Biology 1120

Laboratory Exercise 3: Cell Structure

Work in groups of 3 or 4, using the Zeiss compound microscopes. There are only limited copies of most of the slides you will use today, so please do not monopolise them all. You do not have to work through the slides in the exact order that they are described in this lab.

Oil Immersion

Some of the material today may require the use of oil immersion lenses for best viewing. The procedures are very similar to what you experienced last week with the microscopy lab. If your microscope does not already have an oil immersion (100 power) lens attached, get one from the side of the room. Remove the cap covering the blank spot on the objective lens ring and screw the oil immersion lens into this spot. Focus and view a slide as before, but when you are ready for viewing with the oil immersion lens, rotate the lens out of perpendicular, then place a SMALL drop of immersion oil on the slide directly below the spot where the lens will sit. The lens must contact the oil to allow proper focusing. Examine the slide material as before, but make sure that no other lens contacts the oil. When you are done with the slide, remove it from the stage and clean it with a piece of lens paper to wipe up the excess oil. Use a small amount of alcohol to remove any remaining oil. Use this same procedure to clean off the oil immersion lens.

Microscopic Material

The material you will be examining today is meant to show you the diversity of cells and cell structures. You will see more evidence of cellular diversity when you carry out the histology lab in the near future. Unless otherwise noted, you will get the best detail using 400 power for viewing these slides. There are only a few instances when you will need oil immersion to gain the higher resolution to pick out fine structure. Sketch examples of each of the structures you can find. Label your sketches, including as many cell components as you can identify. Calculate the magnification of your drawings and include that value in the caption beneath each sketch.

Slides

Numbers after the slide descriptions are the serial numbers for the specific microscope slide. Each slide is prepared using a variety of staining techniques to highlight one or more specific cell component, such as a cell organelle. These structures are in bold type in the following descriptions. Some components on the slides are very easily detected but a few are more challenging. Read the descriptions for each slide to get some hints that will help you identify the various structures.

1. Generalised Animal Cell (93 W 2200)

This is a typical slide of an animal cell and will allow you to see the sort of structure that is typically visible, including the **cell membrane**, **nucleus** and **cytoplasm** and not much else.

2. Spinal Cord (93 W 2230)

This slide has been prepared to allow you to easily see the **nucleus**, **nucleolus** and **nuclear membrane**. The **cytoplasm** will contain a set of lines marked with dark dots. These are **ribosomes** attached to the **rough endoplasmic reticulum**. The rough E.R. will carry out the process of protein synthesis.

3. Adrenal Gland (93 W 4305)

There are a number of different cell types visible on this slide. The ones of interest today, are located in the adrenal cortex, the area near the outer surface of the sample. The outer surface will be the edge that appears intact. In this region of the gland you should be able to see cells containing clear, hollowed out ellipses and circles in the cytoplasm. The structures you are seeing are the **smooth endoplasmic reticulum**. It is used to manufacture steroids in these cells.

