Dept. of Physiotherapy

Fluorescence

- Light mat be absorbed by an electron in ground state, raising the electron into an excited state.
- The excited electron may then decay to lower level.
- If the electron decays to a state higher than the ground state it will emit a photon that is less energetic than the absorbed photon and therefore longer wavelength. This process is called fluorescence
- Fluorescein the chemical used in fundus fluorescein angiography absorbs light at 490nm in the blue region.
- **Sodium fluorescence** refers to the emission of light by sodium atoms when they are excited by an external energy source, such as ultraviolet (UV) light.
- This phenomenon is used in various applications, particularly in scientific research and clinical diagnostics
- Sodium atoms absorb energy, often from UV light, which excites the electrons to a higher energy level.
- When these electrons return to their ground state, they release energy in the form of visible light.
- **Color of Fluorescence** The emitted light typically appears yellow or orange, characteristic of sodium's spectral lines.

Clinical relevance of fluorescence:

Diagnostic Imaging

- **Fluorescence Microscopy**: This technique allows for high-resolution imaging of cellular structures and processes. It is widely used in research and clinical labs to study diseases at the cellular level.
- **Fluorescent Dyes and Probes**: Specific fluorescent dyes can bind to biological molecules (e.g., antibodies, nucleic acids) to visualize structures or functions in tissues. This is crucial in identifying cancerous cells and other pathologies

Cancer Detection

- **Fluorescence-guided Surgery**: During surgery, fluorescent dyes can be used to highlight tumors, helping surgeons differentiate between healthy and malignant tissues, improving surgical outcomes.
- **Tumor Markers**: Certain fluorescent markers are used to identify specific tumor types based on their unique cellular characteristics

Histopathology

- **Fluorescent Staining**: Tissue samples can be stained with fluorescent dyes to enhance the contrast of specific structures, facilitating the identification of abnormalities in histological slides.

Flow Cytometry

- This technique uses fluorescently labeled antibodies to analyze the physical and chemical characteristics of cells. It is essential for immunophenotyping and studying cell populations in various diseases.

Infectious Disease Diagnostics

- **Fluorescent In Situ Hybridization (FISH)**: This method detects specific DNA or RNA sequences in cells, aiding in the diagnosis of infections and genetic disorders.

Therapeutic Applications

- **Photodynamic Therapy (PDT)**: This cancer treatment involves using photosensitizing agents that fluoresce. When exposed to specific wavelengths of light, they produce reactive oxygen species that can kill cancer cells.

Point-of-Care Testing

- Fluorescent assays are increasingly used in rapid diagnostic tests for various conditions, providing quick and accurate results.