Stereo microscope

1. Definition

Stereoscopic microscopes is a type of digital optical microscope designed with a low magnification power (5x-250x), by use of light reflected from the surface of the specimen, and not the light reflected the specimen. Its primary role is for dissection of specimens and viewing and qualitatively analyzing the dissected samples.

2. Parts of Dissecting microscope or Stereo microscope

A. **LED illuminators-** For some of the dissecting Microscopes, they have an inbuilt LED illuminator as a source of light.

B. **Eyepieces-** They have two eyepieces each focusing different pathways of the light into and out of the specimen, each with its own magnification power. To increase the magnification, the use of auxiliary eyepieces can be used.

C. **Objective lenses-** They also have different magnifications, focusing the image on the digital camera, and to improve magnification, the addition of auxiliary objectives is used.

D. **Stage-** This is the apparatus for placing the specimen. they are large hence they can hold large specimen apparatus.

E. **Optical system-** This is the system that is found between the fixed and the zoom magnification which offers fixed-focus lensing.

F. **Digital camera-** It is temporarily fixed for most dissecting microscopes for capturing images and recording the outcome of the images. It captures 2D and 3D images depending on the type of digital camera that is installed.

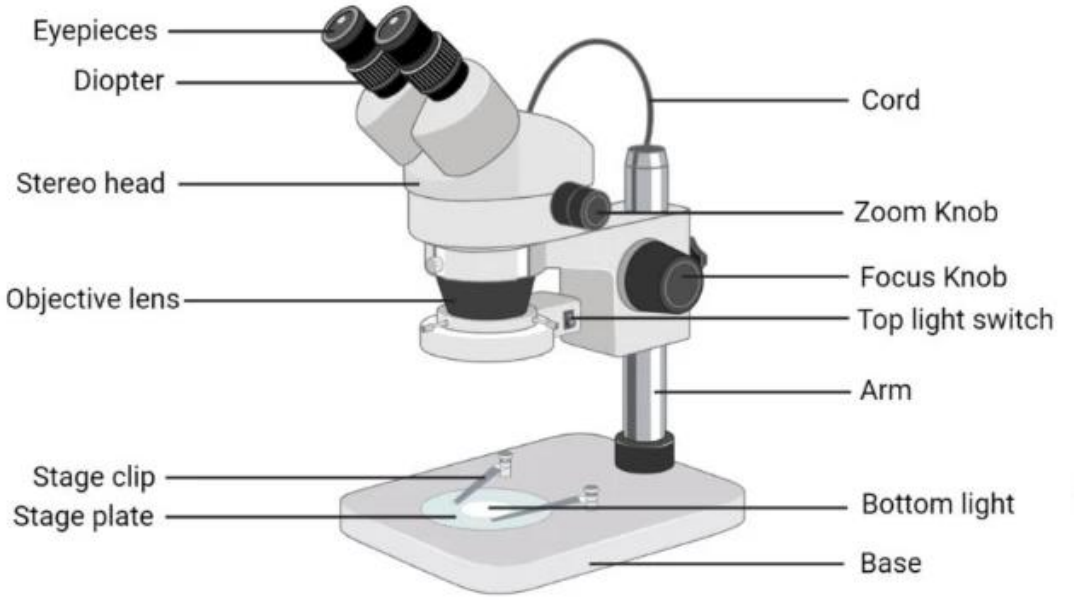

Fig 1: stereoscopic microscope parts. https://microbenotes.com/

3. Principle of Stereo microscope

The working principle of the dissecting Microscope depends on the two types of light paths used by the microscope's objectives and eyepiece. Each light path provides a different angle of viewing. They have the top light which is used while dissecting and the bottom light that is used to view the images. This lighting is enabled by the construction of two eyepieces (binocular stereoscope) each showing a different type of light pathway, each providing a viewing comfort area. Being a digital microscope, the images are viewed live on a computer monitor screen in 3-dimensional visuals. They also offer a very close observation of small specimens such as insects where the image produced is normally larger than the sample size, an effect known as macro-photography. The image is recorded and in complex samples, the topography (surface) is analyzed in 3D. The dissecting microscope works with two magnification systems: Fixed (primary) magnification where two objective lenses provide a degree of magnification and the Zoom (pancratic) magnification which offers a continuous magnification at variant ranges, using the auxiliary objectives whose function is to increase total magnification depending on some factors. The variance between the zoom and the fixed magnification can be achieved by changing the eyepiece lenses. Between the fixed and the zoom magnification is an optical system known as the Galilean optical system which has fixed-focus lenses that confer fixed magnification

for different sets of magnification such as two sets of magnifications offers four-magnifications, three sets offer six-magnifications, etc.

