



Pathology

Doctor 2018 | Medicine | JU

● Sheet

○ Slides

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INTRODUCTION TO PATHOLOGY

***What is pathology?**

*** Why is pathology important?**

***What are the divisions of pathology?**

All these questions and more you can answer it after studying this sheet so let us start!!!

Note: any underlined information is extra and is only included for better understanding 😊

(Pathology is the study of suffering or disease)

In other words, it is the study of the structural, biochemical

And functional changes in the cells, tissues, and organs

That are involved by disease.

Pathos = disease or
suffering

Logos = study

_ Pathologists don't have direct contact with patients

_ We can say that pathologists and light microscopes are friends (usually using microscopes).

But why it is very important to study it well and love it????

_ Because it is the linkage between basic years and clinical years, a bridge between the basics sciences and clinical medicine.

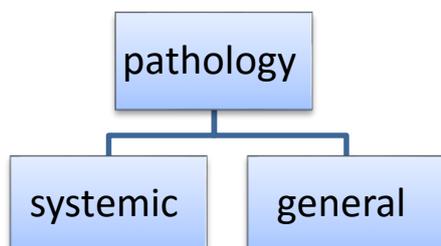
Pathology is trying to reach a true diagnosis and explanation of any disease by using:

1. Molecular techniques
2. Microbiologic techniques
3. Immunologic and morphologic techniques.

The doctor sees the patient, examines him and conducts physical and laboratory tests. After this if he doesn't have a diagnosis, the role of pathologist comes.

*often pathology diagnosis related to cell in puppetry conditions , cancer conditions and other conditions so when doctor takes a biopsy from patient pathologist uses the light microscope to deduct the sample and diagnose it and sometimes guide the type of therapy such as hemotherapy.

Divisions



**General pathology (which we will study) talks about cell injury, hemodynamic disorder, genetic disorders, immune system diseases, infectious diseases and environmental diseases.

**Systemic pathology_ we will take it when we study systems_ alterations in specialized organs and tissues in diseased status.

Now we will talk about terms that will be repeated with us through this course

Aspects of disease

Epidemiological aspects

The quantitative analysis of the circumstances under which disease processes, including trauma occur in population groups factors affecting their incidence distribution and the host response and use of this knowledge in.

How disease will differ from male to female, from a country to another, from geographic region to another one and so on.

Note ** we use statistics in epidemiology**

Etiology /cause

For every disease, there can be many causes, it

Could be **ACQUIRED** (such as: infections, nutritional, chemical)

Or **GENETIC** (such as: mutations, inheritance).

Let's take an example

Hypertension

An individual has hypertension, but his son does not! What might be the reason for that?

قال الشاعر:

من لم يمت بالسيف مات بغيره
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We have mentioned before that there are more than one reason for any disease to occur (except of some genetic inherited disease which is not very common.)

Now you should know that environment has an effect on the appearances of the disease

So, he doesn't have hypertension because of reluctance of the environmental factor. His lifestyle is good, so he is hale.

Environmental factors could be (smoking, obesity, diabetes, etc.)

Pathogenesis

Sequence of events of cells or tissues in response to the etiologic agent, from the initial stimulus to the ultimate expression of the disease (mechanism).

Molecular changes

Molecular evolution is the process of change in the sequence composition of cellular molecules such as DNA and RNA and proteins across generation.

Morphologic changes

Morphology, in biology, the study of the size, shape, and structure of animals, plants, and microorganisms and of the relationships of their constituent parts. The term refers to the general aspects of biological form and arrangement of the parts of a plant or an animal.

We can notes these changes by eye so it is macroscopic change.

But we use light microscope to see microscopic changes and in other cases we use electron microscope to notes ultra-structural changes which is happing in organelles within the cell.

Clinical features

Including sings and symptoms of the disease, biochemical tests, physical findings, radiological findings.

Complications

Complication, in medicine, complication or medical complication is an unfavorable evolution or consequence of a disease, a health condition or a

therapy. ... A medical treatment, such as drugs or surgery may produce adverse effects or produce new health problem(s) by itself.

