Name_____ Class_____ Date _____

Using Tissues as Evidence

Background

Histology is the study of the structure of tissues. A tissue is a group of specialized cells that work together to perform a specific function in an organism. This area of biology is especially important in pathology, the study of diseases. Scientists who study the differences between healthy and diseased tissues are called histopathologists. Their research is used by physicians to identify diseases and to determine how serious a patient's condition is.

The work of a histopathologist is critical in identifying and treating cancer. By examining a tissue sample under the microscope, a histopathologist can help determine whether a cancer is present. If a cancer is found, a histopathologist can identify the type of cancer. This information is extremely important in deciding how to treat the cancer.

Histological evidence is often important in lawsuits that claim a consumer product or other substance caused a person to become ill or die. This has happened in several lawsuits that people have filed against tobacco companies for causing their lung cancer. Tobacco is not the only cause of lung cancer. There are several other factors that make lung cancer likely, including the inheritance of cancer-promoting forms of certain genes and the inhaling of materials such as asbestos. However, the types of lung damage and cancer that smokers develop are different from those that occur in people whose lungs were damaged in some other way. Thus, the testimony of a histopathologist who can recognize these differences is often one of the most important parts of a smoker's lawsuit.

A smoker's lungs are usually damaged in other ways before cancer develops. Figure 1 shows the typical pattern of damage to a smoker's lungs. Tobacco smoke destroys the cells that line the breathing passages. These cells have small hairlike extensions called cilia that normally sweep mucus and particles of smoke and dust out and away from the lungs. Without these cells, mucus and smoke particles accumulate in the breathing passages, causing what is known as "smoker's cough." At the same time, new mucus glands form and secrete more mucus into the already-blocked breathing passages. This blockage can interfere with breathing and can cause part of the lungs to collapse.
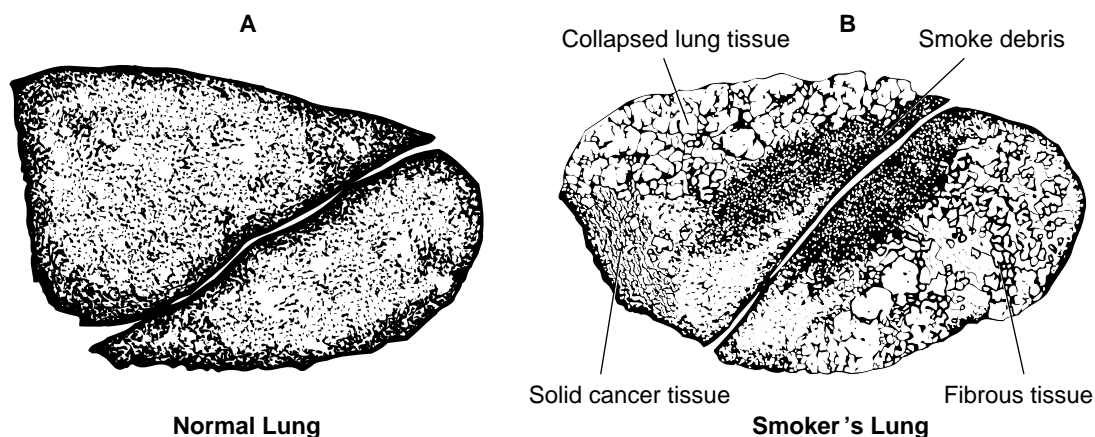
A

Normal Lung

B

Collapsed lung tissue   Smoke debris

Solid cancer tissue   Fibrous tissue

Smoker's Lung

FIGURE 1

Two other lung problems that often occur before cancer develops are bronchitis and emphysema. Bronchitis is the inflammation of the bronchi, the tubes that carry air in and out of the lungs. Emphysema is a disease of the alveoli, the microscopic air sacs that make up most of the lungs. The thin tissues of the alveoli are only one cell thick, but they have an enormous surface area. This surface is where oxygen passes from inhaled air into the bloodstream, as well as where carbon dioxide is released from the bloodstream into exhaled air. In emphysema, the alveoli break down and fuse, forming large open spaces. This process reduces the surface area available for gas exchange, and the patient becomes weakened by a lack of oxygen. The lung loses elasticity, which makes breathing more difficult.

