ARKAN
STUDY HOUSE

HISTOLOGY

2024

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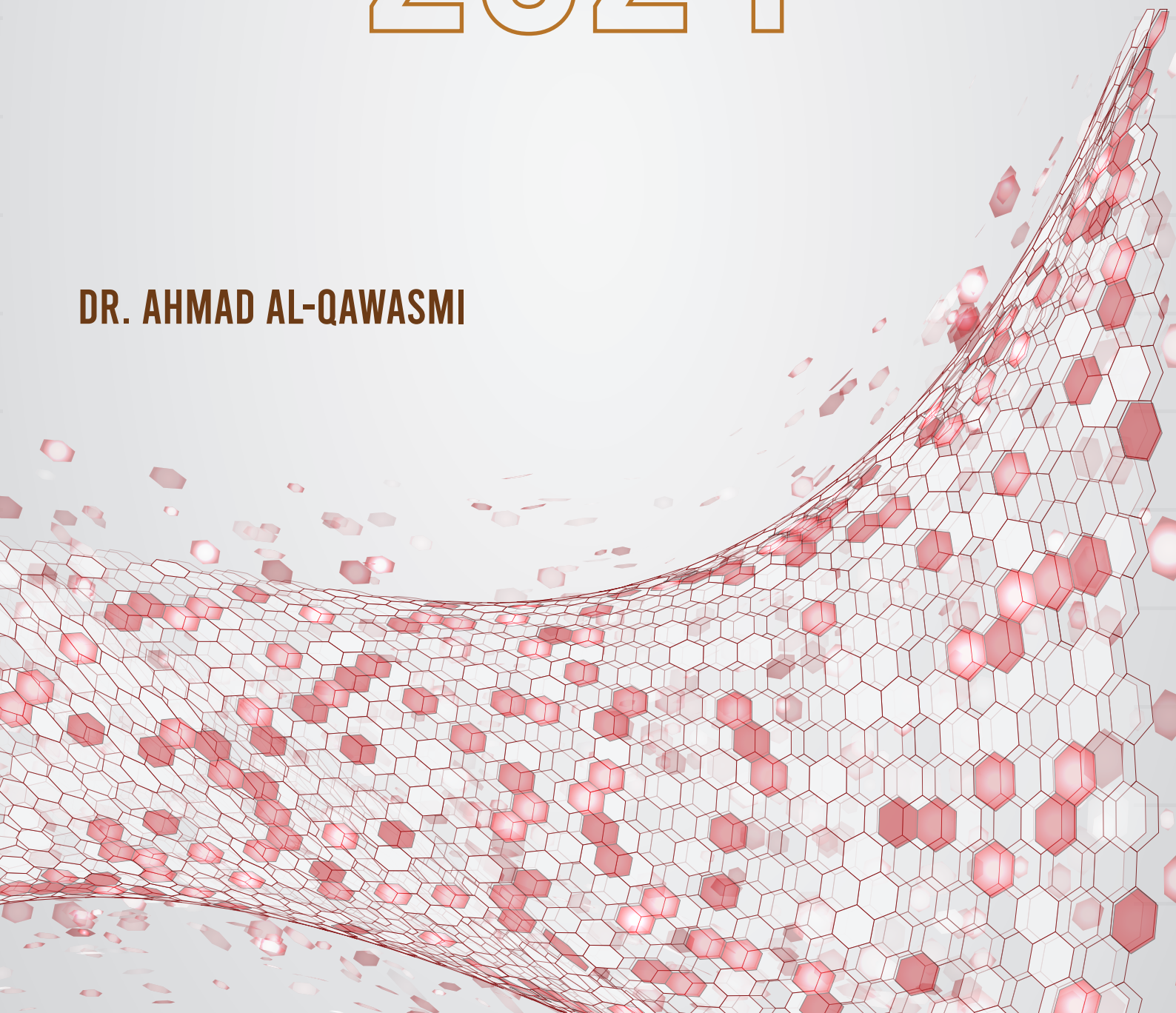


❖ Introduction to histology

- **Histology:** The study of the tissues of the body and how these tissues are arranged to constitute organs
  - **Tissue:** A group *cells* surrounded and impeded in *ECM*
  - **ECM:** Extracellular matrix is a solution between the cells, consisting of water, glycoproteins, electrolytes, …