4. **How to Use a Stereo Microscope**

- Set the microscope on a flat surface in a stable and comfortable position.
- Turn on The Transmitted/Oblique illuminator. Place a small solid specimen onto the stage such as a card, coin or any other flat, detailed object.
- Turn the Magnification adjustment knob to the lowest power and bring the image into focus using the focus control.
- Adjust the eyepieces for the correct interpupillary distance to suit you. Do this by moving the eyepieces closer together or farther apart until a single field of view is observed (B). Now, set the Dioptric adjustment rings on both eyepieces to the zero position (A).
- Use the Magnification adjustment knob to set the highest magnification. Bring the image into focus with the focusing knob. Center the image on some clear point of detail on the specimen.
- Adjust the microscope down to the lowest magnification using the Magnification adjustment knob. The image could be slightly out of focus.
- Do not adjust the focus with the focusing knob. Adjust the focus for each eye separately using the eyepiece Dioptric adjustment rings. Your microscope is now "parfocal". This means that as the microscope is zoomed from high to low magnification the image will stay in focus throughout the entire range. Each individual will have a different setting.

5. Types of Dissecting microscopes or Stereo microscope

a. **Stereo Zoom Dissecting Microscope-** They are trinocular or binocular dissecting microscopes with a zooming range of 6.7x-45x. They can be attached to the digital camera which takes photos of the viewing images. They have a dual-LED illuminator and they can rotate at 360°. Magnification can be changed by adding auxiliary objectives or different eyepieces.

b. **Digital Tablet Dissection Microscope-** These are high-end dissecting microscopes. They have a touch screen LCD tablet camera with a continuous magnification of 6.7x-45x. They have auxiliary eyepieces whose magnification ranges can be increased or decreased. Auxiliary lenses can also be added to the

objectives for modifying the magnification. They have a 5.0-megapixel digital camera for capturing images and recording videos directly into the tablet or a USB cable. They have an in-built LED illuminators both at the top and bottom of the microscope, each operating separately.

c. **Stereo zoom boom stand microscopes-** The have a large base and the largest stage for viewing large samples. They have LED lighting or optional dual-pipe lighting. They have a zooming range of 6x-45x which can be altered upward by adding auxiliary lenses or eyepieces.

d. **Stereo Zoom Dissecting Microscope-** this is a compact stereo zoom dissecting Microscope with a zooming range of 10x-30x producing sharp parfocalled images. They have a rotating head hence the eyepiece can be positioned away and toward the specimen. they have a halogen lamp of 10 watts and fluorescent lighting of 5 watts.

e. **Dual Power Dissecting Microscope-** It has a dual-powered dissecting microscope of 10x and 30x, with a 360° rotation ability, for focussing and viewing. They have a dual objective pair, parfocalled, parcentered, and achromatic. Rotating the lenses allows a change of image magnification. It also uses a high LED intensity light ring which fills the surface with light. With a flexible stand, it can be lifted head high for viewing larger specimens.

f. **Single Power Stereo Dissection Microscope-** they have very low magnification power ranging from 10x-40x with inclined eyepieces at 45°C. they also have diopter adjustments of 50mm to 70mm.

g. **Single Magnification Handheld Pocket Microscope-** This is a single powered handheld dissecting microscope with two magnification powers and it does not require light. Manufactured in Japan, it has high optical quality glass with a lot of ease in useability and its compact size makes it portable.

6. Applications of Dissecting microscope or Stereo microscope

Like most microscopes, it is used in a wide range of fields including manufacturing, medical, quality control, inspection and biomedical studies like the entomological study of insects and some of its functions include:

- Studying the topography of solid samples
- For dissection
- For microsurgical procedures
- For the manufacturing of watches, circuit boards, and their inspections
- Used for inspection of fractures (fractography)
- Used in forensic engineering

7. Maintaining of stereo microscope

Maintaining your stereo microscope is crucial for ensuring its longevity and optimal performance. Regular maintenance not only extends the life of your equipment but also guarantees clear and precise results during usage. This guide provides a comprehensive overview of essential maintenance tasks that should be part of your routine.

