Microscope

CHAPTER 1

- Microscopy refers to the use of microscopes to visualize and magnify objects that are too small to be seen with the unaided eye.
- The first compound microscope is attributed to Zacharias Janssen and Hans Janssen (c. 1590). The term *microscope* was coined by Giovanni Faber in 1625. ***Antonie van Leeuwenhoek*** (1670s) developed powerful single-lens microscopes and is regarded as the "father of microbiology" for his pioneering observations of microorganisms.

Classification of Microscopes

- Microscopes are broadly classified into three types:
  1. Optical (light) microscopes—use visible light (photons) for image formation.
  2. Electron microscopes—use beams of electrons, providing much higher resolution.
  3. Scanning probe microscopes—use a physical probe to scan and generate surface images at the atomic level.

Optical Microscopes

A. Simple Microscope

- Consists of a single convex lens (magnifying glass).
- Provides low magnification.

B. Compound Light Microscope

- Consists of two lenses:
  - Objective lens (near the specimen)
  - Eyepiece/ocular lens (near the observer)
- It is the most commonly used microscope in biological sciences.

Types of Compound Light Microscopes

1. *Bright-field microscope:* Uses transmitted light; specimen appears dark against a bright background. Use: Routine histological examination.
2. *Dark-field microscope:* Oblique illumination; only scattered light enters objective, producing a bright specimen on a dark background. Use: Observing unstained and living specimens.
3. *Phase-contrast microscope:* Converts phase differences into intensity differences using phase annulus and plate. *Use:* For observing living, unstained cells.
4. *Fluorescence microscope:* Uses fluorophores emitting longer wavelength light. Use: For immunofluorescence, immunohistochemistry, and *in situ* hybridization.
5. *Polarizing (polarized light) microscope:* Uses polarized light to detect birefringence (double refraction). Use: For studying structures such as bone, teeth, collagen fibers, and crystalline substances.

Parts of Compound Light Microscope

Optical Parts

These determine magnification and resolution.

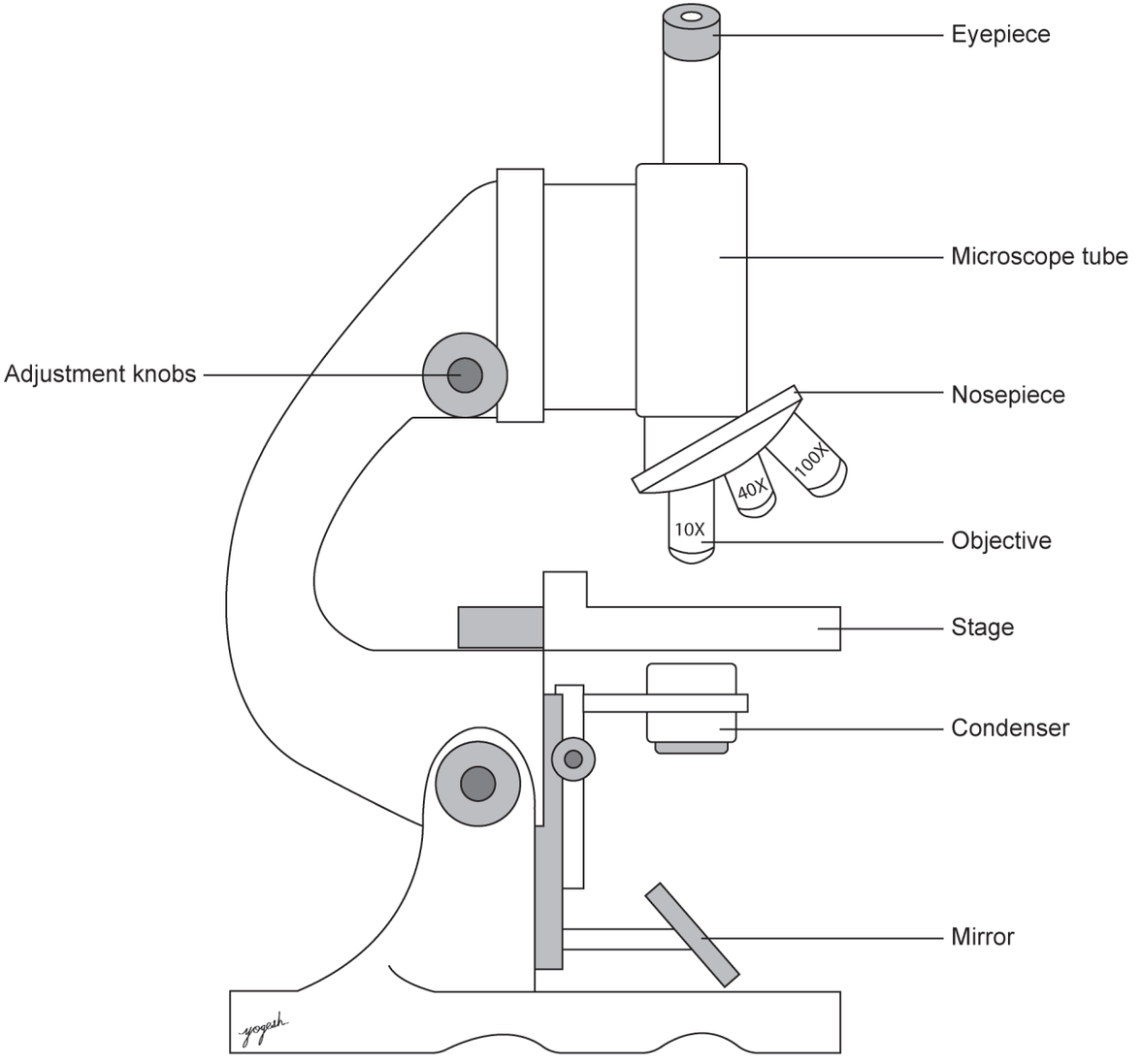
1. *Light source:* Modern microscopes use built-in LED, halogen, or tungsten lamps. A mirror (plane for daylight, concave for artificial light) may be present in simpler models.
2. *Condenser:* Concentrates and focuses light onto the specimen. The iris diaphragm regulates light intensity, and condenser height can be adjusted for optimal illumination.
3. *Objective lenses:* Located near the specimen; provide primary magnification. Common powers include 4× (scanning), 10× (low power), 40× (high power), and 100× (oil immersion).
4. Numerical aperture (NA) reflects light-gathering ability and resolving power.
5. *Eyepiece (ocular):* Further magnifies the image, usually 10 (range: 5×–20×). Can be monocular or binocular. Produces a magnified virtual image.

Mechanical (Non-Optical) Parts

These provide support and enable manipulation.

1. *Base (stand):* Heavy part that stabilizes the microscope.
2. *Arm:* Connects the base to the upper parts; used for carrying.
3. *Stage:* Platform for the slide, equipped with clips or a mechanical stage for precise X–Y movement (often with vernier scales).
4. *Adjustment knobs:*
   a. Coarse adjustment: Rapid focusing
   b. Fine adjustment: Precise focusing
5. *Body tube:* Connects the eyepiece to the objective lenses and maintains proper optical alignment.
6. *Nosepiece (revolving turret):* Holds objective lenses and allows switching between magnifications.

1. Microscope



1. Microscope

Q. Draw a well-labelled diagram of compound light microscope.

Signature of teacher: _____