MED437
KING SAUD UNIVERSITY

PATHOLOGY
TEAM 437

Pathology

teamwork 437

Lecture one (1) : Introduction to Pathology.

Color Index :-

- VERY IMPORTANT
- Extra explanation
- Examples
- <u>Diseases names : Underlined</u>

Definitions

تمت المراجعة
غيداء آل مصمع
&
عبدالرحمن الجيسوني

*{قاتِل لحُلمِك، فما قيمة الحُلم إن كانَ سهلاً مُيسراً...}

OBJECTIVES:

- **Understand the role of pathology and its various subspecialties in the diagnostic process.**
- **Understand the meaning of the terminology used during the study of disease like etiology, pathogenesis, prognosis, sequelae, symptoms, signs, etc.**
- **Be aware of some of the principle techniques used in pathology like light microscopy, cytology, immunohistochemistry, and molecular pathology.**
- **Have a basic knowledge of the definition of autopsy and its indications.**
- **Role of diagnostic pathology in disease management**

WHAT IS PATHOLOGY ?

- **Pathology:** (pathos: disease), (-ology: study). It is the study of changes which occur in cells and tissues as a result of any injury to the cell or tissue.
  - (is the study of diseases processes).
  - Pathology links basic sciences and clinical sciences

  Etymology is the origin or root of the word. Many medical terminologies are derived from smaller words called origins. For example: phagocytosis could be divided to the following origins: phago: means to devour (eat) , cyto: means cell, sis: means the process of. Together they give the meaning which is the process of eating cells.

Disease: is an abnormality in structure or function of any part of the body , It can be an obvious abnormality OR it can be hidden and not expressed physiologically. Is mental or imaginary problem.

Anatomical Dysfunction has 2 types:

- **Physiological Dysfunction:** is an Organic disease. (e.g. Brain Tumor). (مرض عضوي)
- **Psychological Dysfunction**: Is mental or imaginary problem.

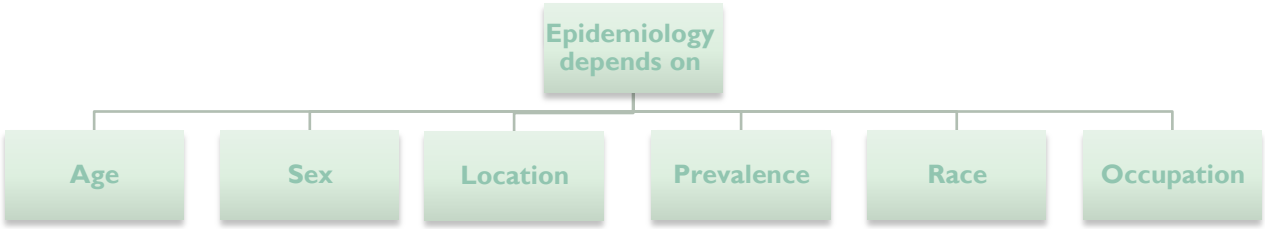
when you examine the patient and you find nothing wrong with his body, but when you talk to him he says:

"يادكتور انا حاس العالم كلها تتآمر علي, وبالليل اطلع اسبح مع الجن و أطير مع الملائكة"

*__Anorexia nervousa:__ a psychiatric illness in which patients starve them selves or use other techniques, such as vomiting or taking laxatives to induce weight loss.

*We must consider psychological and physiological status when examining a patient.

Epidemiology (علم الأوبئة) **:** The branch of medicine which deals with the incidence, distribution, and possible control of diseases and other factors relating to health. Epidemiology LITERALLY means "the study about the people.



A. Sex (gender) . a physician should think of the most common diseases first and rule them out before considering rare diseases

.**1-**Example: If a female has a difficulty in urination, we don't say that she has an enlargement in the prostate (only in male)

2-example: when a female comes with a blood clotting problem, **haemophilia** shouldn't be the first thing to come up as a diagnosis because it is very rare in females.

B. Age : Always ask the age to exclude the non suitable diagnosis.

Example : When a young man is having frequent urination we shouldn't think of prostate cancer directly as it usually affects older men.

C. Race : Asian , African .. Etc.

D. Geographic distribution: (part of epidemiology)

-underdeveloped countries has more malnutrition and infections.

-developed countries have more cardiac problems, obesity related diseases etc.

-Example: It's unlikely that a patient from Sweden gets TB (**tuberculosis**), but more likely someone in central Asia was affected. لأن المرض هذا منتشر في أسيا أكثر

-Example: patient from Bangladesh with fever said: "I have a fever that comes and goes for two months". We should consider that he has **tuberculosis**. 80% of the case you could be right, because this disease is prevalent in Bangladesh.

F-Occupation:

- workers in asbestos industry can have diseases like asbestosis or tumors like mesotheliomas.
- workers in aniline dye industry can have urinary bladder cancer,
- hardwood workers can have nasal cancer from inhalation of wood dust etc..

- **Socioeconomic strata** : The social and financial status of the people affect by a particular disease

  Example : rich people are more suspected to have obesity unlike poor people

- . **Sequalae** : is the complication or the consequence of a disease.We will talk about it in more details
- **Prognosis** التنبؤ : is the expected outcome of the disease based on severity of any disease
- Example : people who have lung cancer have 0% survival rate and this is going to be told by the doctor after reaching his diagnosis.

- **Morbidity** : a measurement of sickness or disease within a geographical location.

- **Mortality rate** معدل الوفيات : is a measure of the number of deaths cases in a particular population due to a particular period of time. Mortality rate can be calculated for any particular disease

  e.g. mortality rates are high for people with high grade cancers .

- **Incidence:** refers to the number of new cases during a specific period of time or in a certain location.

  e.g. increase in incidence of **influenza** during pilgrimage (الحج).

- **Prevalence:** The total number of patients who have a disease at any time of the year at any location, not confined to a period.

  e.g. increase of prevalence of **hepatitis** c in Saudi Arabia.

Factors which affect incidence and prevalence:

- **Time**: how the disease has varied over the course of time.
- **Place**: how the disease varies geographically
- **Person**: the difference between a person who suffer from a disease and other who does not.

Extra explanation :

مهم جداً التفريق بين المصطلحين incidence VS prevalence :

على سبيل المثال, من المعروف أن مرض الملاريا منتشر بشكل واسع في افريقيا، وليس محصور بوقت معين (prevalence)، بينما في السعودية في بداية موسم الشتاء تنتشر الانفلونزا, بسبب التغير المفاجئ من حار جداً لشديد البرودة, وهنا حصرنا المرض بفترة معينه (incidence).

