Introduction to Pathology

Pathology is the study of disease by scientific methods. The word pathology came from the Latin words "patho" & "logy". 'Patho' means disease and 'logy' means study, therefore pathology is a scientific study of disease.

Definition of Disease

Diseases may, in turn, be defined as an abnormal variation in structure or function of any part of the body. Pathology gives explanations of a disease by studying the following four aspects of the disease.

Etiology

The cause of the disease

Pathogenesis

The mechanism of disease development

Morphologic changes

Structural alterations in cells or tissues

Functional derangements and clinical significance

Impact on organ function and clinical features

1. Etiology

Etiology of a disease means the cause of the disease. If the cause of a disease is known it is called **primary etiology**. If the cause of the disease is unknown it is called **idiopathic**.

Knowledge or discovery of the primary cause remains the backbone on which a diagnosis can be made, a disease understood, & a treatment developed.

Classes of Etiologic Factors

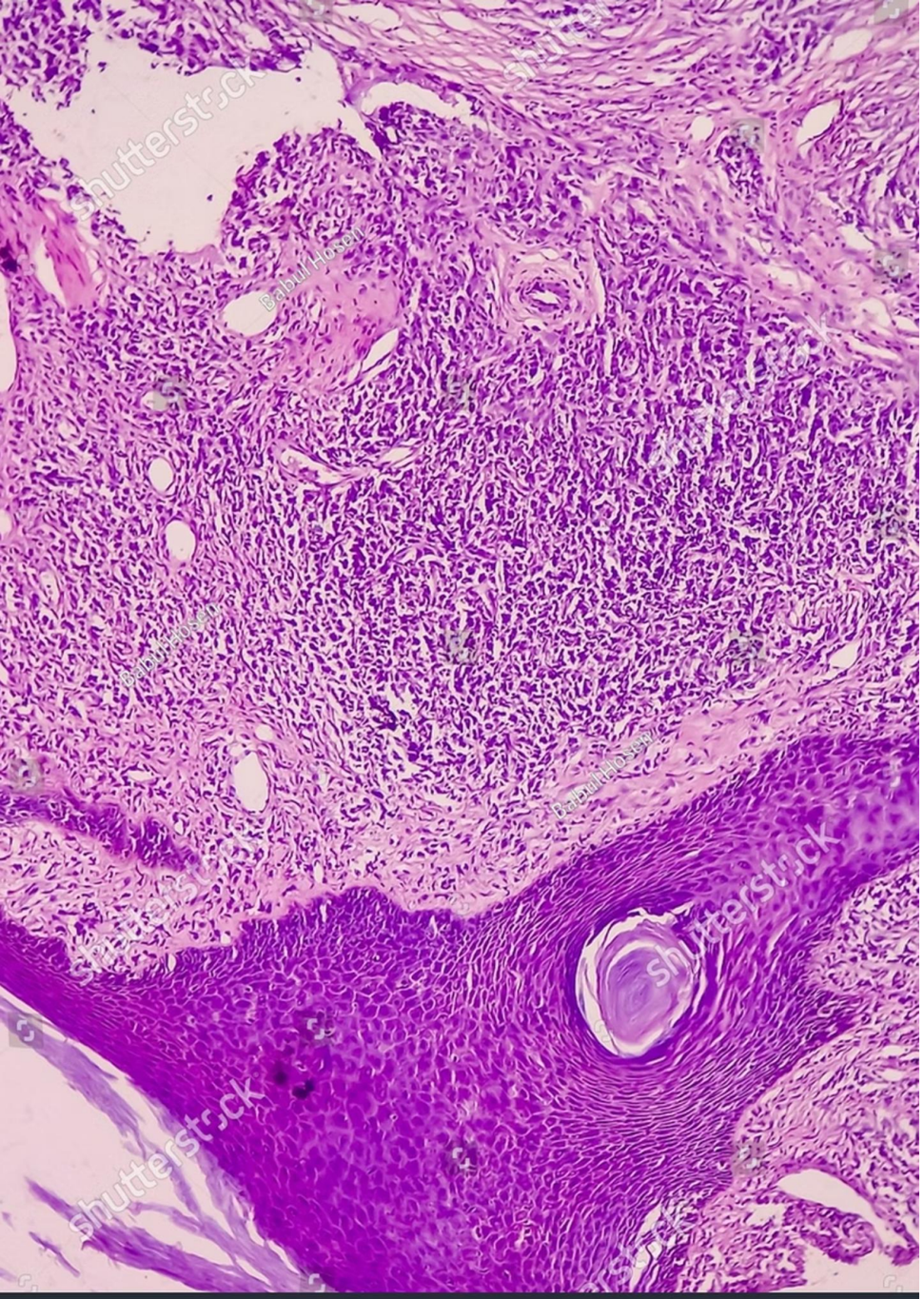
Genetic Factors

Inherited causes of disease that are present from birth and passed down through generations.