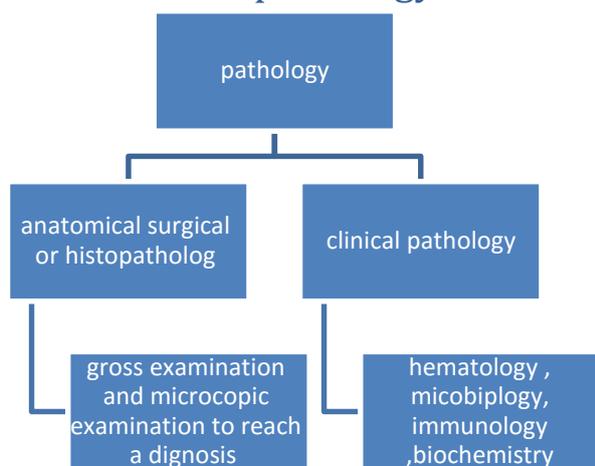
Treatment

Prognosis

How the disease will be in future it is would have a good or bad behavior.

Some tumor has a good prognosis that means we can treat it and may it has a bad prognosis.

Classification of pathology



Anatomic pathology

It is include:

Histopathology which is deal with tissue diseases.

Cytopathology cellular diagnosis

For example:

A patient with enlarged thyroid gland and we want to diagnose his disease, we can draw a sample of thyroid cells using the needle and then perform some steps until the sample is ready for laboratory testing under a microscope.

Autopsy which is dealing with dead patients.

You should know that pathology is a specialty so after graduation you can have a specialty on it and also subspecialty such as neuropathology, dermatopathology, oral pathology, Etc.....

Diagnosis in histopathology

Biopsies (excisional, incisional)

A [biopsy](#) is a sample of tissue taken from the body in order to examine it more closely. A doctor should recommend a biopsy when an initial test suggests an area of tissue in the body isn't normal. Doctors may call an area of abnormal tissue a lesion, a tumor, or a mass. These are general words used to emphasize the unknown nature of the tissue.



The suspicious area may be noticed during a [physical examination](#) or internally on an imaging test.

Smears (exfoliative and fine needle aspiration)

Specimen identification and labeling:

- ✓ Tissue specimen received in the surgical pathology laboratory have a **request form** that lists the patient information and history along with a description of the site of origin.
- ✓ The specimen are accessioned by giving them a **number** that will identify each specimen for each patient



Patients samples arrive at the pathology lab, these samples are labeled with patient's name, his medical history and where the sample was taken.

Samples shall be preserved with formalin and water shall be withdrawn from these samples to be mummified and then waxed and then dyed with special dyes .the samples are then cut by a microtome device and seen under a microscope.

Note: Hematoxylin is a basic **dye** that is commonly **used** in this process and stains the nuclei giving it a bluish color while eosin (another stain **dye used** in **histology**) stains the cell's nucleus giving it a pinkish stain