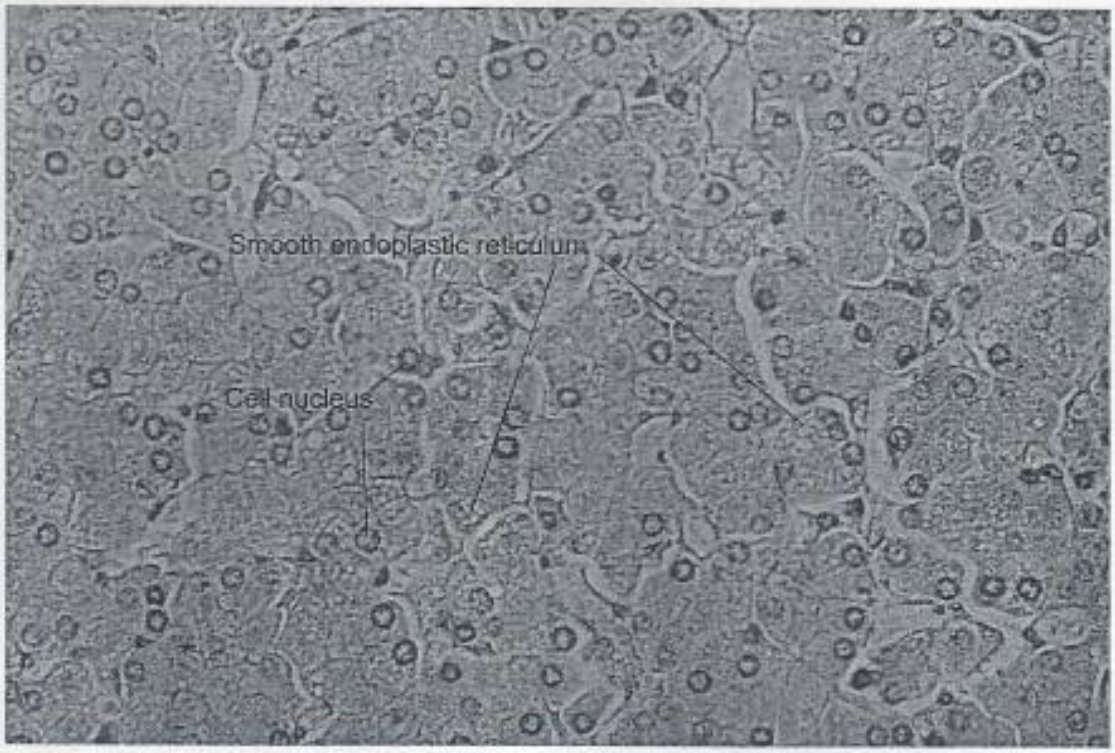

Figure 6. Photomicrograph of an adrenal gland showing the transparent –looking smooth endoplasmic reticulum in several cells and the darker cell nuclei.

4. Dorsal Root Ganglion (93 W 2221)

This slide is treated with silver stain that turns structures black. Again, there are a number of different cell types present. Look for the large, circular to cuboidal cells near the edge. There will be a hollowed out appearance to these structures. When you find these cells, you will see black circles and ellipses in the cytoplasm near the nucleus. This is the **Golgi apparatus** that processes proteins for export from the cell. The proteins in this case may be neurotransmitters or other proteins.