Acquired Factors

- Infectious
- Nutritional
- Chemical
- Physical
- And others

There are two major classes of etiologic factors: genetic and acquired (infectious, nutritional, chemical, physical, etc). Detailed discussion will be given in subsequent topics. The etiology is followed by pathogenesis.



Lesions

Lesion : is any abnormalities in the tissue of an organism:

Type: grossly and microscopy lesion

2. Pathogenesis

Pathogenesis means the mechanism through which the cause operates to produce the pathological and clinical manifestations. The pathogenetic mechanisms could take place in the latent or incubation period. Pathogenesis leads to morphologic changes.

1

Etiologic Factor

Initial cause of disease

2

Pathogenetic Mechanism

How the cause operates

3

Morphologic Changes

Resulting structural alterations

3. Morphologic Changes

The morphologic changes refer to the structural alterations in cells or tissues that occur following the pathogenetic mechanisms. The structural changes in the organ can be seen with the naked eye or they may only be seen under the microscope.

Types of Morphologic Changes

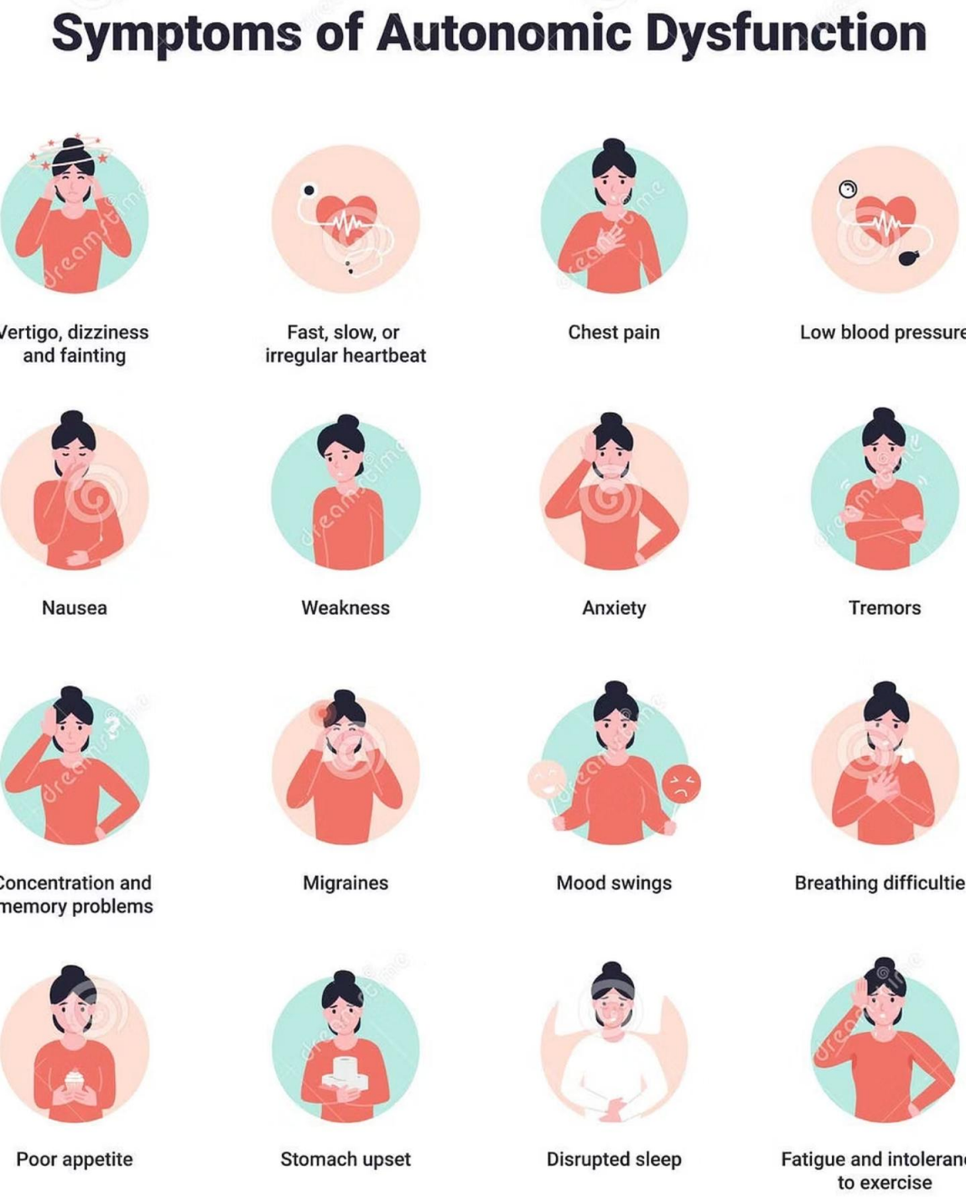
Gross Morphologic Changes

Those changes that can be seen with the naked eye are called gross morphologic changes

Microscopic Changes

Those that are seen under the microscope are called microscopic changes

Both the gross & the microscopic morphologic changes may only be seen in that disease, i.e. they may be specific to that disease. Therefore, such morphologic changes can be used by the pathologist to identify (i.e. to diagnose) the disease.