These images show the steps of preparing microscopic sections

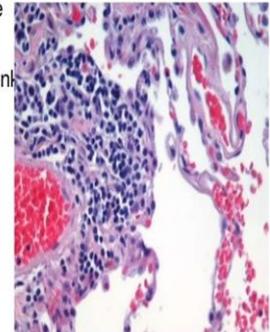


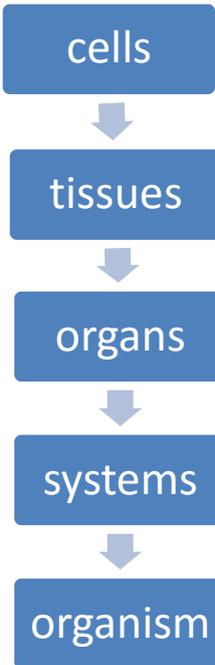
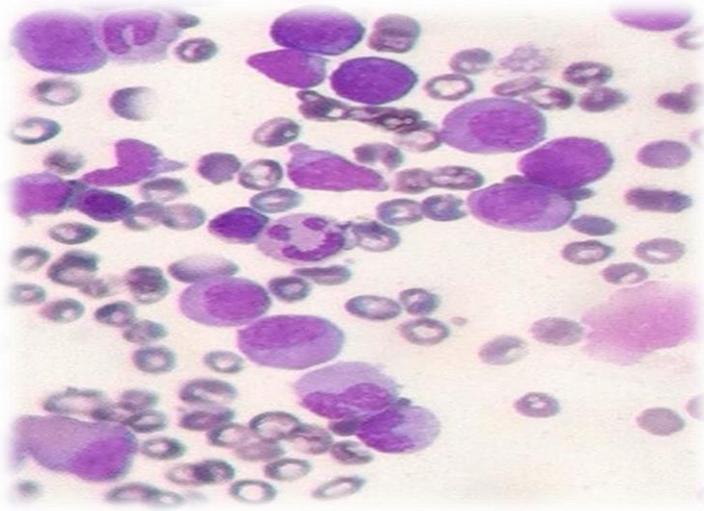


• Result :

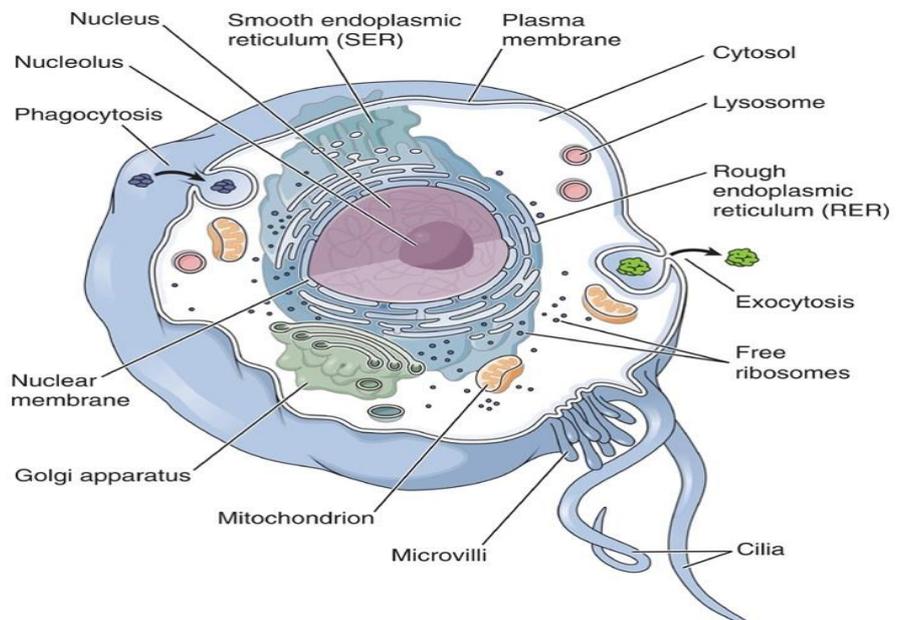
The nucleus stains Blue

The cytoplasm stains pink





***** The basic unit of our body is cell *****



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**** Each cell in our body lives in the case of homeostasis and it is stable until it is exposed to stress, then that cell starts trying to adapt to its new state in different ways let us say that our cell is adapted then it will return to homeostasis again (reversible cell injury) and what about our cell cant adapt anymore or the stress has become very severe (irreversible cell injury) its lead to cell death.**

