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# Medical Laboratory

## ASCP-HTLI

ASCP Histotechnologist International (ASCP-HTLI)



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## Question: 1

Which of the following is a type of mold used for embedding?

- A. Flat embedding molds.
- B. Flat dishes.
- C. Small capsules.
- D. All of the above.

## Answer: D

Explanation:

To answer the question about the type of mold used for embedding in histological practices, it is essential to understand the context and process of tissue preparation.

The question provided offers multiple choices: Flat embedding molds, Flat dishes, Small capsules, and All of the above. Each of these choices refers to different types of molds that can be used in the process of embedding biological tissue for microscopic examination.

Embedding is a critical step in tissue preparation for microscopy, following the fixation process. Fixation is vital as it preserves the tissues in as close to a life-like state as possible by preventing decay and maintaining the structure. Once the tissue is fixed, it has to be embedded in a medium that provides support and allows it to be cut into very thin sections for microscopic examination. This medium is typically a resin or paraffin wax.

The types of embedding molds mentioned (flat embedding molds, flat dishes, and small capsules) are tools used to shape the embedding medium around the tissue. Each type serves a specific purpose depending on the tissue size, the type of microscopy required, and the physical characteristics desired in the embedded block. - **Flat embedding molds** are typically used when a uniformly flat surface is required on the embedded tissue. This is crucial for ensuring consistent section thickness when the tissue is later sliced for slide preparation. - **Flat dishes** might be used for larger tissue samples that do not fit into standard molds or when a larger surface area is required for the embedding medium. This can be useful for tissues that need to be oriented in specific ways for slicing. - **Small capsules** are ideal for very small or delicate tissues that could be lost or damaged in larger molds. They help in focusing the embedding medium closely around the tissue, minimizing the amount of cutting required to reach the tissue of interest.

Given the variations in the embedding needs based on the sample size, shape, and the detail needed in the microscopic analysis, multiple types of molds are used to accommodate these requirements.

Therefore, the correct answer to the question of which type of mold is used for embedding is "All of the above." Each type of mold listed plays a specific role in the embedding process, catering to different types of tissues and embedding requirements. This allows for flexibility and precision in histological studies, ensuring that tissue samples are well-preserved and adequately supported for detailed microscopic examination.

## Question: 2

The solvent used in the first step of paraffin embedding must:

- A. Be a 2% solution.
- B. Be miscible with paraffin.
- C. Be in gas form.
- D. Be a 100% solution.

**Answer: B**

Explanation:

To correctly answer the question about the solvent used in the first step of paraffin embedding, we need to understand the paraffin embedding process thoroughly. This process is commonly used in histology to prepare tissue samples for microscopic examination by embedding them in paraffin wax, which ensures that the tissue retains its structure and can be cut into thin sections for analysis.

The initial step in the paraffin embedding process involves the complete dehydration of the tissue sample. This is crucial because paraffin wax is hydrophobic and does not mix with water. Therefore, any residual water in the tissue would prevent the paraffin from adequately infiltrating the tissue, leading to poor embedding and inadequate sectioning quality. Dehydration is typically achieved through a series of alcohol baths of increasing concentrations, eventually leading to a 100% alcohol solution, which effectively removes all water from the tissue.

Following dehydration, the tissue must undergo a clearing process. The purpose of clearing is to replace the dehydrating agent (e.g., ethanol) with a substance that is both miscible with alcohol and with the paraffin wax. Common clearing agents include xylene and toluene. These agents are chosen specifically for their ability to interact favorably with both the dehydrating alcohol and the paraffin wax. This step ensures that there is a seamless transition from the alcohol to the paraffin wax, facilitating the complete infiltration of the wax in the subsequent embedding step.

The critical property of the solvent used in the first step of paraffin embedding, which involves the clearing stage, is its miscibility with paraffin. This is essential because the solvent needs to prepare the dehydrated tissue for the paraffin wax infiltration. If the solvent were not miscible with paraffin, it would be unable to perform this role effectively, leading to incomplete or uneven embedding of the tissue in the wax. This could adversely affect the quality of the tissue sections obtained later for microscopic examination.