WHY DO WE USE/STUDY EPIDEMIOLOGY?

1- To investigate the extent of a disease in a community.
عشان نكون عارفين بمدى انتشار المرض في المجتمع

2-To study natural pattern/history and prognosis of disease.
نعرف انماط التشخيص وكيف نقدر نتنبأ بالمرض

3-To identify causes and risk factors.
عشان نعرف الاسباب وعوامل الخطورة في هذا المرض

4-To provide good health care based on the findings.
عشان نوفر العناية الصحية من المضاعفات اللي عرفناها عن هذا المرض

5- .To recommend and assist in various health programmes to prevent or treat disease (preventive and therapeutic measures), e.g. immunizations and screening programs for different disease etc..)
عشان نأخذ التدابير الوقائية و العلاجية مثل : التطعيمات والفحوصات لمرض معين مثل : سرطان الثدي.

6-To evaluate all health care facilities and programs. -

7-Provide information on public health in order to help the health care system and develop health policies.
عشان نقدم معلومات عن الصحة العامة إذا أحد سألنا ونساعد في نظام الرعاية الصحية ونطور السياسات الصحية

Etiology: Etiology means the cause of the disease, and the origin of a disease , including the underlying causes and modifying factors.

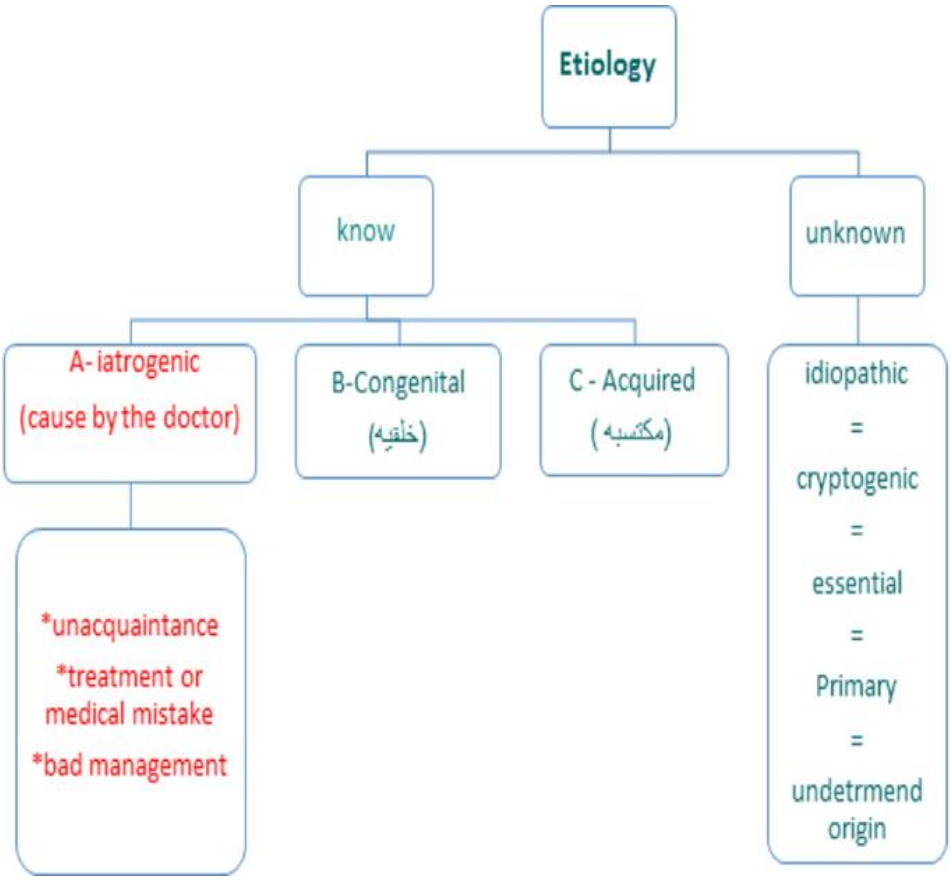
-For example **(bacterial, viral, degenerative, fungal, unknown cause etc.)**

If the **etiology is unknown** the disease is known as **[idiopathic= essential=primary = cryptogenic= Spontaneous diseases]**

- Disease may be **environmental** (or behavioral). (Diseases resulting from chemicals, smoking, getting run over by a bus…)
- Diseases may be **congenital**; the environment has no role in this disease. (Trisomy 21 or Down syndrome) we will talk about them in more details next slides ;)

*Note:
some diseases may results from an **environmental** factor in conjunction with a **genetic** predisposition (problem).

When looking at patients with vitiligo or albinism, there is no –or little- melanin stain in the skin. This isn't a problem by its self, but it makes the patient more susceptible to other diseases such as skin cancer



CLASSIFICATIONS OF DISEASES:

- Diseases are classified depending on the **etiology** and **pathogenic mechanism** involved. Disease can be **congenital** or **acquired**.

congenital

Inherited /Genetic /chromosomal : certain inherited diseases are characterized by an abnormality in the chromosomes .

Example : hemophilia (an X-chromosome linked disorder), Down syndrome(chromosomal abnormality with extra chromosome 21),