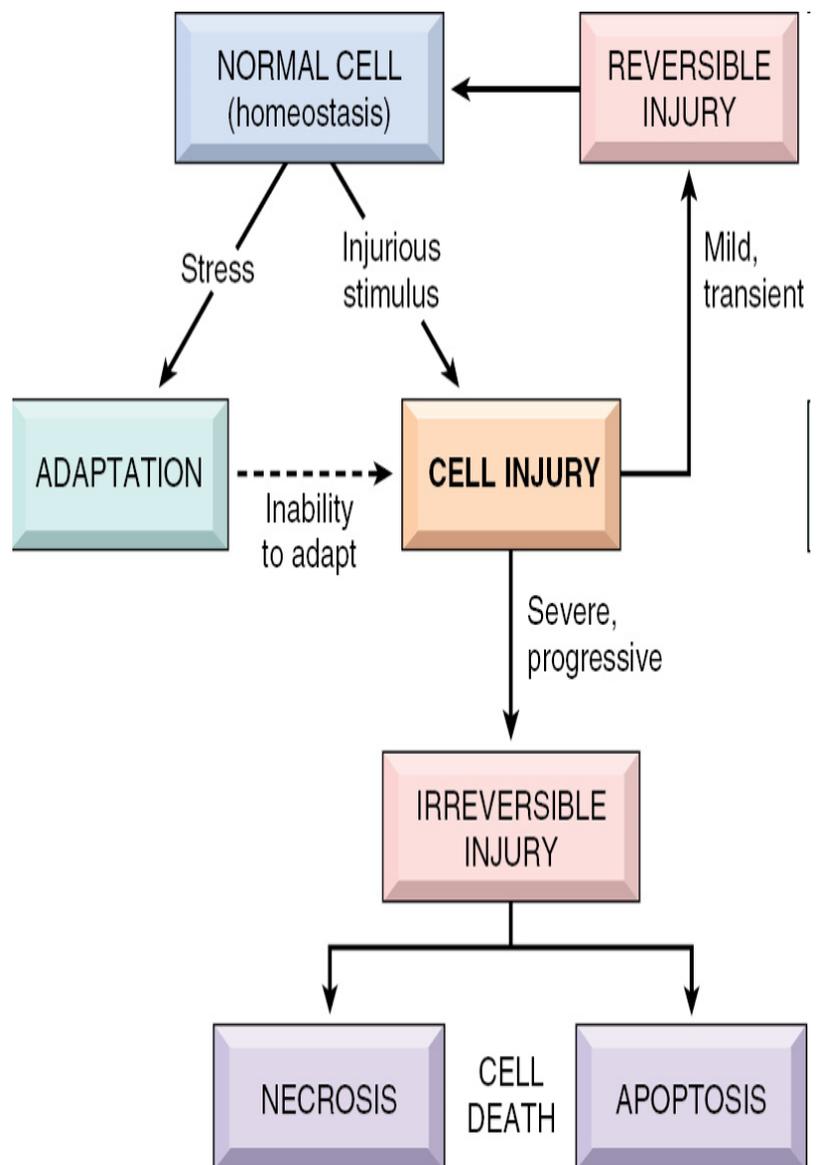
If the cell cannot adapt we will have firstly (reversible cell injury) and cell still live but It is function will differ depending on condition and it can go recovery and returns normal and as I said above if the stress is severe cell will have (irreversible cell injury) which means cell death (necrosis or apoptosis or both together *it will discuss later *)

All adaptation is reversible and we have 2 types of adaption depending on the driving force

- **Physiologic adaptations**
* are internal systematic responses to external stimuli in order to help an organism maintain homeostasis like hormonal variation (puberty, pregnancy, menstrual cycle)

A great example of a physiological adaptation would be how your body responds to working out - larger muscles more capable of bearing a higher load/doing work. Your body keeps up, or ADAPTS, to the stress that you place on it so it can perform better under those same circumstances.

- **Pathologic adaption**



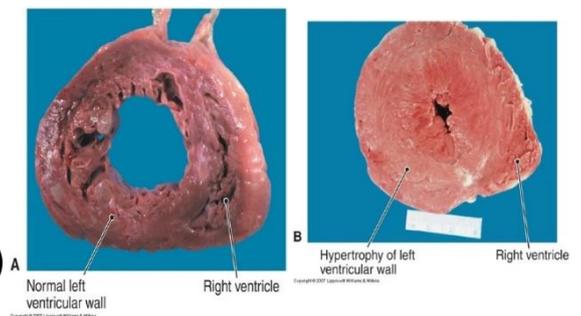
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*When these cells or tissues are damaged, the body attempts to adapt and repair or limit the harmful effects. Often the adaptive changes result in cells or organs that cannot function normally. This imperfect adaptation is a pathological change. (Because of diseases \ abnormalities)

Example: Cellular changes in people who smoke cigarettes: The ciliated columnar epithelium changes to non-ciliated squamous epithelium in the trachea and bronchi of cigarette smokers. The replacement of squamous epithelium can better withstand the irritation of the cigarette smoke. However, the loss of cilia and mucous secretions of columnar epithelium diminish the tracheobronchial defense mechanisms.