A. Daily Care Routine

Implementing a daily care routine for your stereo microscope is essential to maintain its performance and longevity. These simple, everyday tasks help prevent damage and ensure that your microscope is always ready for use, providing you with clear and precise observations every time.

- Cleaning the Lenses

Lenses are the most critical components of your microscope. Keeping them clean ensures clarity and precision.

- Use of Lens Cleaning Solution and Microfiber Cloth:

Always use a dedicated lens cleaning solution and a microfiber cloth to clean the lenses. This prevents scratches and maintains the quality of the optical components. Never use household cleaners or rough materials that could damage the delicate surfaces of the lenses. Make sure the cleaning solution is specifically formulated for optical lenses, as other solutions might leave residues or cause damage.

B. Dust Prevention

Dust can degrade the performance of your microscope over time. Keeping your microscope free from dust is essential for maintaining its optical quality and mechanical functionality.

- **Using Dust Covers and Proper Storage:**

Always cover your microscope with a dust cover when not in use. This simple step prevents dust from settling on the lenses and other components. Store it in a clean, dry place to prevent dust accumulation. The storage area should be away from windows and vents, which can introduce dust and moisture.

- Choosing the Right Dust Cover:

Select a dust cover made of breathable material to avoid trapping moisture, which can lead to mold and mildew. A good dust cover should fit snugly around the microscope, covering it completely.

- Proper Placement:

Place the microscope in a cabinet or a dedicated storage box if possible. This adds an extra layer of protection against dust and environmental pollutants.

C. Proper Handling

Handling your microscope correctly is essential to avoid damage. Proper handling ensures that your microscope remains in good condition and functions optimally for years to come.

- **Avoiding Fingerprints and Scratches:**

Use gloves or handle the microscope by its base and arm to prevent fingerprints on the lenses and body. Fingerprints can leave oily residues that are difficult to clean and can attract dust and dirt.

- **Wearing Gloves:**

When handling the microscope, especially the lenses, wearing cotton or latex gloves can prevent oils and dirt from transferring onto the microscope. This is particularly important during cleaning and adjustments.

- **Holding the Microscope:**

Always hold the microscope by its base and arm. This ensures a firm grip and minimizes the risk of dropping it. Avoid touching the lenses directly; use lens tissue or a blower to remove dust.

- **Correct Ways to Handle and Move the Microscope:**

Always carry the microscope with both hands, holding the arm with one hand and supporting the base with the other. This technique provides stability and reduces the risk of accidents.

- **Carrying the Microscope:**

Before moving the microscope, ensure that all parts are securely fastened. Carry it close to your body to maintain balance and control. Keep the path clear of obstacles to avoid tripping or bumping into anything.

- **Setting Down the Microscope**:

Place the microscope gently on a stable, flat surface. Ensure the surface is sturdy enough to support the weight of the microscope without wobbling or tipping over.

D. Monthly Maintenance Tasks

Monthly maintenance tasks are crucial for the continued smooth operation and longevity of your stereo microscope. These routine checks and adjustments help identify and address minor issues before they become major problems, ensuring your microscope remains in top working condition.

- **Inspecting the Mechanics**

Regular mechanical inspections ensure smooth operation and help prevent issues that could disrupt your work. By routinely checking and maintaining the mechanical parts of your microscope, you can ensure it remains in top condition.

- **Checking the Focus Mechanism and Stage for Smooth Operation:**

Test the focus knobs and stage for smooth movement. If you notice any resistance or irregularities, it may be time for lubrication.

    - **Focus Mechanism:**

Rotate the focus knobs gently to check for smooth and consistent movement. If you feel any stiffness or hear unusual noises, inspect for dust or debris that might be causing the issue.

- **Stage Movement:**

Move the stage back and forth, ensuring it slides smoothly without sticking. Any jerky movements could indicate a need for cleaning or lubrication.

- **Lubricating Moving Parts Where Necessary:**

Apply a small amount of microscope-specific lubricant to the moving parts to maintain smooth operation.

- **Choosing the Right Lubricant:**

Use only lubricants recommended by the microscope manufacturer. These are designed to work with the specific materials and tolerances of microscope components.

- **Applying Lubricant:**

Apply the lubricant sparingly. Excess lubricant can attract dust and create additional problems. Use a fine applicator to target the precise areas that need lubrication, such as gears and sliding surfaces.