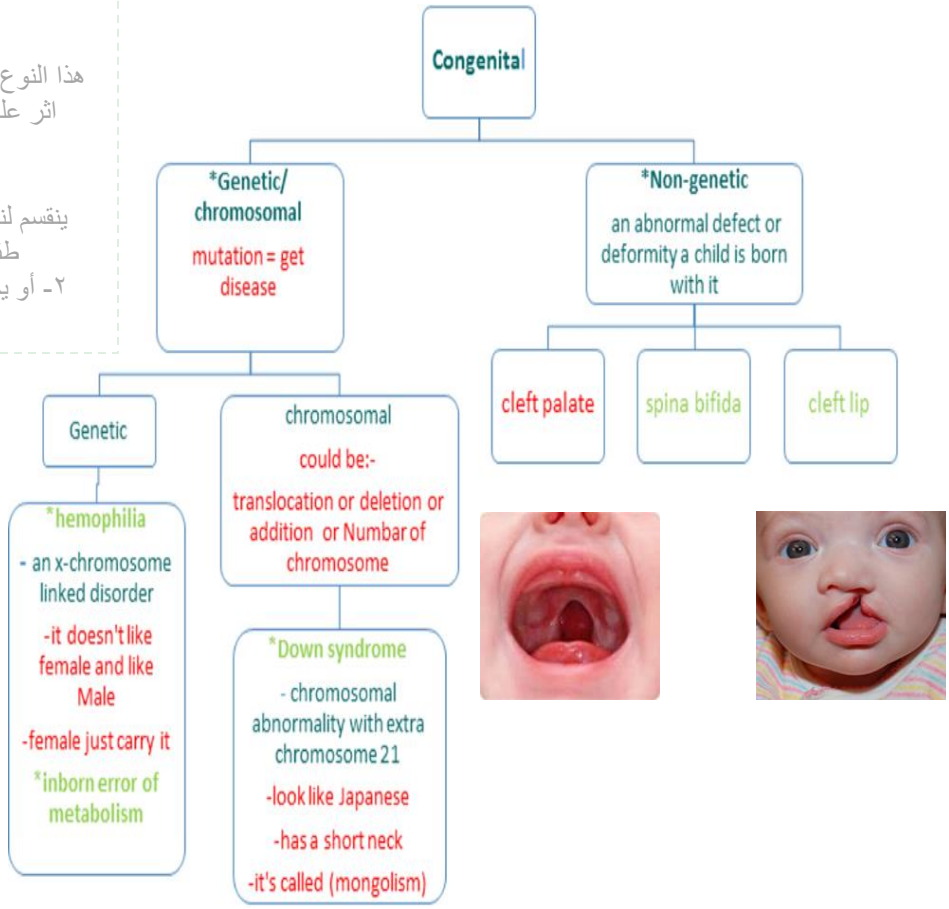
Non-inherited/ non-genetic : due to abnormality, which occurred in embryonic life, or deformity

Example : cleft lip or spina bifida

NOTE :

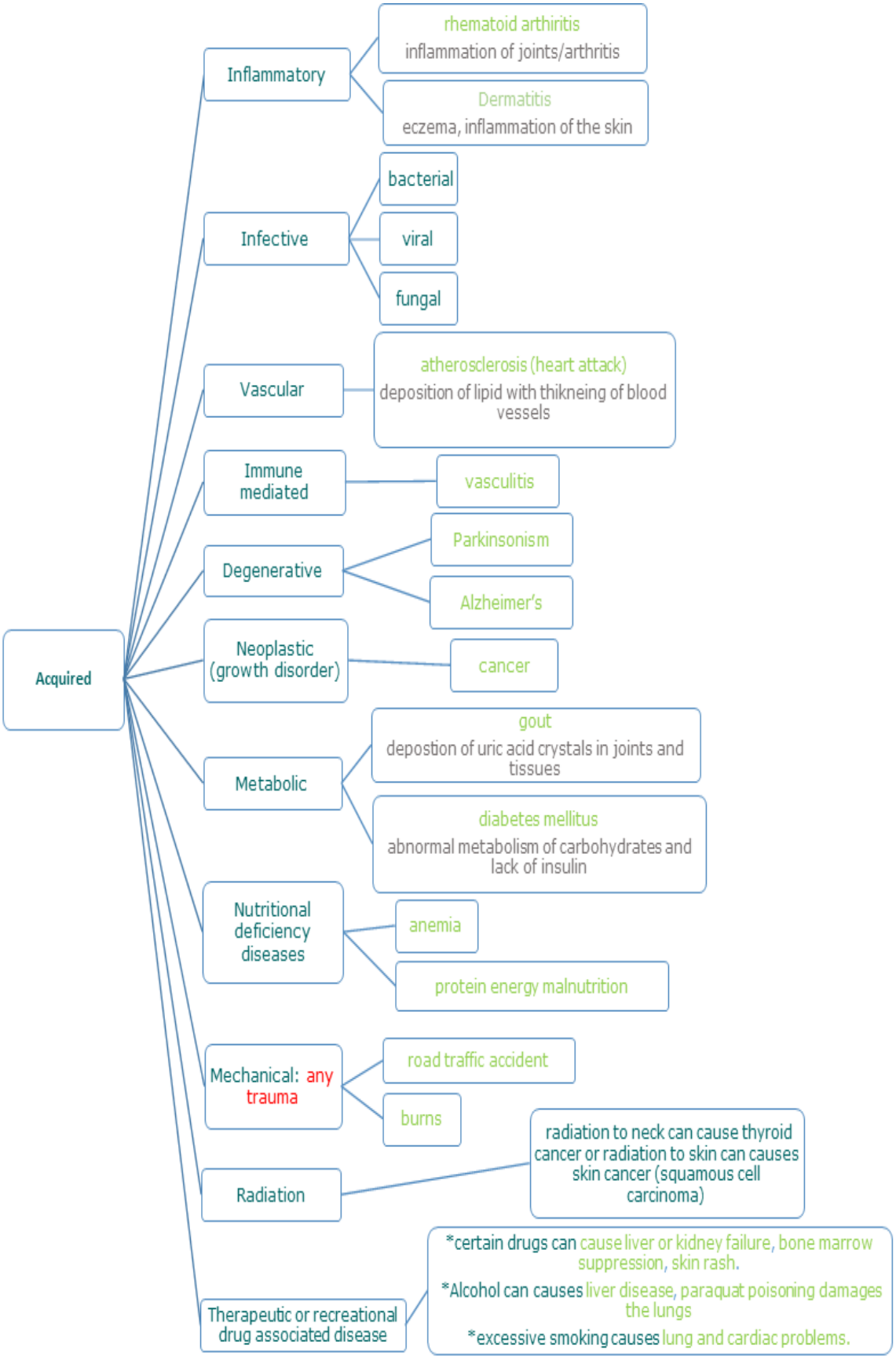
هذا النوع من الامراض، تكون الطبيعة مالها اثر عليه ولكن يكون عيب خلقي عادة منذ الولادة، او ممكن يظهر بعد الولادة

ينقسم لنوعين : ١- يكون عيب خلقي نتيجة طفرات بالكروموسومات أو بالجينات
٢- أو يكون عيب خلقي نتيجة تشوه الجنين في بطن الأم



Acquired: acquired from the environment.(مكتسب)