Adaptations have many forms

1. Increase in cell size (hypertrophy)
2. Increase in number of cells (hyperplasia)
3. Change into another type of cell (metaplasia)
4. Decreased cell size and function (atrophy)



Let's start with hypertrophy

1. Hypertrophy: the increase in cell size

Question: How does cell size increase?

-by increasing the number of organelles and proteins in the cell

Hence, cell size increases, and whole organ increases.

*Question: Do all cells that undergo hypertrophy also undergo hyperplasia?

-If the cell can undergo proliferation, it can undergo hyperplasia as well as hypertrophy.

If not, it can only undergo hypertrophy (pure).

Cells that can undergo hypertrophy only: cardiac muscle, skeletal muscle, neurons (they are differentiated)

Cells that can undergo hypertrophy and hyperplasia: smooth muscle in uterus.

Underlying causes of hypertrophy:

1. Increased functional demand (As function of cells increase, cell size has to increase as well)
2. Hormonal stimulation (can be pathologic or physiologic)
3. Growth factor

It can be

- 1) Pathologic: happens in cardiac muscle

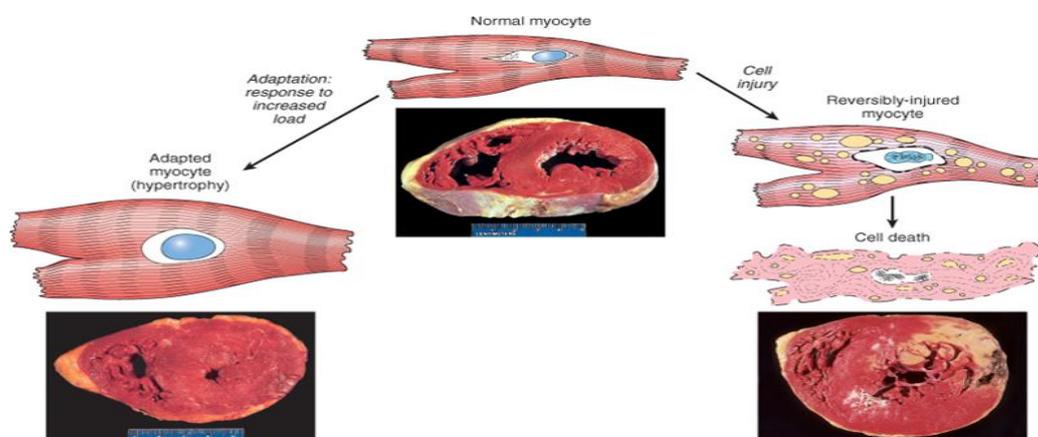
Cardiac muscle pumps blood in systemic circulation and pulmonary circulation. Systemic circulation requires high pressure. If the patient has hypertension or aortic stenosis, where resistance is high, the heart must increase the size of myocardial muscle cells; hence the size of the whole heart will increase.

Purpose: More forceful pumping capacity

Result of: increased demand of pumping capacity

Question: Is this always an adaptation?

-No. At first it does adapt. But with time, if stress and hypertension is not treated, stenosis keeps increasing, cell injury occurs heart failure, myocardial ischemia, cardiac infarction and so on.