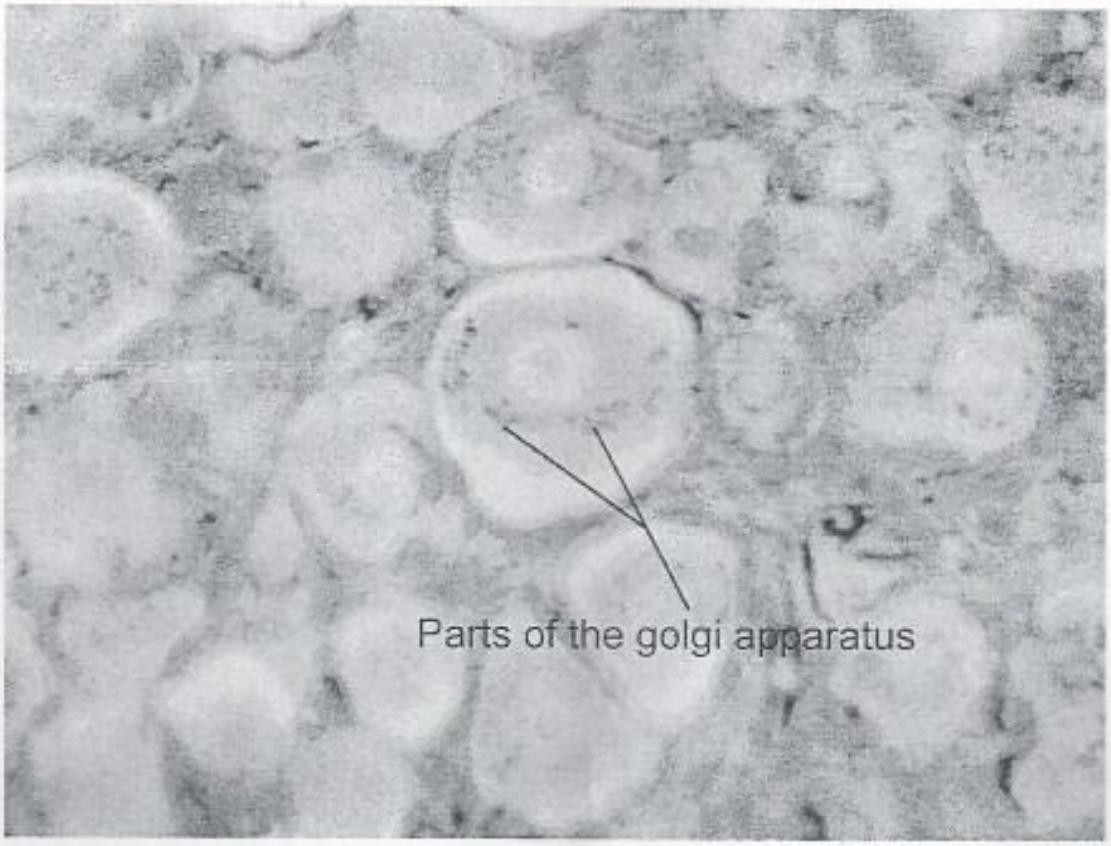

Figure 7. Photomicrograph of a sectioned dorsal root ganglion showing the golgi apparatus near the nucleus of a cell..

5. Amphiuma liver (93 W 2215)

This cell shows the **mitochondria** very clearly. They will appear as dark blue, large organelles throughout the tissue although they seem to be more common at the periphery. Inside the mitochondria you should be able to see the **cristae** or membrane folds that are important in the chemical reactions that allow mitochondria to generate energy for the cell through cellular respiration.

6. Mammal liver (93 W 4562)

Look near the canaliculi or small channels in the tissue. The cells surrounding these channels will often contain dark purple circular organelles just smaller than the cell nuclei. The dark purple organelles are **lysosomes**, vesicles containing strong degradation enzymes that are used for digestion of materials.

7. Pancreas (93 W 4600)

Look at the large, purplish cells throughout the sample. In these cells you should see a nucleus as usual. You should also see large, clear circles of about the same size as the nucleus. These vesicles will most likely be lying just under the cell membrane. These are **exocytotic vesicles** containing pancreatic enzymes. Depending on the quality of your slide you may need oil to see these vesicles, as they are fairly small.