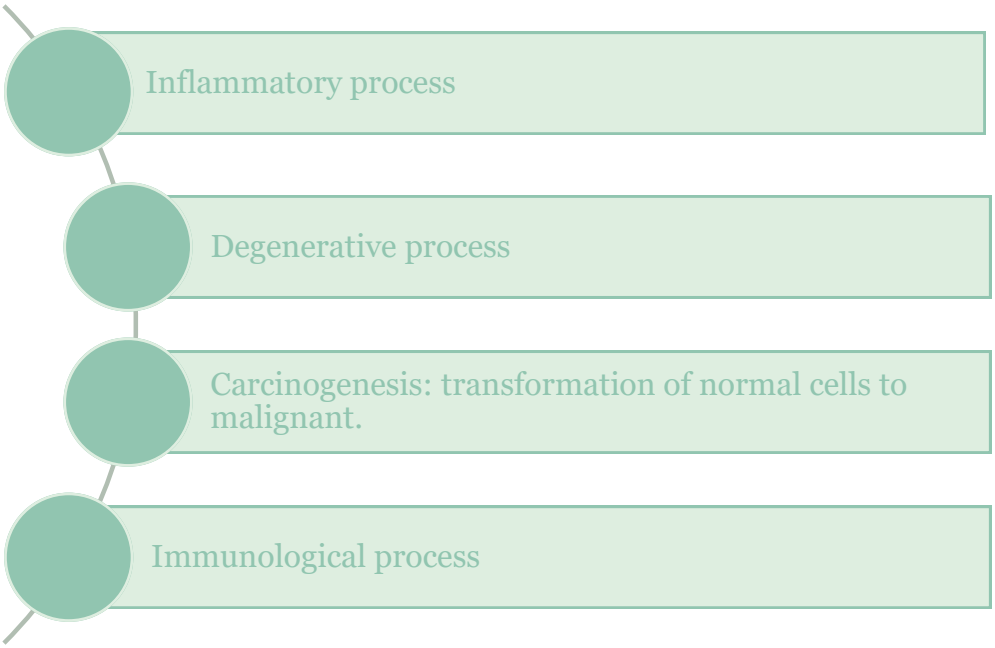
Types of acquired diseases :-



PATHOGENESIS:

- **Pathogenesis**: it is the steps that take place in the body once the problem begins (whatever it may be) that finally lead to **tissue injury** (pathological manifestations).

- The **four basic pathogenic mechanisms** (or steps that usually take place in diseases) are as follows:



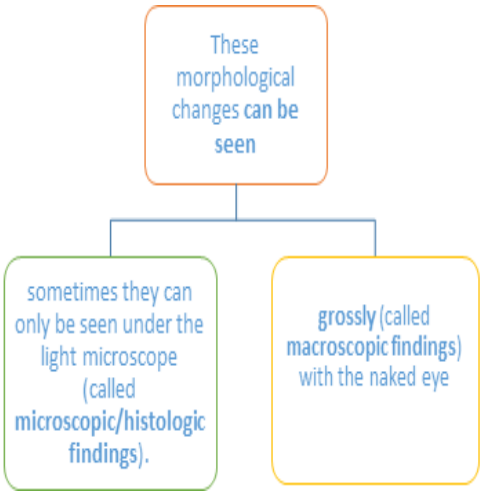
Example: lung cancer develops for years. Stages: Smoking -> irritation for the bronchial mucosa (lined with ciliated columnar epithelium) -> chronic inflammation -> (Metaplasia) Transformation of ciliated columnar to squamous -> (dysplasia) squamous transformed into pre-cancerous cells -> cancer -> death

-Pathogenesis leads to **morphologic changes** (changes in the gross or microscopic appearance of human tissue)

The morphologic changes : are he structural changes that take place in cells or tissues due to any disease .

macroscopic findings	• can be seen **grossly** • with the naked eye
microscopic/histologic findings).	• can only be seen under **the light microscope**

- Commonly diseases have certain specific gross or microscopic changes and **this helps in the diagnosis of that disease**
  - Example : Chicken Pox (جدري الماء) : Changes are happening inside the cell when you see the microscope .. But also in the same time you can see the changes in your own eyes.



Clinical Features :-

- When an organ is damaged by a disease, the normal function of that organ is affected and this will lead to the development certain clinical changes called **signs & symptoms.**

Symptoms: is something experienced and reported by the patient e.g. 'I am feeling tired', 'I have a headache', 'I have a pain in my stomach' etc. Basically it is what the patient will tell the doctor.

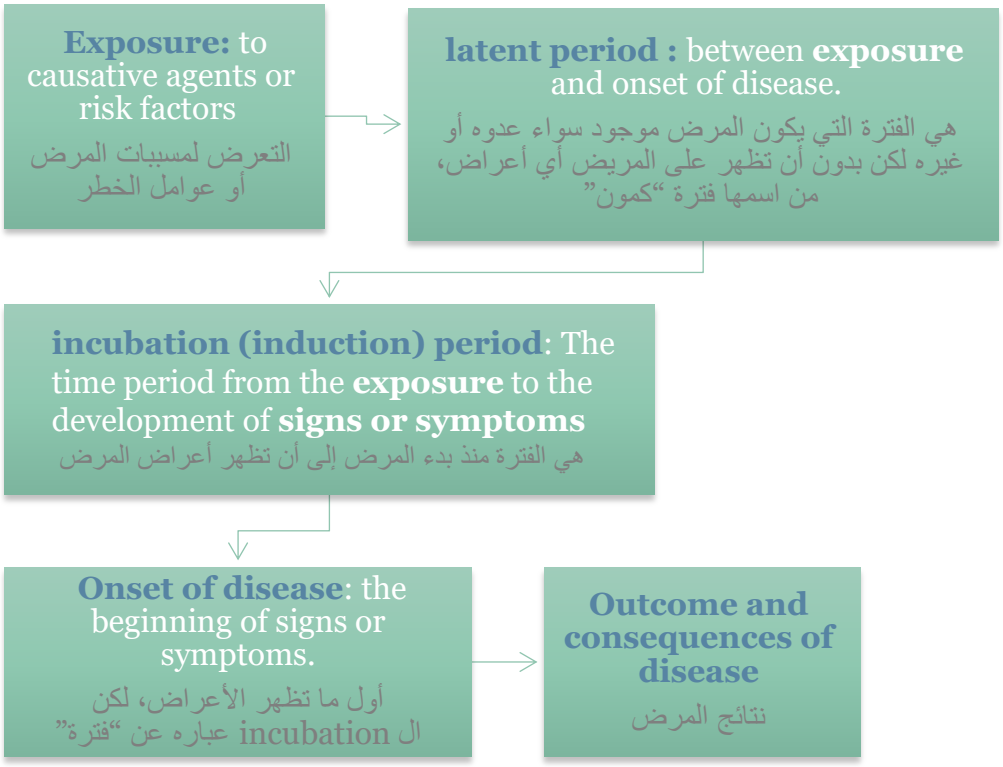
Signs: are findings discovered by the physician during examination of the patient e.g. doctor finds a swelling somewhere or doctor find a liver or spleen enlargement while examining the abdomen etc. Basically it is what the doctor will find on examining the