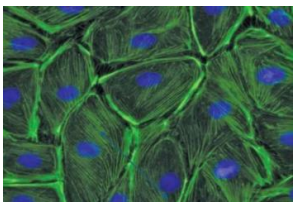
Levels of organization of the body:
- Chemical (Atoms, Molecules)
- Cellular
- Tissue
- Organ
- System

- Tissue processing for histology:
  - ***Fixation:*** Small pieces of tissue are placed in solutions of chemicals that *cross-link* proteins and *inactivate degradative enzymes*, which ***preserves*** cell and tissue structure
    - ✓ Most popular fixative is *formalin*
  - ***Dehydration:*** The tissue is transferred through a series of *increasingly concentrated alcohol* solutions, ending in 100%, which ***removes all water***
  - ***Clearing:*** ***alcohol is removed*** in an *organic solvent* in which both alcohol and paraffin are miscible
  - ***Infiltration:*** the tissue is placed in melted *paraffin* until it becomes completely ***infiltrated*** with it
  - ***Embedding:*** the tissue is placed in a small *mold* with melted paraffin and allowed to ***harden***
  - ***Trimming:*** the paraffin block is trimmed to ***expose*** the tissue for sectioning (*slicing*) on a microtome
    - ✓ The perfect thickness of the section is 7-10 µm
  - ***Staining:*** adding a stain (pigment) to enhance the contrast of the image

❖ Microscope

Resolving power: the ***smallest distance*** between two structures at which they can be seen as ***separate*** objects (high quality)
- Objects smaller or thinner than 0.2 µm (such as a single ribosome or cytoplasmic microfilament) cannot be distinguished
- It determines the quality, clarity and richness of detail, and depends mainly on the quality of its *objective lens*

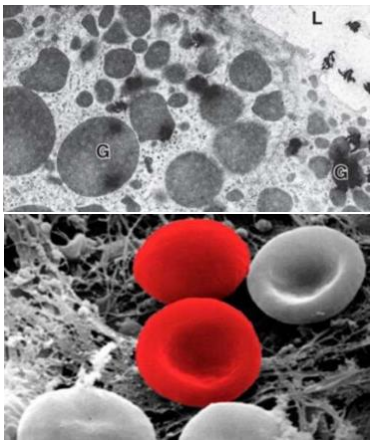
- **Light Microscope**
  - Uses *visible light*
  - Maximum resolution *0.2 µm*
  - Has 2 main lens, ocular and objective lens
    - ✓ The magnification power of the microscope equals the ***multiplication*** of the 2-lens power
    - ✓ Permit magnification of 1000- 1500 time
- Types of light microscope:
  - *Bright-field microscopy*
    - ✓ ***Stained*** tissue is examined with ***ordinary light*** passing through the preparation
    - ✓ Includes an optical system and mechanisms to move and focus the specimen
    - ✓ The ***condenser*** collects and focuses a cone of light that illuminates the tissue slide on the stage
    - ✓ Objective lenses enlarge and project the illuminated image x4, x10
    - ✓ The two eyepieces or oculars magnify this image another x10 and project it to the viewer, yielding a total magnification of x40, x100, or x400
  - *Fluorescence microscopy*
    - ✓ In fluorescence microscopy, tissue sections are irradiated with ***Ultraviolet (UV)*** light and the emission is in the visible portion of the spectrum



Fluorescence: when certain cellular substances are irradiated by light of a proper wavelength, they emit light with a longer wavelength

- ✓ The fluorescent substances appear bright on a dark background
- ✓ For fluorescent microscopy the instrument has a source of UV or other light and filters that select rays of different wavelengths emitted by the substances to be visualized
- ✓ It can use an Immune-Fluorescent staining which is more specific (using antibodies)

➢ *Phase-contrast microscopy*
➢ *Confocal microscopy*
➢ *Polarizing microscopy*



- **Electron Microscope** uses a *beam of electrons*, and it has 2 types:
  - ➢ *Transmission electron microscope (TEM):* produces **2D images** where the electrons penetrate the cell and can produce images for the internal structures and organelles
  - ➢ *Scanning electron microscope (SEM):* produces **3D images** where the electrons can't penetrate the surface producing images for the cell surface