**ASSIGNMENT TITLE: ELECTTRON MICROSCOPY**

**COURSE TITLE: ELECTRON MICROSCOPIC TECHNIQUE AND ULTRASTRUVTURE**

**COURSE CODE: ANA 402**

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**MATRIC NUMBER: 15/MHS01/015**

**QUESTIONS:**

1. WRITE AN ESSAY ON THE HISTORY OF MICROSCOPY

**History of the Microscope**

 **Who Invented the First Microscope?**

The history of the microscope spans centuries.

Roman philosophers mentioned “burning glasses” in their writings but the first primitive microscope was not made until the late 1300’s. Two lenses were placed at opposite ends of a tube.

This simple magnifying tube gave birth to the modern microscope.

**First Microscope**

**vintage microscope**

Grinding glass to use for spectacles and magnifying glasses was commonplace during the 13th century. In the late 16th century several Dutch lens makers designed devices that magnified objects, but in 1609 Galileo Galilei perfected the first device known as a microscope.

Dutch spectacle makers Zaccharias Janssen and Hans Lipperhey are noted as the first men to develop the concept of the compound microscope. By placing different types and sizes of lenses in opposite ends of tubes, they discovered that small objects were enlarged.

**Lens Improvement**

Later in the 16th century, Anton van Leeuwenhoek began polishing and grinding lenses when he discovered that certain shaped lenses increased an image’s size. The glass lenses that he created could enlarge an object many times. The quality of his lenses allowed him, for the first in history, to see the many microscopic animals, bacteria and intricate detail of common objects.

**Leeuwenhoek is considered the founder of the study of microscopy and an played a vital role in the development of cell theory.**

**Achromatic Lens**

The microscope was in use for over 100 years before the next major improvement was developed. Using early microscopes was difficult. Light refracted when passing through the lenses and altered what the image looked like. When the achromatic lens was developed for use in eyeglasses by Chester Moore Hall in 1729, the quality of microscopes improved. Using these special lenses, many people would continue to improve the visual acuity of the microscope.

**Mechanical Improvements**

During the 18th and 19th centuries, many changes occurred in both the housing design and the quality of microscopes. Microscopes became more stable and smaller. Lens improvements solved many of the optical problems that were common in earlier versions.

The history of the microscope widens and expands from this point with people from around the world working on similar upgrades and lens technology at the same time.

**August Kohler** is credited with inventing a way to provide uniform microscope illumination that allowed specimens to be photographed.

**Ernst Leitz** devised a way to allow for different magnifications using one microscope by putting multiple lenses on a movable turret at the end of the lens tube.

Looking for a way to allow more light-spectrum colors to be visible, Ernst Abbe designed a microscope that in a few years would provide Zeiss with the tools to develop the ultraviolet microscope.

**Modern Technology Improving Microscopy**

The invention of the microscope allowed scientists and scholars to study the microscopic creatures in the world around them.

When learning about the history of the microscope it is important to understand that until these microscopic creatures were discovered, the causes of illness and disease were theorized but still a mystery.

The microscope allowed human beings to step out of the world controlled by things unseen and into a world where the agents that caused disease were visible, named and, over time, prevented.

**Charles Spencer** demonstrated that light affected how images were seen. It took over one hundred years to develop a microscope that worked without light.

The first electron microscope was developed in the 1930’s by Max Knoll and Ernst Ruska.

Electron microscopes can provide pictures of the smallest particles but they cannot be used to study living things. Its magnification and resolution is unmatched by a light microscope.

However, to study live specimens you need a standard microscope.

Scanning probe microscopy allows specimens to be viewed at the atomic level which began first with the scanning tunneling microscope invented in 1981 by Gerd Bennig and Heinrich Rohrer. Later Bennig and his colleagues, in 1986, went on to invent the atomic force microscope bringing about a true era of nanoresearch.

1. DIFFERENTIATE BETWEEN THE LIGHT AND ELECTRON MICROSCOPE

|  |  |  |
| --- | --- | --- |
| S/N | LIGHT MICROSCOPE | ELECTRON MICROSCOPY |
| 1. | Uses ray of visible light to form highly magnified images of tiny areas of materials or biological specimen . | Uses beam of electrons to magnify the image of an object. |
| 2. | Uses light (approx. 400-700nm) as an illuminating source. | Uses electron beam (approx.1nm) as an illuminating source. |
| 3. | Lower magnification than electron microscopic.  | Higher magnification than light microscope.  |
| 4. | No risk of radiation leakage.  | Risk of radiation leakage.  |
| 5. | Specimen preparation takes about a few minutes or an hour.  | Specimen preparation takes several days. |
| 6. | Low resolution. | High resolution. |
| 7. | Inexpensive and requires low maintainance cost. | Expensive and requires high maintainance cost. |
| 8. | Both live and dead specimen can be seen. | Only dead and dried specimen can be seen. |
| 9. | The image of formation depends upon the light absorption from the different zones of the specimen. | The image formation depends upon the electron scattering. |
| 10. | The image is seen through the ocular lens no screen needed.  | The image is received on a zinc sulphate fluorescent screen. |
| 11. | Useful magnification of 500x to 1500x  | Direct magnification as high as 16000x and photographic magnification as high as 1000000x |

1. DIFFERENTIATE BETWEEN THE SEM AND TEM

|  |  |  |  |
| --- | --- | --- | --- |
| S/N | DIFFERNCE BASED ON | SEM | TEM |
| 1. | Type of electron | Scattered scanning electron. | Transmitted electron. |
| 2. | High tension | Approx. 1-30kv. | Approx. 60-300kv. |
| 3. | Specimen thickness | Any. | Typically less than 150nm. |
| 4. | Type of info | 3D image of surface.  | 2D projection image of inner structure.  |
| 5. | Max magnification | Up to approx. 1-2 million times. | More than 50million times. |
| 6. | Max. FOV | Large.  | Limited. |
| 7. | Optimal spatial resolution  | Approx.0.5nm. | Less than 50pm. |
| 8. | Large formation | Electrons are captured and counted by detectors, image on PC screens. | Direct imaging on fluorescent screen with CCD. |
| 9. | operation | Little or no sample preparation easy to use. | Laborious sample preparation trained user required. |