Hence, the correct answer to the question is that the solvent used in the first step of paraffin embedding must be miscible with paraffin. Options suggesting that the solvent needs to be a 2% solution or in gas form do not pertain directly to the requirements of solvent properties for successful paraffin embedding. Additionally, while the solvent should indeed be a 100% solution (i.e., pure and not diluted), the critical aspect for this particular stage of embedding is its miscibility with paraffin, not necessarily its concentration.

### Question: 3

Which of the following is true about Wright's stain?

- A. It is outdated.
- B. It does not require a fixation step.
- C. It does not require more than 30 seconds of staining.

D. It requires multiple fixation steps.

**Answer: B**

**Explanation:**

Wright's stain is a widely used staining technique in hematology for differentiating blood cell types, which is crucial for diagnosing various blood disorders. Despite the emergence of more advanced technologies and staining techniques, Wright's stain remains highly valued and frequently used in both clinical and research settings due to its effectiveness and reliability.

The statement that Wright's stain is outdated is incorrect. Wright's stain continues to be the preferred method for staining bone marrow aspirate smears and peripheral blood smears. It provides excellent differentiation of blood cells, allowing for detailed examination of cell morphology which is critical in the diagnosis of diseases such as anemia, leukemia, and other hematological conditions.

Regarding the fixation step, Wright's stain indeed does not require a separate fixation step when using the traditional protocol. The smears are typically fixed as part of the staining process itself. Typically, the blood smear is first dipped into methanol, which acts as a fixative, and then stained with Wright's stain. This dual-purpose dipping simplifies the staining process while effectively preserving the morphology of the blood cells.

As for the duration of staining, it is important to clarify that Wright's staining process usually requires more than just 30 seconds. The standard procedure involves dipping the smear into methanol for fixation, followed by application of the Wright's stain for approximately 10-15 minutes to ensure adequate staining and differentiation of cellular components.

Finally, the claim that Wright's stain requires multiple fixation steps is incorrect. The process is straightforward with the methanol dip serving as the sole fixation step before the application of the Wright's stain. This simplicity in the procedure makes it a convenient choice for routine hematological examinations.

In summary, Wright's stain remains a critical tool in hematological diagnostics, requiring no separate fixation step and providing reliable results with a staining duration of about 10-15 minutes. Its continued use in medical laboratories underscores its effectiveness and reliability in blood smear analysis.

**Question: 4**

Which is done during tissue processing?

- A. Clearing.
- B. Mixing.
- C. Draining.
- D. Dragging.

**Answer: A**

**Explanation:**

The correct answer to the question about what is done during tissue processing is "Clearing." Tissue processing is a crucial step in preparing biological samples for histological examination, typically involving several distinct stages. These stages ensure that the tissue is adequately preserved and prepared for detailed microscopic study.

The process begins with fixation, where the tissue samples are treated with chemicals such as formaldehyde to preserve their structure by cross-linking proteins. This step is vital as it prevents the decay of the tissue and maintains the cellular details necessary for accurate diagnosis. Following fixation, the tissue undergoes dehydration. During dehydration, the water content of the tissue is gradually replaced with alcohol. This step is essential because the embedding medium used in later stages, typically paraffin wax, is not miscible with water. Therefore, removing water from the tissue is crucial for effective infiltration and embedding.

Clearing is the next step, which comes right after dehydration. In clearing, the dehydrating agent (usually alcohol) is replaced with a substance like xylene or toluene, which are clear agents that help in the transition between the dehydration and infiltration stages. Clearing agents are miscible with both alcohol and the embedding medium, making them pivotal in ensuring that the dehydrated tissue is prepared for the infiltration of wax.

Infiltration follows clearing, where the clearing agent is gradually replaced with molten paraffin wax or another embedding medium. This step is critical as it ensures that the tissue is thoroughly saturated with wax, which supports and stabilizes the tissue structure, allowing for thin sectioning without damage.