- The combination of **signs** and **symptoms** is called as **clinical features.**

COURSE OF DISEASE:

- The **course of a disease** is the **different stages** in the natural history or progression of a disease in the absence of any intervention.

- The different stages in the natural history or course of a disease especially **infectious** are as follows:



- **Outcome and consequences of disease**: Following clinical onset, disease may follow any of the following trends:

-Recovery/resolution of disease without complication or sequalae. Person is back to normal health. يعود المريض إلى حالته الطبيعية كما كان قبل المرض

-The disease recovery but with sequelae. يتعافى لكن بوجود أثار تُرى بالعين نتيجة المرض غالباً تظل لوقت الأبد، مثل : فقدان القدرة على المشي، الشلل، وجود أثار حريق، أثار إصابة. الخ..طويل أو إلى

-Development of complications: يتعافى ولكن بوجود مضاعفات للمرض نفسه مثل مضاعفات مرض السكر : فقدان البصر،اعتلال الدماغ السكري ، اعتلال الكلى السكري

-Death.

THE DIAGNOSTIC PROCESS AND THE ROLE OF PATHOLOGIST

Any patient going to a clinic meets clinician who will :

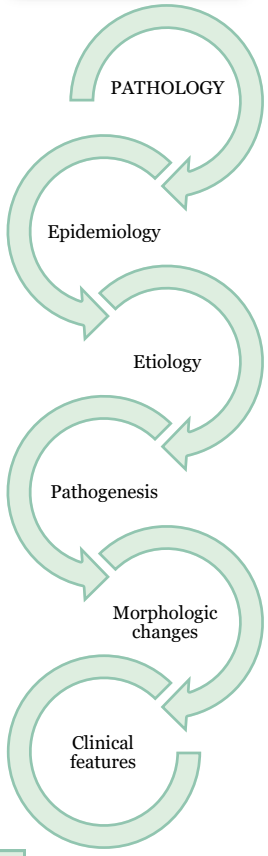
1-Take history and do clinical examination.
2-Ask for radiological and pathological examination.

The common pathological examinations are:

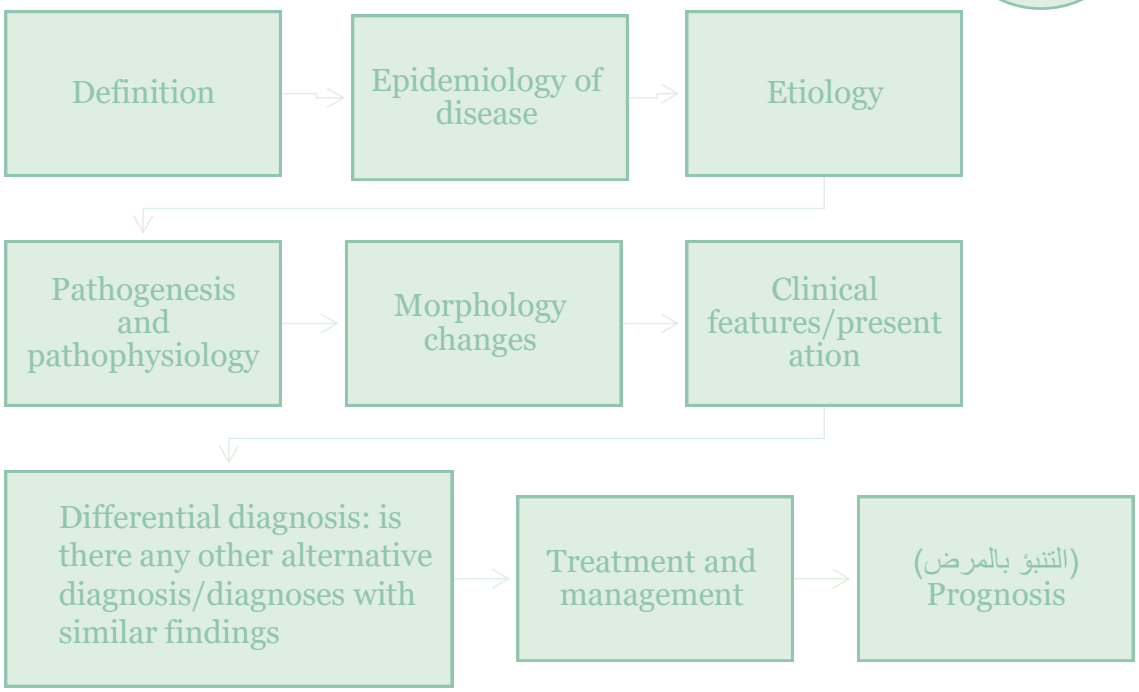
- Blood.
- Urine.
- Stool.

Sometimes the patient is also asked to undergo:

- Cytopathology test.
- Histopathology test.
- other special pathological tests in order to obtain an accurate diagnosis



How do we study the diseases?