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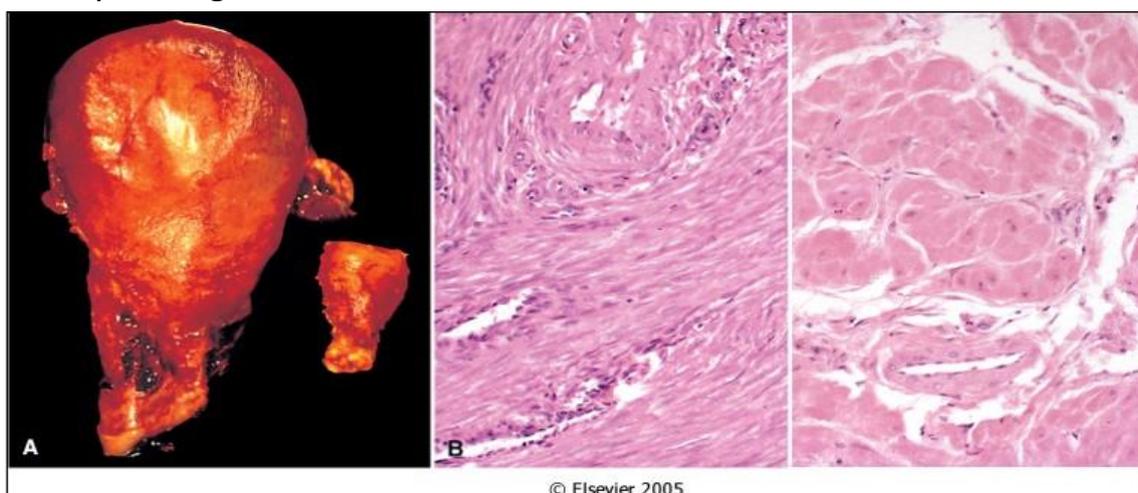
2) Physiologic:

a) Happens in uterus during pregnancy.

During pregnancy, the hormone estrogen increases. This hormone stimulates the smooth muscle cells, in order for the uterus to increase in size to be able to carry the fetus.

Question: Do cells in the uterus perform hypertrophy only or does it undergo hyperplasia as well?

- They undergo a mix of both



When pregnancy is terminated, the smooth muscle cells that were newly formed will die and the muscle cells that increased in size will go back to its normal size.

This case does not include a disease hence its physiologic.

b) Skeletal muscle in body builders.

The demand on the muscles causes muscle cell size increase. It doesn't undergo hyperplasia because it cannot.

2. Hyperplasia: increase in cell number

-Also can be mixed with hypertrophy or it can be pure Hyperplasia.



It can be:

1) Physiologic: due to hormonal stimulation

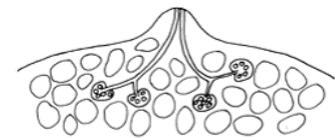
a) Pregnancy (as we mentioned before, estrogen stimulates cell to replicate).

b) Compensatory hyperplasia:

Example: If a patient had a liver tumor, we resect a large part of the liver. The liver has an ability: if 1/3 of the liver is left in place, it can grow back to its original size.

c) Breast during puberty and pregnancy:

Due to hormones (progesterone, estrogen) cause proliferation in the breast glands during lactation.



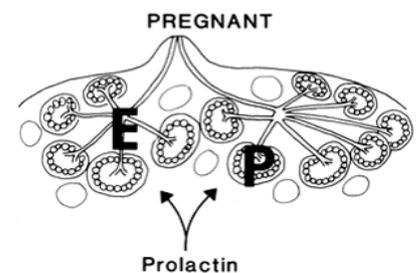
2) Pathologic: due to excessive

hormonal stimulation.

a) Endometrial hyperplasia:

Excessive release of estrogen causes hyperplasia

in the endometrium of the uterus.



It's pathologic because it's irreversible and can lead to cancer.

b) Prostatic hyperplasia:

In elderly men, testosterone causes prostatic glands to proliferate forming nodules.

c) Viral infections (warts):

Are caused by HPV virus. Causes proliferation in the skin which causes warts. Certain types can turn, in a certain point, to cancer.

3) Tumors and cancer.

Mutlu son olmasın, mutlu sonsuz olsun ;)

Tekrar görüşmek üzere

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