Eventually, the person with emphysema may develop lung cancer.

The type and location of cancers caused by smoking are different from those of other types of lung cancer. Many smokers develop cancer in the bronchi or the bronchioles, the smaller branches of the bronchi. Cancers in these locations are rare in nonsmokers. A histopathologist can often identify the type of lung cell that became cancerous.

Smokers tend to develop cancer in different types of cells than do nonsmokers. A type of cancer called small cell carcinoma is common in smokers, while rare in nonsmokers. Small cell carcinoma often begins in the bronchi and grows in cords or small, grapelike clusters. Under the microscope, the cancer appears darker than the surrounding tissue. The type and location of the cancer are important facts in a histopathologist's testimony in a smoking-related lawsuit.

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Investigation

CASE SUMMARY

A smoker is suing a tobacco company for causing his cancer. The company is trying to argue that, in this case, the patient's cancer was not caused by smoking. You have been asked to compare lung tissue from the patient to cancerous and healthy lung tissues and report your observations and conclusions to the court.

QUESTION FOR FORENSIC ANALYSIS

Does the patient have the typical signs of tissue damage and cancer due to smoking?

SAFETY

Always carry the microscope with two hands.
Handle glass slides with care to avoid breakage.

MATERIALS (*per group*)

compound microscope

prepared slide of normal human lung tissue

prepared slide of smoker's cancerous lung tissue

prepared slide of patient's lung tissue

PROCEDURE

1. View the prepared slide of normal human lung tissue with the microscope at low magnification and then at high magnification. Draw and label your observations of the slide in the appropriate field-of-view circle in Figure 2 and record the magnification.
2. Repeat Step 1 with each of the other prepared slides.
3. Label any parts of your drawings that indicate similarities or differences between the patient's lung tissue and either of the other two slides. Use the additional space provided in Figure 2 to draw and label details of the similarities and differences that you observed.
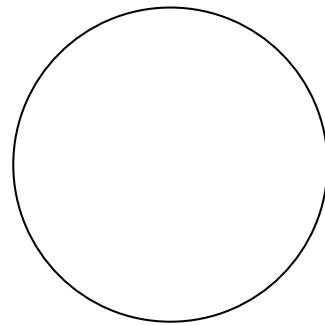
ANALYSIS AND CONCLUSIONS

1. **Comparing and Contrasting** What differences did you observe between the normal and cancerous lung tissues?

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   _____
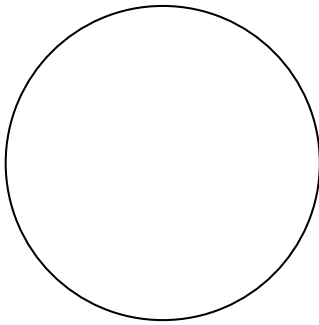
Magnification _____
Normal human lung tissue
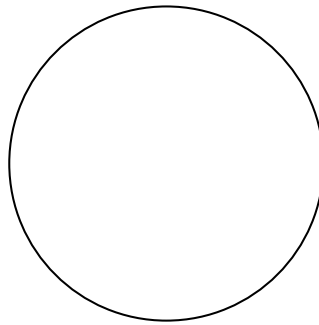
Magnification _____
Cancerous human lung tissue

Magnification _____
Patient's lung tissue

Additional observations:

FIGURE 2

2. **Analyzing Data** Did you see evidence of other diseases in the cancerous lung tissue? Explain your answer.

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3. **Drawing Conclusions** Did the patient's lung tissue more closely resemble the normal tissue or the cancerous tissue? Explain your answer.

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4. **Evaluating** Are you confident that the patient's cancer was caused by smoking? State the reasons for your answer.

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5. **Inferring** How would you expect the growth of a solid cancer mass in the lungs to affect a smoker's ability to obtain oxygen? Explain your answer.

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