4. Functional Derangements and Clinical Significance

The morphologic changes in the organ influence the normal function of the organ. By doing so, they determine the clinical features (symptoms and signs), course, and prognosis of the disease.

In addition, the morphologic changes will lead to functional alteration & to the clinical signs & symptoms of the disease.

Summary: What Pathology Studies

01

Etiology

The cause of disease

02

Pathogenesis

Disease development mechanism

03

Morphologic Changes

Structural alterations

04

Clinical Features & Prognosis

Disease outcomes and predictions

In summary, pathology studies:-

Etiology → Pathogenesis → Morphologic changes → Clinical features & Prognosis of all diseases.

II. Diagnostic Techniques Used in Pathology

The pathologist uses the following techniques to the diagnose diseases:

Histopathology

Cytopathology

Hematopathology

Immunohistochemistry

Microbiological examination

Biochemical examination

Additional Diagnostic Techniques

Cytogenetics

Study of chromosomes and genetic abnormalities

Molecular techniques

DNA and RNA analysis for disease diagnosis

Autopsy

Post-mortem examination to determine cause of death

A. Histopathological Techniques

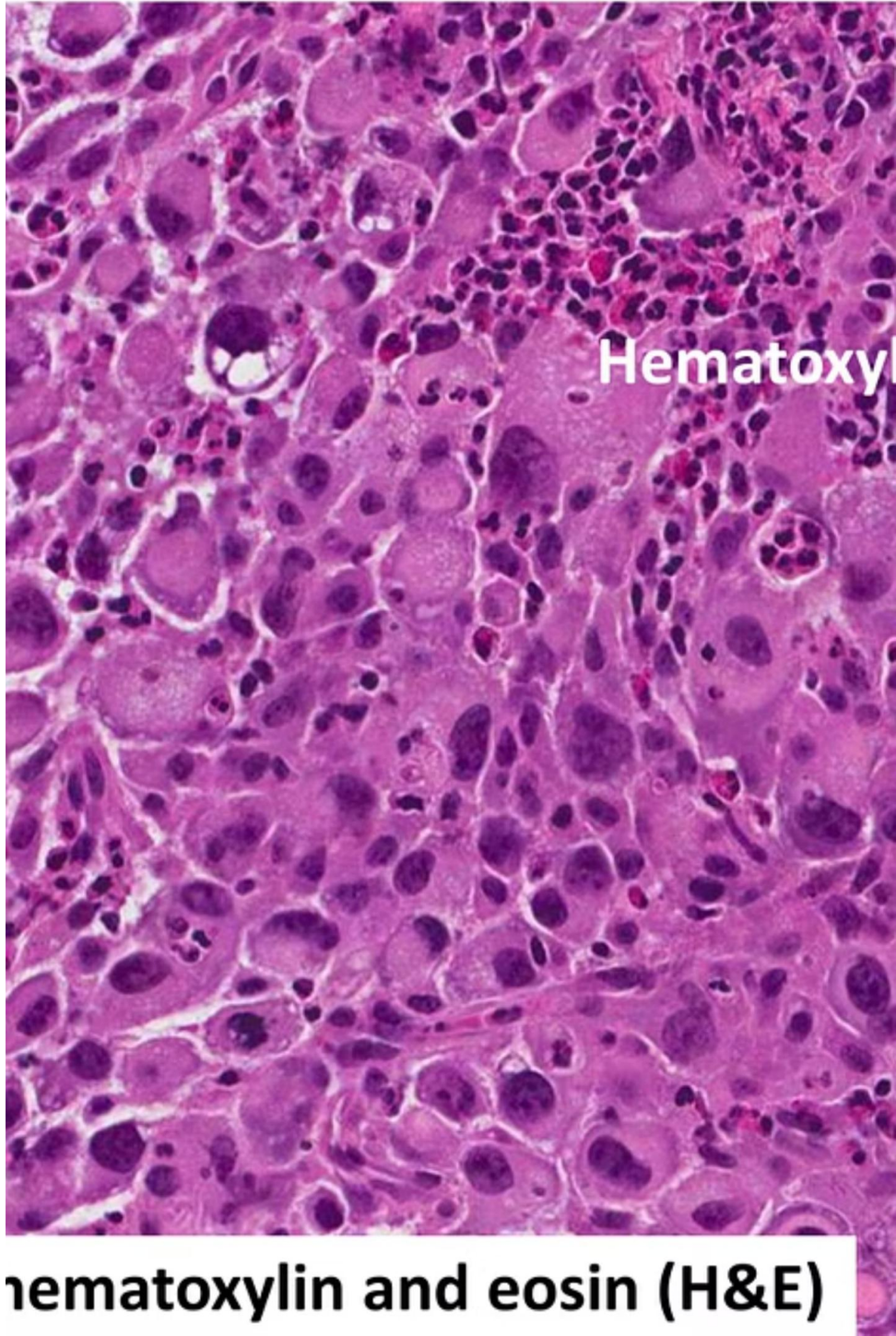
Histopathological examination studies *tissues* under the microscope. During this study, the pathologist looks for abnormal structures in the tissue. Tissues for histopathological examination are obtained by biopsy.