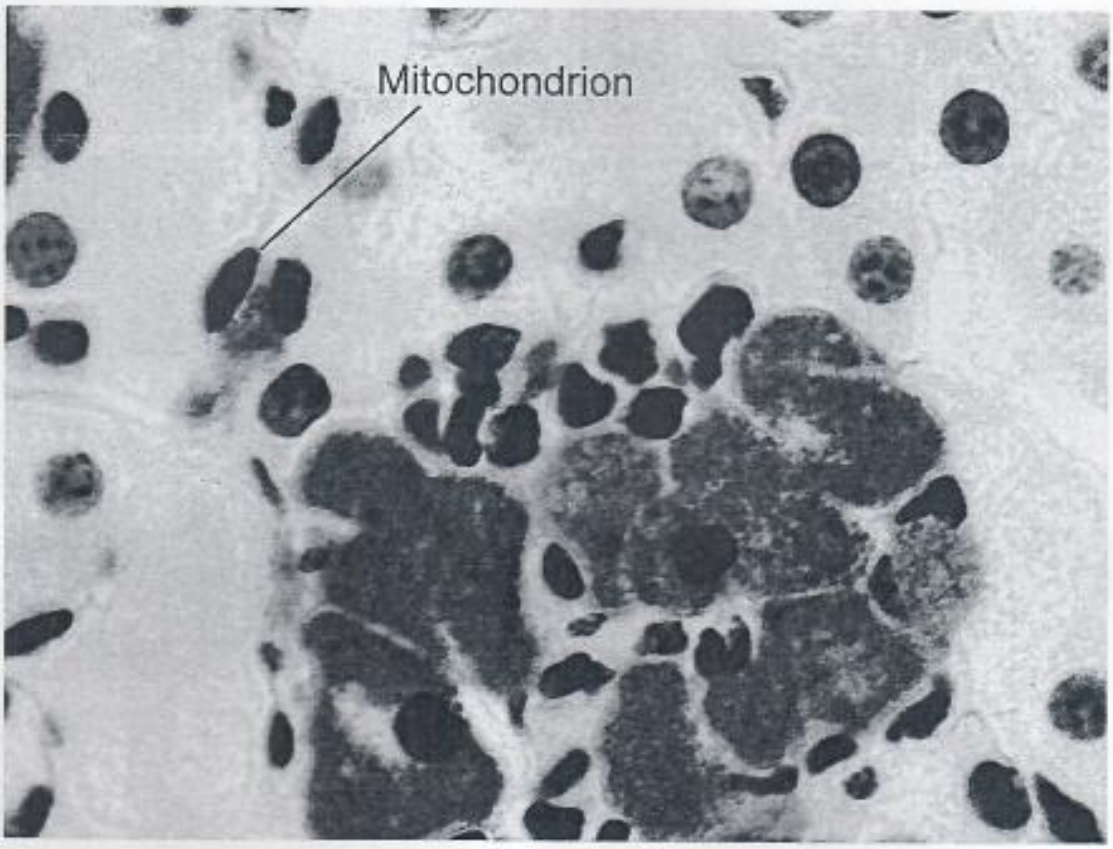

Figure 8. Photomicrograph of Amphiuma liver showing stained mitochondria.

8. Liver Macrophage (93 W 2238)

The structures that we are looking for in this slide are fairly hard to pick out. Look in areas known as the spaces of Disse: spaces or fissures between the typical hepatocytes (liver cells) that make up most of this tissue sample. In these breaks in the tissue, you will find a special type of immune cell known as a Kupffer cell. These cells will appear as large irregular cells with a clear to purple colour. They are a type of white blood cell known as a macrophage and their role is to engulf and destroy old and damaged erythrocytes or red blood cells. The engulfed erythrocytes are what we are looking for as this slide is demonstrating **endocytosis** and **endocytotic vesicles**. You are likely to need oil immersion to see this set of vesicles.

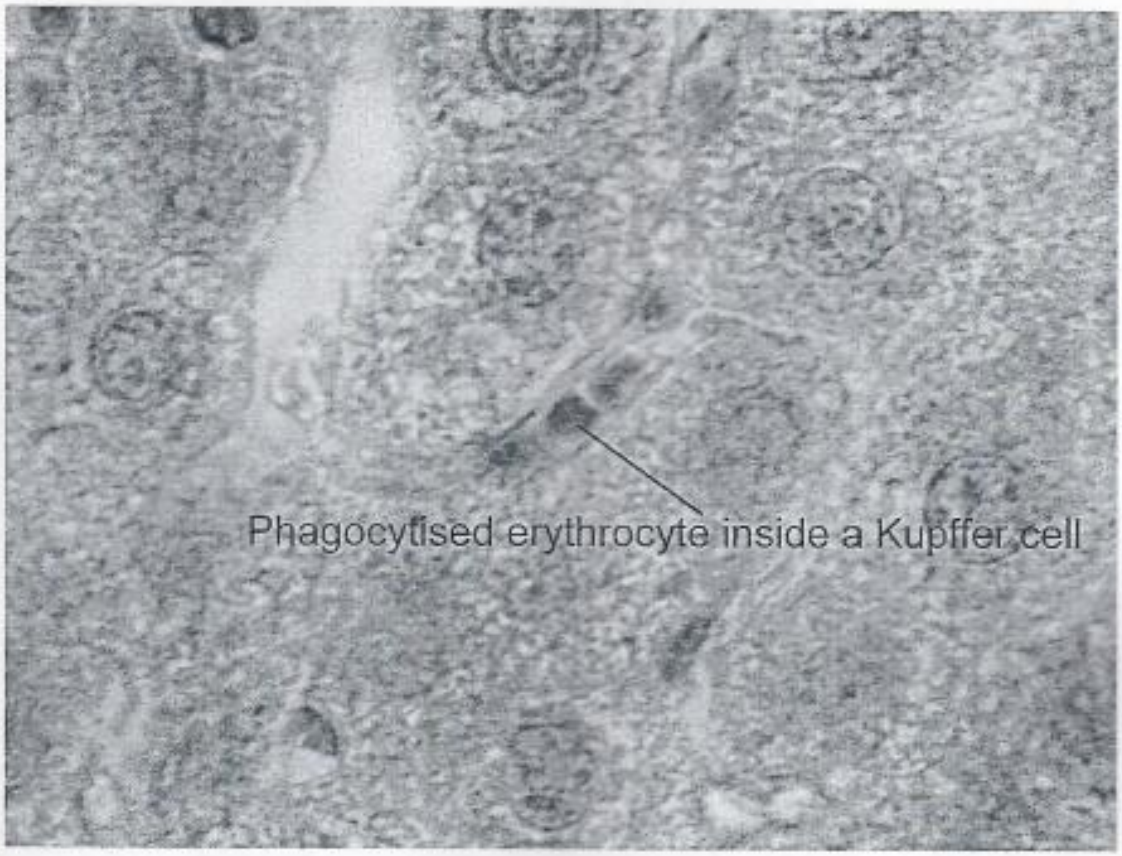

Figure 9. Photomicrograph showing Kupffer cells from a liver section.

