EXERCISE # 2

DESCRIPTION OF DIFFERENT TYPES OF MICROSCOPES

There are many types of microscopes. Optical microscope was first invented which was followed by many other advance type of microscopes including Electron Microscope and Scanning Probe Microscope. Following are different types of microscopes:

1. Light microscope
2. Compound light microscope
3. Digital microscope
4. Stereomicroscope
5. Fluorescence Microscope
6. Portable microscopes
7. Inverted microscope
8. Electron microscope
    i. Scanning Electron microscope
    ii. Transmission Electron microscope
    iii. Scanning transmission electron microscope
9. Scanning Probe microscope
10. Confocal microscope

1) LIGHT MICROSCOPE

It employs visible light for detection of small objects and it is the most well-used research tool in the field of biology.

2) COMPOUND LIGHT MICROSCOPE

Compound light microscope is a microscope with more than one lens and its own light source. It has ocular lenses in the binocular eyepieces and objective lenses in a rotating nosepiece closer to the specimen. The strongest compound microscopes have magnifying powers of 1,000 to 2,000 X. As it contains its own light source in its base, a compound light microscope is also considered a bright field microscope. Bright field microscopy simply means that the specimen is lightened from below and viewed from above.

3) DIGITAL MICROSCOPE

The digital microscope was invented in Japan in 1986. It makes use of the computer to visualize the objects not visible to the naked eye. A digital microscope has a digital CCD camera attached to it and connected to a LCD or a computer monitor.

4) STEREOMICROSCOPE

A stereo microscope also known as "dissecting microscope", uses two objectives and two eyepieces which makes it possible to view a specimen under angles to the human eyes forming a stereo 3D optical vision. It has two optical paths at slightly different angles allowing to view the three dimensional image under the lenses.

5) FLUORESCENCE MICROSCOPE

A fluorescence microscope or "epifluorescent microscope" is a special type of a light microscope which instead of light reflection and absorption uses fluorescence and phosphorescence to view the samples and their properties. Fluorescence is a physical phenomenon in which a compound absorbs light and re-emits this as light of a usually higher wavelength. Since the wavelengths of the excitation light source and the emitted fluorescence can be separated very well, the fluorescence can be detected with very high sensitivity, making it possible to visualize even single molecules.

6) PORTABLE MICROSCOPES

These are small, durable and portable microscopes sometimes as small as an ink pen. They provide detailed close images of objects and larger single celled organisms. These hand-held microscopes do not need batteries and may operate using natural light while producing high definition of images without blurred edges.

7) INVERTED MICROSCOPE

An inverted microscope has its light source and condenser on the top, above the stage pointing down, while the objectives and turret are below the stage pointing up. Inverted microscope is useful for observing living cells or organisms at the bottom of a large container (e.g. a tissue culture flask) under more natural conditions than on a glass slide. The stage on an inverted microscope is fixed and focus is adjusted by rotating the objective lens along a vertical axis to bring it closer to or further from the specimen.

8) ELECTRON MICROSCOPE

An electron microscope is an advanced microscope with the highest magnification and resolution capacity. In electron microscope, electron beam is used to illuminate the tiniest particles. Electron microscope is a much more powerful tool in comparison to commonly used light microscopes.

8.1) TRANSMISSION ELECTRON MICROSCOPE

The transmission electron microscope (TEM) is operated on the same basic principles as the light microscope but here electrons are used instead of light. This microscope helps to study the ultra structure.

8.2) SCANNING ELECTRON MICROSCOPE

A scanning electron microscope (SEM) is a type of electron microscope that images a sample by scanning it with a beam. The electrons interact with the atoms that make up the sample producing signals which contain information about the sample's surface topography, composition, and matrix.

8.3) SCANNING TRANSMISSION ELECTRON MICROSCOPE

The scanning transmission electron microscope (STEM) is an important tool for the characterization of nanostructures, ensuring a range of different imaging modes with the ability to provide information on elemental composition and electronic structure. The STEM works on the same principle as the normal scanning electron microscope (SEM). The difference with SEM is that thin specimens are used so that transmission modes of imaging are also available.

9. SCANNING PROBE MICROSCOPE (SPM)

These microscopes are used in research and development as standard analysis tools. Images are highly magnified and are visualized as three-dimensional-shaped-specimens in real time. SPMs employ a delicate probe to scan the surface of the specimen eliminating the limitations generally found in electron and light microscopy.

10. CONFOCAL MICROSCOPE

It ensures an optical imaging technique to increase optical resolution and contrast of a micrograph by using point illumination and a spatial pinhole to eliminate out-of-focus light in specimens that are thicker than the focal plane. It provides the reconstruction of three-dimensional structures from the obtained images. This technique has its useful application in life sciences.

QUESTION # 1. What is difference between light and compound light microscope?

QUESTION # 2. What are the uses of electron microscope?

QUESTION # 3. What is electron microscopy?

QUESTION # 4. What is difference between scanning and transmission electron microscope?

QUESTION # 5. Which type of electron microscope is used to examine the ultra structure of the specimens?