THE BRANCHES/SUBDIVISIONS OF PATHOLOGY:

Histopathology	study of tissue biopsied/excised from body
Cytopathology	study of cell morphology, exfoliated or aspirated from body.
Hematology	a study of blood, blood cells and bone marrow, used in the diagnosis of anemias & leukemia's.
Immunohistochemistry	a special staining procedure is used to detect antigens in the tissue.
Chemical pathology/ clinical biochemistry	is the analysis of bodily fluids (blood, urine, etc.) for diagnosis.
Microbiology	is the study of micro-organisms
immunology	is the analysis of the immune system of the body.
Toxicology	study of various poisonous and toxic substances.
Cytogenetics (clinical genetics):	is a study of chromosomal abnormalities.
Molecular pathology	study of the genetic material to detect their diseases **e.g.** fluorescent in situ hybridization, Southern blot tests etc.
Autopsy	discussed in the last slide

TECHNIQUES USED IN HISTOPATHOLOGY

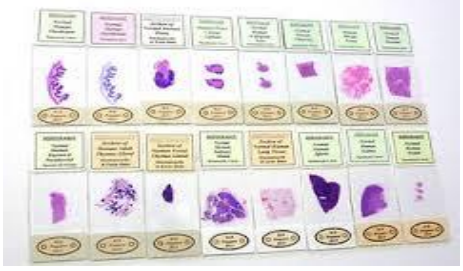
Histopathology: It is the study of tissues using **light microscope**. Tissues are obtained by **biopsies (a sample of a tissue)** by physicians and surgeons.

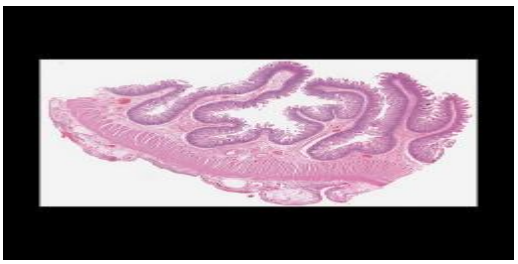
Steps after excision of organ:

1. **Fixation:** preservation of tissue in a solution of formalin(10% formaldehyde). This prevents autolysis and decomposition of tissue.

2. Processing of the extracted tissue into glass slides ready for magnification.

3. Staining of the samples using Hematoxylin and Eosin, giving the nucleus a blue color and the cytoplasm a pink one





4. Pathologist will then look through slide and provide a diagnosis

(Histopathology is often considered the final/golden standard for diagnosis)

TECHNIQUES USED IN CYTOLOGY

- **Cytopathology**: study of the morphology of cells from various parts of the body.

Exfoliative (falling or scrapping off)cytology

Aspiration (fine-needle aspiration cytology

- **It is used for the purpose of:**

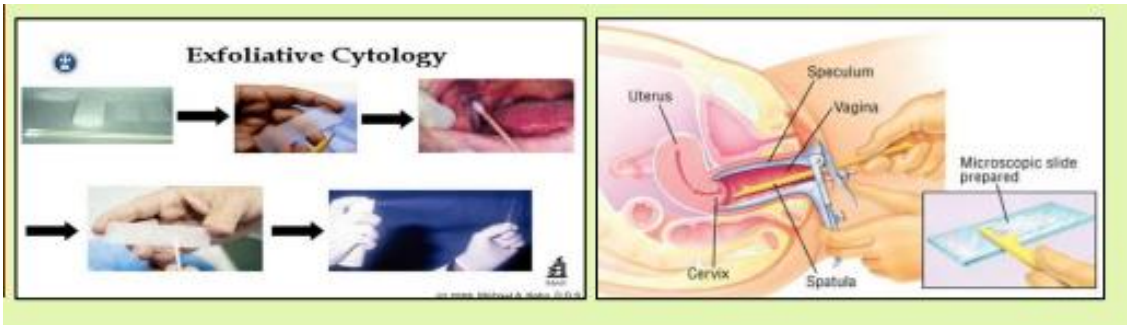
  1-Screening for cancer, **carcinoma(tumor)** e.g. cervical cytology(خلايا (عنق الرحم

  2-Diagnosing cancer

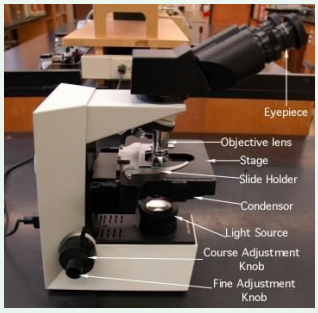
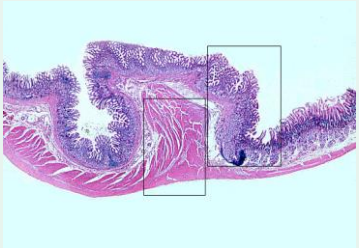
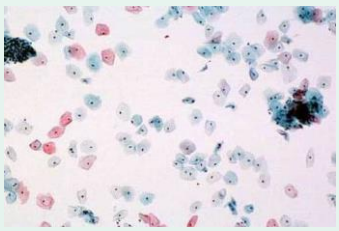
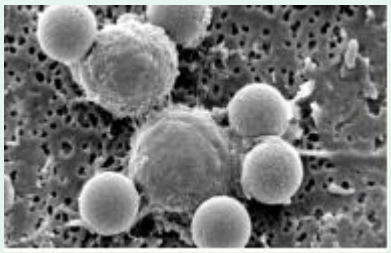
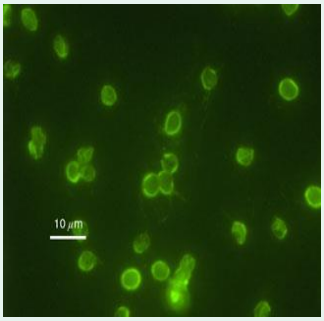
- **The advantage of cytological technique when compared to histopathological techniques is that the procedure is:**
  - Cheap.
  - Takes less time.
  - Requires no anesthesia

- **Fine-needle aspiration cytology (FNAC):** In it the cells are obtained by aspiration/suction of cells from affected organ or tumor mass using a needle. The cells obtained are put on a slide, stained and examined under a microscope.

Exfoliative (falling or scrapping off)cytology: The cells are scraped of any mucosa (غشاء مخاطي) using a spatula (ملعقة) (e.g. cervix and oral cavity) or the cells exfoliate (fall off) themselves and collect in the respective fluids/secretion (e.g. in urinary tract disease the cells which exfoliate collect in the urine, sputum etc. ..e.g. **Urinary tract disease**: cells collect in urine



INSTRUMENTS USED IN PATHOLOGY

Light microscope:	Electron microscope	Immunofluorescence microscope
-most commonly used to view stained samples of cells and tissue in **histopathology** and **cytopathology**. -it is the oldest design of microscope	-uses electron to magnify objects up t**o 2 million times**, enabling us to see cell structures and organelles. -e.g. mitochondria, nuclei and viral structures. Also known as Ultra structural examination	-uses a special blue filter to search for antigens in a tissue with the help of fluorescent dye. -Helps diagnose immunological diseases
  	 	 

AUTOPSY = (NECROPSY) = (POSTMORTEM) "فتح الجثة بعد الوفاه"

- It is a sub-specialty(تخصص فرعي) of pathology which involves examining a dead body to discover the cause of death or audit the clinical diagnosis (المراجهة و التدقيق في التشخيص السريري).