9. Liver section with glycogen (93 W 2371)

The title of this slide describes what you are looking for. The **glycogen** will appear as bright pink inclusions in the hepatocytes that make up most of this tissue.

11. Pseudostratified ciliated columnar epithelium (93 W 3033)

In this slide, look for the columnar epithelial cells that will look very similar to the same type of cells in the intestinal slide above. These epithelial cells line the tracheal passage and are covered with **cilia** on the exposed ends. These are microscopic hair-like structures. The cilia here are more discretely apparent than the microvilli were in the intestine. Their function is to move debris for expulsion from the airways.

12. Heart (93 W 3530)

This slide is of cardiac muscle. The strands of muscle cells will show dark ragged lines between the cells. These are **intercalated discs**. These cell junctions consist of **desmosomes** and close or **gap junctions**. Gap junctions are a specialised means of joining cells that allow material to pass directly from one cell to the next, since they contain pores that allow transit. In the cardiac muscle they are important for the transmission of the electrical signals that provide a coordinated heart beat. You may need oil immersion for some of these slides.

13. Mammal kidney (93 W 5236)

This slide shows various components of the kidney. Look for circular structures that have cellular inclusions in the centre. These are glomeruli and surrounding tissues such as the Bowman's capsule. The epithelial cells that form these capsules have a bright pink layer lining the capsule. This **basement membrane** is an **extracellular matrix** produced by the overlying epithelial cells. These matrices are usually made of structural molecules such as carbohydrates and proteins.

14. Cerebellum anti-neurofilament (93 W 3743)

This slide shows the unipolar neurons quite clearly. There are strong brown filamentous inclusions that are components of **cytoskeleton**.

15. Frog sperm (93 W 8803)

This smear of frog sperm shows many spermatozoons. Most are broken but the flagella used to propel them are obvious. A few are still attached to the heads of the sperm. **Flagella** are produced from the **cytoskeleton** and protrude out through the cell membrane. Their anchors are internal. The energy to move them is provided by mitochondria.

These are **asters**, which are extensions of the spindle fibres of the **mitotic spindle**. The centrioles will be at the centres of these asters. Oil immersion may help in locating these structures.