Finally, the embedding process involves enclosing the infiltrated tissue in a solid block of paraffin wax, which hardens and provides a supportive matrix that enables very thin slicing (sectioning) of the tissue. These thin sections are then placed on slides and stained for microscopic examination.

In summary, each step in tissue processing, from fixation to embedding, plays a crucial role in preparing the tissue samples for histopathological analysis. Clearing, as one of these steps, involves the use of specific agents to bridge the dehydration and infiltration stages, ensuring a smooth transition necessary for embedding and subsequent microscopic evaluation.

## Question: 5

The Nissl stain is which of the following?

- A. Both negatively and positively charged.
- B. 100% neutral.
- C. Negatively charged.
- D. Positively charged.

**Answer: C**

**Explanation:**

The correct answer to the question "The Nissl stain is which of the following?" is "Negatively charged." This means that Nissl stain carries a negative charge, which influences how it binds to tissue components during the staining process.

Staining techniques are essential in histology and pathology for visualizing cellular structures and components that are otherwise transparent under a microscope. Stains can be classified based on their charge properties into negatively charged, positively charged, or neutral. The charge of a stain determines its affinity for different cellular components, which typically possess opposite charges.

The Nissl stain, specifically, is used primarily for staining neurons in neurological tissue. It targets the rough endoplasmic reticulum found within neurons, commonly referred to as Nissl bodies. The stain binds to these structures because of its negative charge. The Nissl bodies are basophilic, meaning they have an affinity for the basic (negatively charged) dyes due to their acidic (positively charged) nature.

In comparison, hematoxylin, another commonly used stain in histology, also possesses negatively charged properties. It is used for staining cell nuclei, which contain DNA and RNA that attract the negatively charged dye. On the other hand, eosin, which is positively charged, stains the cytoplasmic and extracellular proteinaceous components of cells, highlighting them in different colors.

Understanding the charge properties of stains like the Nissl stain helps in selecting the appropriate staining method for specific tissues and cellular components, facilitating detailed examination and diagnosis in microscopic studies.

## Question: 6

Neuroglia is composed of ependymal cells found where?

- A. Endocrine system.
- B. Digestive system.
- C. Central nervous system.
- D. Peripheral nervous system.

## Answer: C

Explanation:

The correct answer to the question “Neuroglia is composed of ependymal cells found where?” is the Central nervous system.

Neuroglia, also known as glial cells, play a crucial role in supporting and maintaining the nervous system. There are two main types of nervous systems in the human body: the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS includes the brain and spinal cord, while the PNS consists of the nerves and ganglia outside the brain and spinal cord.

In the CNS, neuroglia comprises several types of cells, each serving distinct functions. These include oligodendrocytes, which are responsible for forming myelin sheaths around neurons in the CNS, aiding in the rapid transmission of electrical signals. Astrocytes support blood-brain barrier maintenance, provide nutrients to nervous tissue, and play a role in repair and scarring processes of the brain and spinal cord after traumatic injuries. Microglia act as the primary immune defense in the CNS.

Ependymal cells, another type of glial cells, are specifically found lining the ventricles of the brain and the central canal of the spinal cord. They are involved in the production and regulation of cerebrospinal fluid (CSF), which cushions the CNS and removes waste products. Ependymal cells form a barrier between the CSF and the nervous tissue, and their cilia help circulate the CSF throughout the ventricles. In contrast, the glial cells found in the PNS include Schwann cells and satellite cells. Schwann cells are similar to oligodendrocytes but are located in the PNS, where they also help in myelination of peripheral nerves. Satellite cells provide support and nutrients to the surrounding neuronal bodies.

Understanding the distribution and function of different neuroglial cells is essential for comprehending how the nervous system operates and maintains its essential functions. The presence of ependymal cells in the CNS underscores their specific role in managing the environment of the central nervous system, distinct from the roles of glial cells located in the peripheral nervous system.