Biopsy is a tissue sample from a living person to identify the disease. **Autopsy** is a tissue sample from a dead person to identify the disease.

H&E Staining

The Hematoxylin/Eosin stain is usually abbreviated as H&E stain. The H&E stain is routinely used. It gives the nucleus a **blue color** & the cytoplasm & the extracellular matrix a **pinkish color**.

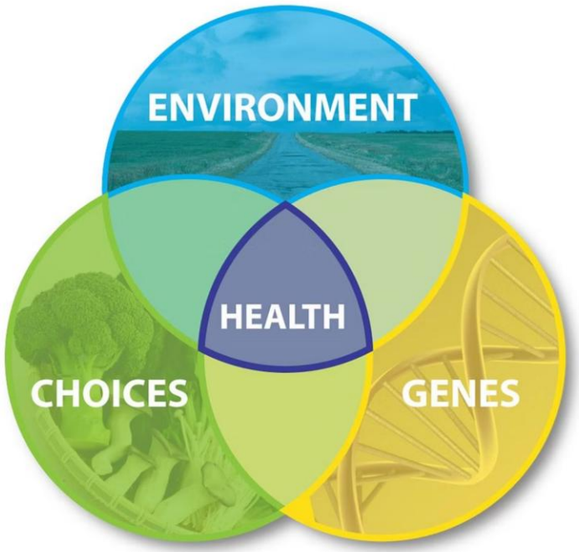
Then the pathologist will look for abnormal structures in the tissue. And based on this abnormal morphology he/she will make the diagnosis. Histopathology is usually the gold standard for pathologic diagnosis.



Aims of Studying Histopathology

The aims of study histopathology:

1. Diagnosis the disease
2. Scientific research and discovery
3. Unit research tumor
4. University and hospital laboratory
5. Application the drugs to scientific researches



III. The Causes of Disease

Diseases can be caused by either environmental factors, genetic factors or a combination of the two.

Environmental Factors

External causes that affect the body from outside

Genetic Factors

Inherited causes present from birth

A. Environmental Factors

Environmental causes of disease are many and are classified into:

Physical agents

These include trauma, radiation, extremes of temperature, and electric power. These agents apply excess physical energy, in any form, to the body.

Chemicals

With the use of an ever-increasing number of chemical agents such as drugs, in industrial processes, and at home, chemically induced injury has become very common.

Nutritional deficiencies & excesses

Defect in absorption of food may causes anemia.

More Environmental Factors

Infections & infestations

Like infection with Viruses, bacteria, fungi, parasite

Immunological factors

Like: Hypersensitivity reaction, Immunodeficiency and Autoimmunity

Psychogenic factors

Like stress

Their effects vary:

- Some act in a general manner, for example cyanide is toxic to all cells.
- Others act locally at the site of application, for example strong acids and caustics.

IV. Course of Disease

The course of disease is shown with a simplified diagram as follows.

The course of a disease in the absence of any intervention is called the **natural history of the disease**. The different stages in the natural history of disease include:

1. ## Exposure

   Exposure to various risk factors (causative agents)

2. ## Latency

   Period between exposure and biological onset of disease

3. ## Biological Onset

   This marks the initiation of the disease process, however, without any sign or symptom

4. ## Incubation Period

   Variable period of time without any obvious signs or symptoms from the time of exposure

VI. Outcome and Consequences of Disease

Following biological onset of disease, it may remain asymptomatic or subclinical (i.e. without any clinical manifestations), or may lead to overt clinical disease.

The clinical onset of the disease, when the signs and symptoms of the disease become apparent. The expression of the disease may be variable in severity or in terms of range of manifestations.

The onset of permanent damage, and death.

Following clinical onset, disease may follow any of the following trends:

Resolution

Resolution can occur leaving no sequelae

Sequelae

The disease can settle down, but sequelae are left

Death

It may result in death