, reduces the incidence of renal complications by 85%, as does an anti-cancer drug, SAHA. Lupus patients often have neuropsychiatric problems, and their memory is sometimes affected. Mice with lupus have shown why this might be: the immune system sends defensive antibodies into the brain and selectively kills memory cells. This effect can be blocked by the drug memantine, which is used for Alzheimer's.

3.2 Diseases of Skin

Eczema Eczema is term for a group of medical conditions that cause the skin to become inflamed or irritated. Psoriasis Psoriasis is a common skin disorder that produces thick red plaques covered with silvery scales. Acne although acne remains largely a curse of adolescence, about 20% of all cases occur in adults. Endocrine glands with adrenal gland disorders, your glands make too much or not enough hormones. In Cushing's syndrome, there's too much cortisol, while with Addison's disease, there is too little.

3.3 Diseases of kidney

The kidneys are two bean-shaped organs. Each kidney is about the size of a fist. Your kidneys filter extra water and wastes out of your blood and make urine. Kidney disease means your kidneys are damaged and can't filter blood the way they should. You are at greater risk for kidney disease if you have diabetes or high blood pressure. If you experience kidney failure, treatments include kidney transplant or dialysis. Other kidney problems include acute kidney injury, kidney cysts, kidney stones, Oedema,Nephritis and other kidney infections.

3.3.1 Hepatitis C and Kidney Disease

Hepatitis C (hep C) is a viral disease that affects the liver. The liver is an organ in the human body that converts everything you eat or drink into nutrients and gets rid of toxins. There is a connection between hepatitis C and kidney disease. Hep C can cause kidney disease, and sometimes kidney patients can get hep C from hemodialysis, a treatment for kidney failure, if a medical facility does not carefully follow guidelines for infection control.

3.3.2 Kidney Infection

Kidney infections are usually caused by bacteria that spread to your kidneys from another part of your urinary tract. Common symptoms of kidney infections include fever, vomiting or pain in your back, sides or groin. Women are more likely to have kidney infections than men because of the way women's bodies are built. Treating kidney infections right away can help prevent permanent kidney damage.

3.3.3 Kidney Stones

Kidney stones are one of the most common kidney problems. They are usually caused by a buildup of certain minerals that clump together inside your kidneys. Large kidney stones cause pain when they move through your urinary tract. You may not feel anything if you have a small kidney stone that moves easily through your urinary tract. When a kidney stone moves through your urinary tract and out of your body with your urine, it is called passing a kidney stone.

3.3.4 Nephritis

Nephritis is often caused by infections, and toxins, but is most commonly caused by autoimmune disorders that affect the major organs like kidneys. Pyelonephritis is inflammation that results from a urinary tract infection that reaches the renal pelvis of the kidney.

3.3.5 Oedema

Oedema associated with kidney disease usually occurs in your legs and around your eyes.

Kidney damage: Damage to the tiny, filtering blood vessels in your kidneys can result in nephrotic syndrome. In nephrotic syndrome, declining levels of protein (albumin) in your blood can lead to fluid accumulation and Oedema.

Liver

Diseases caused by viruses, such as hepatitis A, hepatitis B, and hepatitis C. Diseases caused by drugs, poisons, or too much alcohol. Examples include fatty liver disease,cirrhosis and Liver cancer.

3.4 Central Nervous System

Central nervous system diseases, also known as central nervous system disorders, are a group of neurological disorders that affect the structure or function of the brain or spinal cord, which collectively form the central nervous system (CNS).

3.4.1 Trauma

Any type of traumatic brain injury (TBI) or injury done to the spinal cord can result in a wide spectrum of disabilities in a person. Depending on the section of the brain or spinal cord that suffers the trauma, the outcome may be anticipated.

3.4.2 Infections

Infectious diseases are transmitted in several ways. Some of these infections may affect the brain or spinal cord directly. Generally, an infection is a disease that is caused by the invasion of a microorganism or virus.

3.4.3 Degeneration

Degenerative spinal disorders involve a loss of function in the spine. Pressure on the spinal cord and nerves may be associated with herniation or disc displacement. Brain degeneration also causes central nervous system diseases. Studies have shown that obese people may have severe degeneration in the brain due to loss of tissue affecting cognition.

3.4.4 Structural Defects

Common structural defects include birth defects, anencephaly, hypospadias, and spina bifida. Children born with structural defects may have malformed limbs, heart problems, and facial abnormalities. Defects in the formation of the cerebral cortex include microgyria, polymicrogyria, bilateral frontoparietal polymicrogyria, and pachygyria.

Movement-Disorder
A tumor is an abnormal growth of body tissue. In the beginning, tumors can be noncancerous, but if they become malignant, they are cancerous.

In general, they appear when there is a problem with cellular division. Problems with the body's immune system can lead to tumors.

Autoimmune disorders
An autoimmune disorder is a condition where in the immune system attacks and destroys healthy body tissue. This is caused by a loss of tolerance to proteins in the body, resulting in immune cells recognising these as 'foreign' and directing an immune response against them.

Stroke
A stroke is an interruption of the blood supply to the brain. Approximately every 40 seconds, someone in the US has a stroke. This can happen when a blood vessel is blocked by a blood clot or when a blood vessel ruptures, causing blood to leak to the brain. If the brain cannot get enough oxygen and blood, brain cells can die, leading to permanent damage.

Diagnostic and forensic pathology
Diagnostic Pathology is a clinical pathology, immunology, and biology, with a special focus on cutting-edge approaches in diagnostic pathology and tissue-based therapy.

Forensic pathology
Forensic pathology is the main field of forensic medicine which involves all matters diagnosed at autopsy such as the cause of death, determination of time of death, estimation of degree/properties of injuries, personal identification of an unidentified body, and so on.
Forensic pathology is pathology that focuses on determining the cause of death by examining a corpse. A post mortem is performed by a medical examiner, usually during the investigation of criminal law cases and civil law cases in some jurisdictions. Coroners and medical examiners are also frequently asked to confirm the identity of a corpse.

4.0 CONCLUSION

Students had learnt about the diseases of the inflammatory systems and the diseases of the kidney.

5.0 SUMMARY

Scientists have used gene therapy to prevent the development of lupus in mice by boosting levels of an immune system component. A receptor gene known as Fc acts like a gatekeeper, helping to maintain a healthy immune system instead of one that turns on itself, as is the case in

autoimmune diseases. In mice and in humans with lupus, production of the Fc receptor is reduced. Gene therapy reversed this and prevented the disease in a lupus-susceptible strain of mice, but not in untreated mice. The scientists expect their finding to apply to humans, since there seemed to be no serious adverse effects from the therapy in mice.

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6.0 TUTOR-MARKED ASSIGNMENT

1. What is inflammatory joint disease.
2. List four diseases of the kidney.

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