## Question: 7

Cables and cords in the laboratory should:

- A. Be bundled.
- B. Be kept off the floor.
- C. Be properly covered.
- D. All of the above.

**Answer: D**

Explanation:

In the context of maintaining safety in a laboratory setting, it is essential to manage cables and cords appropriately. The question presents several options regarding how to handle cables and cords, including bundling them, keeping them off the floor, covering them properly, and an option that includes all these measures. Here's an expanded explanation for each option:

**\*\*Be bundled.\*\*** Bundling cables and cords helps in organizing them, reducing clutter and minimizing the risk of tripping hazards. When cords are bundled, they are less likely to spread across walkways or become entangled with equipment or personnel. This not only protects the physical safety of individuals working in the lab but also ensures that the workspace remains orderly and functional.

**\*\*Be kept off the floor.\*\*** Cables and cords on the floor are a major trip hazard, especially in an environment like a laboratory where attention might be focused on complex tasks. Keeping them off the floor helps prevent accidents. This can be achieved by using cable organizers, clips, or ties to secure cords along desks or walls, or by implementing overhead cable management systems where possible.

**\*\*Be properly covered.\*\*** Covering cables and cords further enhances safety by protecting them from physical damage and reducing exposure to chemical spills or other hazardous materials found in a laboratory setting. Protective covering can also prevent the cords from becoming a catch hazard, where tools or other equipment could snag on an exposed cable, leading to accidents or equipment damage.

**\*\*All of the above.\*\*** The safest approach in a laboratory—or any workplace—is to incorporate all these practices: bundling, keeping cables off the floor, and covering them properly. This comprehensive strategy ensures maximum safety and organization, significantly reducing the risk of accidents and injuries related to mishandling of cables and cords.

In conclusion, maintaining an organized and safe environment in a laboratory includes proper management of all potential hazards, including how cables and cords are handled. The option "All of the above" is the most effective and prudent choice, as it encompasses all necessary precautions to ensure both safety and efficiency in the lab.

## Question: 8

Which of the following is not a category of epithelium?

- A. Glandular epithelium.
- B. Pseudostratified columnar epithelium.
- C. Fixed epithelium.
- D. Stratified epithelium.

**Answer: C**

Explanation:

The question asks which option listed is not a recognized category of epithelium tissue. To answer this, it's necessary to understand how epithelial tissues are classified.

Epithelial tissues are one of the four primary types of tissues in the human body, alongside connective, muscle, and nervous tissues. Epithelial tissues are primarily concerned with protection, secretion, absorption, and filtration. They cover body surfaces, line body cavities and hollow organs, and are also present in glands.

Epithelial tissues are classified based on two main characteristics: the number of cell layers and the shape of the cells. Based on the number of layers, epithelial tissue can be categorized as: 1. **Simple epithelium**: Consists of a single layer of cells and is involved in processes like absorption, secretion, or filtration. This type is found in locations where there is not a high degree of wear and tear. 2.

**Stratified epithelium**: Composed of two or more layers of cells, this type provides protection against physical and chemical wear and tear. It is found in areas like the skin and the lining of the mouth. Based on the shape of the cells, epithelial tissues can be further divided into: 1. **Squamous** (flat and thin), 2. **Cuboidal** (cube-shaped), 3. **Columnar** (tall and column-like).

There is also a special category known as **pseudostratified columnar epithelium**, where the tissue appears to be stratified but is actually a single layer of cells of varying heights, giving it a layered appearance.

Another important category of epithelial tissue is **glandular epithelium**, which forms the secreting portion of glands. For example, the glandular epithelium in the thyroid gland secretes thyroid hormones. Given these classifications, the options listed in the question include: - Glandular epithelium (a valid category, specialized in secretion), - Pseudostratified columnar epithelium (a valid category, appears stratified but is not), - Stratified epithelium (a valid category, multiple layers for protection), The term "Fixed epithelium" does not align with standard anatomical and physiological terminology used to describe epithelial tissue types. There is no recognized category of epithelial tissue known as "fixed epithelium." Therefore, the correct answer to the question, "Which of the following is not a category of epithelium?" is "Fixed epithelium." This term is likely a misnomer or confusion with other terminology used in tissue classification.