- **Frequency of Lubrication:**

Depending on the frequency of use, lubricate the moving parts every few months. Over-lubrication can be as harmful as no lubrication, so follow the manufacturer's guidelines.

E. Checking Electrical Components

Ensuring electrical components are functioning correctly is vital for uninterrupted use. Regular checks and timely maintenance of the electrical parts of your microscope can prevent unexpected downtimes and extend the lifespan of your equipment.

Ensuring All Lights and Electronic Components Are Functioning:

Regularly check that all lights and electronic components are working. Proper illumination is crucial for accurate observations, so it's essential to ensure that the lighting system is functioning optimally. Replace any burnt-out bulbs promptly to maintain consistent lighting.

- **Regular Inspection:**

Develop a routine to inspect all electronic components, including lights, power switches, and any digital displays. Ensure that all connections are secure and that there are no visible signs of wear or damage.

- **Bulb Replacement:**

Always have spare bulbs on hand to replace any burnt-out bulbs immediately. Follow the manufacturer's instructions for replacing bulbs to avoid damaging the socket or the bulb itself. When handling bulbs, use gloves or a cloth to avoid transferring oils from your skin, which can reduce the lifespan of the bulb.

Troubleshooting Common Electrical Issues:

If you encounter any electrical issues, consult the user manual or seek professional assistance. Addressing electrical problems promptly can prevent more severe damage to your microscope.

- **Consulting the Manual:**

Your microscope's manual will often have troubleshooting tips for common electrical issues. Refer to it first to see if you can resolve the problem yourself.

- **Professional Assistance:**

If the issue persists or seems complex, do not attempt to fix it yourself. Seek professional assistance to avoid causing further damage. Certified technicians have the expertise to diagnose and repair electrical problems safely and effectively.

- **Regular Maintenance:**

Consider scheduling regular professional maintenance checks for your microscope. This can help identify and fix potential electrical issues before they become significant problems.

F. Annual Deep Clean

An annual deep clean is essential to keep your stereo microscope in optimal condition. This comprehensive cleaning process involves disassembling the microscope, thoroughly cleaning each component, and reassembling it with care. Performing a deep clean once a year ensures that your microscope maintains its performance and extends its lifespan.

- Disassembling for Deep Cleaning

A deep clean once a year keeps your microscope in top condition. This process involves carefully disassembling the microscope to thoroughly clean each component. Proper cleaning and reassembly ensure that your microscope performs optimally and has a prolonged lifespan.

- **Step-by-Step Guide on Safely Taking Apart and Cleaning Components:**

Preparation:

Before disassembling, gather all necessary cleaning tools and solutions, such as lens cleaning solution, microfiber cloths, soft brushes, and the user manual. Ensure your workspace is clean and well-lit to avoid losing small parts.

- **Disassembling the Microscope:**

Follow the manufacturer's instructions carefully. Start by removing larger components like the eyepieces, objective lenses, and stage. Keep a container handy to store screws and small parts safely.

Take photos at each step of disassembly to use as a reference when reassembling the microscope. This helps ensure all parts are returned to their correct places.

- **Cleaning Each Part:**

Use appropriate solutions and tools to clean each part thoroughly. For lenses, use lens cleaning solution and a microfiber cloth. For other components, use a soft brush to remove dust and debris, and a damp cloth for any sticky residues.

- **Which Parts to Be Extra Careful With During Cleaning:**

Lenses and Optical Components:

These are the most delicate parts of the microscope. Use gentle, circular motions to clean the lenses, starting from the center and moving outward. Avoid applying excessive force to prevent scratches.

Electrical Components:

Ensure that all electronic parts are dry before reassembling. If any part requires cleaning, use a dry brush or a can of compressed air to remove dust without causing moisture damage.

- **Mechanical Parts:**

Lubricate moving parts sparingly after cleaning to maintain smooth operation. Make sure no lubricant comes into contact with the optical or electronic components.

Be very careful when cleaning and handling the lenses and other delicate optical components. Incorrect cleaning techniques or using the wrong tools can easily damage these critical parts.

- **Professional Servicing**

Professional servicing can address issues beyond regular maintenance. While routine cleaning and adjustments can be handled at home, certain problems require the expertise of a certified technician to ensure your microscope remains in optimal condition.