- **An autopsy is done to :**

1) **Determine the cause of death (this is the main reason why autopsy is done). It can be performed in any of the following situations:**
   - Homicidal (مقتول)
   - Suicidal (منتحر)
   - Accidental (حادث)
   - To identify the disease
2) **To provide useful information about various disease.**
3) **To do research.**
4) **A tool to educate students, surgeons etc.**
5) **Forensic pathology (legal purposes)** = (الطب الشرعي) : is the application of pathology to the legal system.
6) **audit the clinical diagnosis** = (المراجهة و التدقيق في التشخيص السريري).

Who Does The Autopsy? **The Pathologist**

What does the pathologist do? The pathologist can help the clinician to make a diagnosis by looking at sample of tissue (known as biopsies) .Pathologist also perform autopsies.

Clinical cases:

Case 1:

-70 years old man, swelling in legs/chest from minor trauma. After aspiration of swelling we get blood. Patient has a **hematoma**, he's bleeding. Brother is affected but sister isn't. This means he has a bleeding disorder which affects family members (congenital not acquired), only affects males.

-After investigation , it turns out he has a deficiency in coagulation factor 8 (**hemophilia**).
-Disease might be present at birth but symptoms appear much later.
-Case 1 has a **congenital hereditary disease**.
-Disease only affects males. Females only carry the gene

Case 2:

child is slow in school, can't speak properly, and has elongated eyes. The canthus (the fold at the eye) is prominent. Patient is short with webbed neck and big tongue.

-Patient has **trisomy 21**, chromosomal disease (congenital, but not inherited).
-Caused by numerical abnormality in the number of chromosomes.

Case 3:

baby won't breastfeed and has struggles breathing.

-Baby has **cleft palate** (palate is roof of mouth).

-Sometimes patients have cleft lip.

-This is a congenital disease, he was born with it.

-It is a non-inherited disease. Fixed easily through surgery.

Case 4:

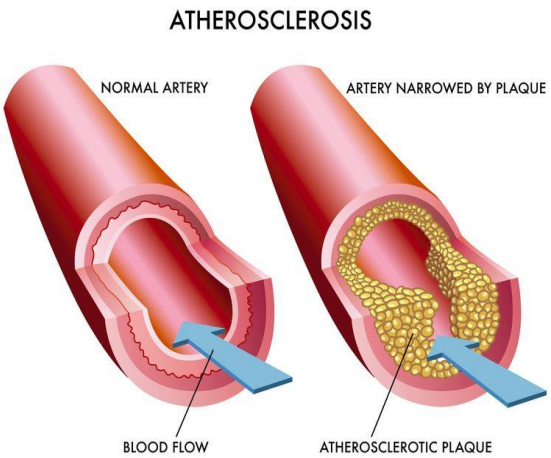
patient eats too much junk food.

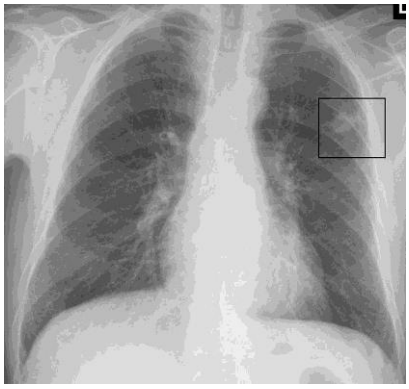
-Atherosclerosis (acquired): caused by accumulation of lipids **(e.g. Cholesterol)** in blood vessels.

-Could cause obstruction of blood flow.

-Could cause stroke.

للتذكر : واحد يروح لمطعم يطلب ٥ برجر ويشرب بيبسي دايت ويبقى هذا الشيء بسبب له تصلب الشرايين





Case 5:

patient is a smoker of 20 years, suddenly loses weight, experiences a lot of coughing.

-He has a tumor in their chest. (Neoplastic disease/plastic disease/disorder of cellular growth.)

Case 5:

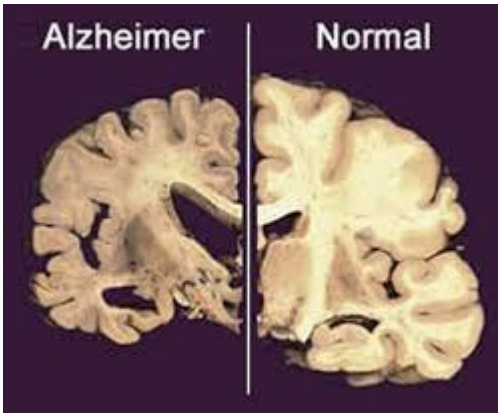
my hand is always red and feels hot. He could be: allergic / inflamed / infected. He says: I bought nylon socks and after wearing them my hand got red & “”فيهاصديد

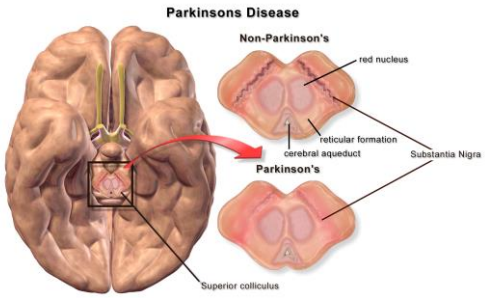
He has: eczema / dermatitis (allergic)

Case 6 :

man old years 80 يروح يصلي كل يوم ومرة مارجع بعدين اتصلوا الشرطة على أهله وقالوا انه ضايع مايعرف وين بيته وموعارف يرجع):

-This man has **dementia or Alzheimer's**: doesn't remember near memories and remembers remote memories
- **atrophy** of brain
- shrinkage in number of brain cells.





Case 7:

80 year old, has no expression on his face, hands are.shivering

-Parkinson's: stiff facial features, rigidity, tremors.
-caused by diminishing of the size of subtantia nigra.