## Question: 9

Samples in the laboratory must:

- A. Be labeled correctly.
- B. Be kept without labels.
- C. Be stored at least 1 foot away from each other.
- D. Be stored in the freezer, regardless of the type.

## Answer: A

Explanation:

The question prompts a decision on what must always be done with samples in a laboratory that tests tissue. The correct answer is that samples must be labeled correctly. Here's an expanded explanation of why this is critical:

**Labeling Correctly:** Ensuring that each sample is accurately labeled is fundamental for several reasons. First, correct labeling prevents sample mix-ups, which can lead to incorrect diagnoses or ineffective treatments if the samples are medical in nature. Mislabeling could potentially cause harm to patients or

skew research data, leading to inaccurate conclusions. Proper labeling includes details such as the type of sample, the date it was collected, and the source from which it was obtained.

**Minimizing Risk of Disease Transmission:** In environments such as medical or research laboratories, where samples might contain infectious agents, clear labeling is also crucial to minimize the risk of transmitting infections. It alerts laboratory personnel to the necessary precautions they need to take when handling these samples, such as wearing appropriate protective equipment or using specialized handling techniques.

**Organizational Efficiency:** Correctly labeled samples contribute to the efficiency and effectiveness of laboratory operations. It allows for quick identification, proper handling, and accurate processing of samples. This is particularly important in high-throughput environments where large volumes of samples are processed.

**Regulatory Compliance:** In many cases, there are strict regulatory requirements regarding the handling and labeling of laboratory samples. These regulations are designed to ensure safety, traceability, and accountability. Failure to comply with such regulations can lead to legal repercussions for the institution responsible for the laboratory.

**Other Incorrect Options:** The other options provided, such as keeping samples unlabeled, storing them a specific distance from each other, or storing all samples in a freezer regardless of type, do not universally apply to every type of sample or situation. These actions might be relevant under specific conditions but are not standard practices like correct labeling. In summary, correct labeling is not just a procedural formality but a critical requirement for safety, compliance, and operational integrity in laboratory settings.

## Question: 10

Which of the below is mainly used in botanical specimens?

- A. Mixed microtome.
- B. Sliding microtome.
- C. Rocking microtome.
- D. Hand microtome.

## Answer: D

**Explanation:**

The correct answer to the question of which microtome is mainly used for botanical specimens is the "Hand microtome." To understand why this is the case, it is essential to first understand what a microtome is and the different types available.

A microtome is a tool used in microscopy to cut extremely thin slices of material, known as sections. These sections are then observed under a microscope to study the microstructures of the material. Microtomes are used extensively in biology and medical research to prepare samples of biological tissues for examination.

There are multiple types of microtomes, each designed for specific purposes and materials. These include the rotary microtome, base sledge microtome, rocking microtome, sliding microtome, ultramicrotome, and hand microtome. Each type has its own unique mechanism and applications, depending on the precision and thickness required for the sections.

The hand microtome, specifically, is a simple and portable device. It consists of a scalpel blade positioned above a micrometer screw, which allows the user to control the thickness of the sections

manually. This type of microtome does not require electricity and is less sophisticated compared to other types, such as the rotary or sliding microtomes.

Hand microtomes are particularly suited for botanical specimens for several reasons. Firstly, they are ideal for fieldwork or situations where portability is essential. Researchers can use hand microtomes to prepare sections of plant tissues on-site, which is particularly useful for botanical studies. Secondly, the simplicity and ease of use make the hand microtome suitable for educational purposes, where students can learn about plant anatomy without the need for complex equipment.

In summary, the hand microtome's design, ease of use, and portability make it the preferred choice for preparing thin sections of botanical specimens, particularly in settings that require fieldwork or educational tools for teaching plant anatomy.

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