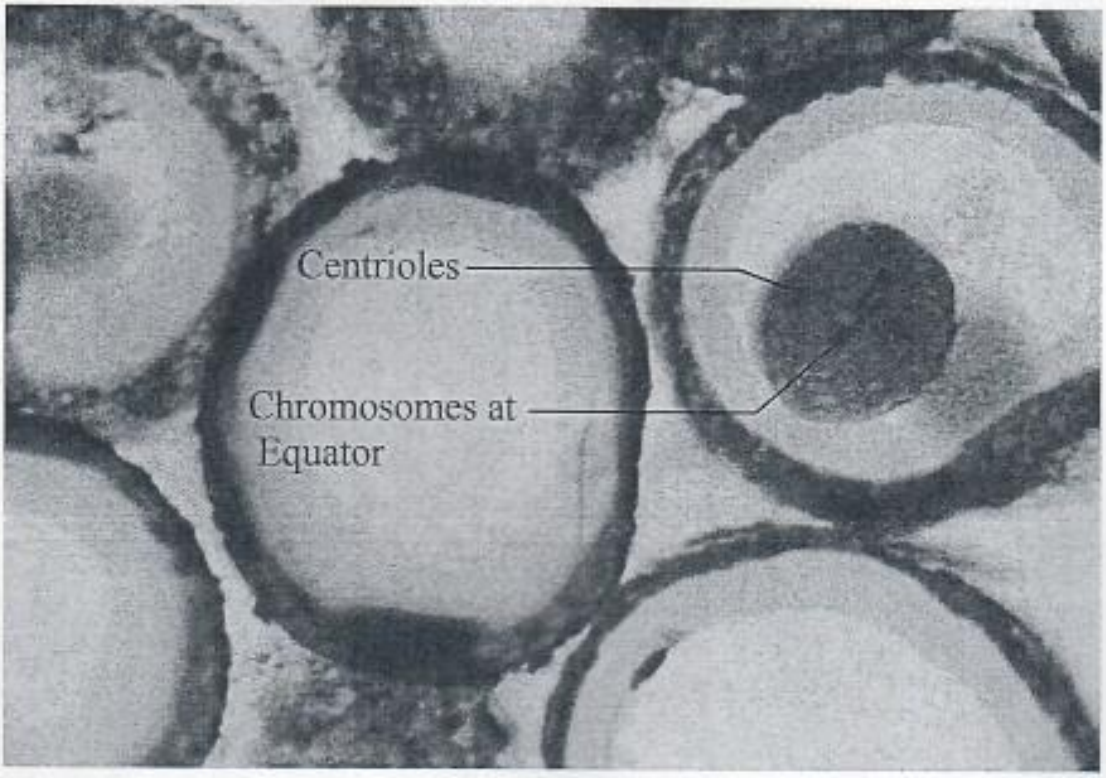

Figure 12. Ascaris cells showing centrioles (small dark structures at poles of cell) with spindle apparatus spanning the cell and chromatids lined up at the equator. Asters are also present but poorly visible.

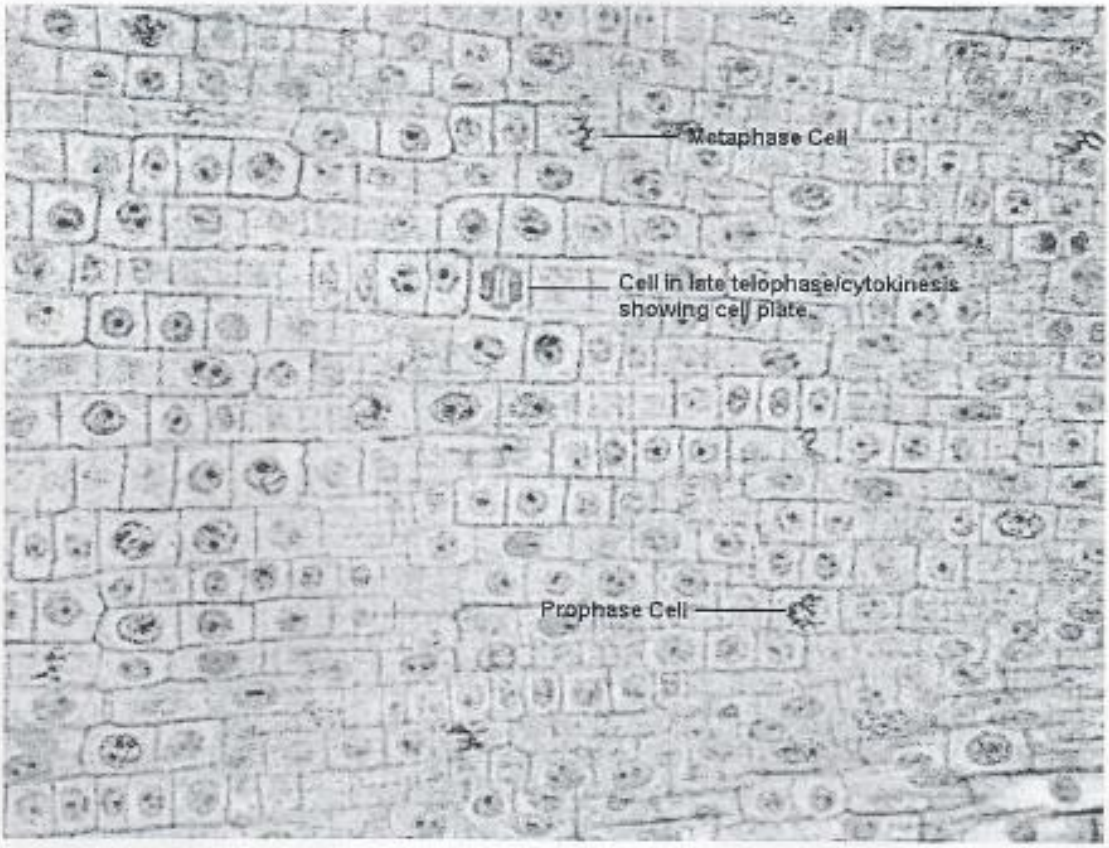

Figure 13. Example photomicrograph showing one field of view of cells from a plant root. Several mitotic cells are labelled, but various other cells in the image are also undergoing mitosis.