Case 8:

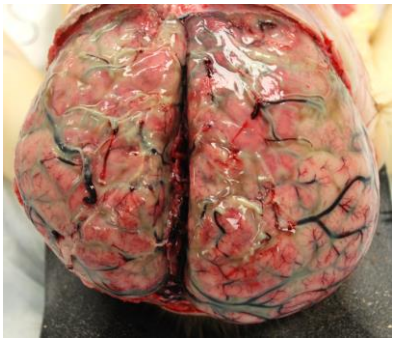
A patient has a sore throat and the doctor prescribes amoxicillin for the patient. The patient experiences an allergic reaction and has a drug eruption.

- **drug induced disease** (toxicity) can cause diseases in liver/kidney/lungs/mostly rash.
- Ask about the history to know which drug he has taken -acquired- drug induced.

Case 9 :

Man with bacterial السحايا التهابmeningitis (16 years)
Symptoms: headache, high body temperature [39.5], stiff neck, fear of light (photophobia) .

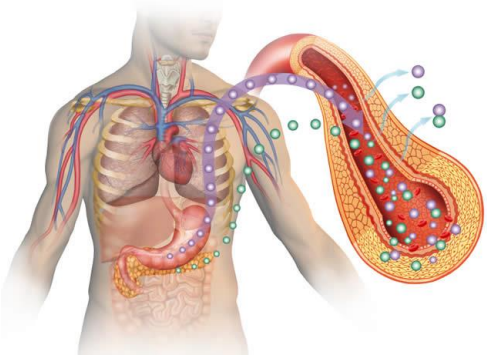
-meningitis; a non-idiopathic acquired inflammatory disease that causes puss to build up around the brain. It is caused by a known bacterium, meningococcal.



Case 10 :

Works at a company + eats meat a lot Sign: Swollen toe, patient presented with a painful swelled toe and very high uric acid content

Gout ; metabolic disease caused by an error of metabolism of purines. Leads to accumulation of uric acid which is transformed to crystals called monosodium urate crystals which accumulate in joints and cause an inflammatory reaction, causing pain and swelling



Case 11:

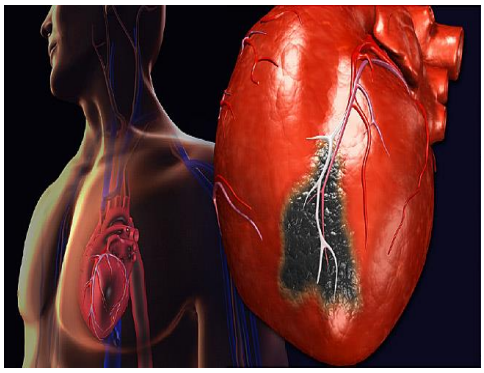
Urinating often. very thirsty, feeling very hungry. Extreme fatigue. Blurry vision. Cuts/bruises that are slow to heal

diabetes:

- (16-20% of population of Saudi Arabia is affected);
- error in metabolism of carbohydrates. Not enough insulin is produced. Or there is a resistance to the action of insulin.

Case 12:

Cardiovascular disease 50 years old man with central chest pain.



The doctors suspects he has myocardial infarction (ذبحة صدرية) why?
1- Because this symptom is very common
2- This case is the most common in his age.

Pathogenesis: High cholesterol > thrombosis > جلطة coronary arteries clot (الشرايين القلبية تجلط they supply blood to heart) > heart doesn't get blood needed > ischemia (poor blood supply to an organ or part of the body, especially the heart muscles.) > Hypoxemia >severe pain (60% die)

MCQ'S (TEST YOURSELF !)

- 1) What is " the act of naming a disease in an individual patient " ?
- a) Pathogenesis
- b) Autopsy
- c) Diagnosis
- d) Epidemiology

- 2) A subspecialty that involves examining a dead body?
- a) Toxicology.
- b) Immunology.
- c) Chemical pathology.
- d) Forensic Pathology

- 3) Are findings discovered by the physician during examination of the patient?
- a) Signs
- b) Symptom
- c) Pathogenesis
- d) Prognosis

- 4) If the patient came to the clinic , and is complaining about shortness of breath … this is ?
- a) Sign
- b) Symptom
- c) Prognosis
- d) Pathogenesis

- 5) What is the classification of cancer?
- a) Degenerative.
- b) Inflammatory.
- c) Drug induced.
- d) Growth disorder

- 6) To give a patient some ideas of the out come of the disease?
- a) Pathogenesis
- b) Degenerative.
- c) Mortality
- d) Prognosis

- 7) It is known as ultra structural studies?
- a) Electron microscope
- b) Immunofluorescent microscope
- c) Light microscope

- 8) Sample of tissue (from an alive person) taken for diagnostic purpose?
- a). Autopsy
- b) Molecular techniques
- c) Biopsy
- d) Cytogenetics

- 9) The analysis of bodily fluids (blood, urine, etc.) for diagnosis?
- a) Histopathology
- b) Biochemistry
- c) Microbiology
- d) Toxicology

- 10) Anorexia nervosa is an example for?
- a) Psychological Disease
- b) Epidemic
- c) Physiological Disease
- d) Infection

1-c
2-d
3-a
4-b
5-d
6-d
7-a
8-c
9-b
10-a

MEMBERS :

Females:

-leader : بثينة آل ماجد

-روان الحربي
-وفاء العتيبي
-الجوهرة الشنيفي
-رزان الزهراني
-رهف الشمري
-روان مشعل
-منيره المسعد
-لميس السويلم
-نوف العتيبي
-رزان الزهراني
-هديل عورتاني
-فاطمة بالشرف
-ابتسام المطيري
-رناد الفرم
-غرام جليدان
-بلقيس الراجحي
-نورة القاضي
-آلاء الصويغ
-ريم القحطاني
-نورة بن حسن

Males:

-leader : فيصل الطحان

عبدالجبار اليماني
محمد باحاذق
أحمد الراشد
عبدالله بالعبيد
عبدالله السرجاني
أحمد الحربي
أنس السيف
داود إسماعيل
خالد الدوسري
فهد الفايز
محمد بن معيوف
فهد النهابي
معاذ العبد الغني
سعد الفوزان
سيف المشاري
تميم الوهيبي
أحمد الرخيمي
رشيد البلاع
محمد النجيم

Gently contact us if you have any questions/comments and suggestions:

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* TWITTER : @pathology437

GOOD LUCK!☺

Resources:-

1- Females slides
2- Robbins reference book

Pathology

teamwork437