International Technologist in Cytogenetics ASCP Practice Test (Sample)

Study Guide

Everything you need from our exam experts!

Questions

1. To avoid empty magnification in microscopy, the total magnification should not exceed what value?

A. 500X the N.A. of the objective

B. 1000X the N.A. of the objective

C. 1500X the N.A. of the objective

D. 2000X the N.A. of the objective

2. What is a characteristic feature of an inverted microscope?

A. The objectives are located beneath the stage

B. It has a built-in light source

C. It offers higher magnification than standard microscopes

D. It is primarily used for live cell imaging

3. What can be inferred if a single control signal is consistently absent across all cells during a FISH test?

A. The control signal is non-essential

B. Sampling errors occurred

C. The deletion of a specific genomic region

D. Technical issues with the assay

4. If a regulatory inspector requests a copy of a lab patient's record, what should the technician do?

A. Provide a copy of the record

B. Deny the inspector a copy of the record

C. Consult with a supervisor

D. Refer the inspector to the patient's physician

5. When capturing a metaphase, what is a likely reason for the technician being unable to focus on the metaphase?

A. The sample is contaminated

B. The camera is not parfocal

C. The microscope is damaged

D. The light source is low

6. Phytohemagglutinin (PHA) stimulates which type of cells into division?

A. B-cell lymphocytes

B. Natural killer cells

C. T-cell lymphocytes

D. Monocytes

7. Which banding technique should be used if the addition of nonhomologous material to the q-arm of chromosome 16 is suspected?

A. C-banding

B. Q-banding

C. FISH

D. G-banding

8. Which ingredient is not considered necessary in modified medium?

A. Amino acids

B. Glucose

C. Antibiotics

D. Salts

9. Peripheral blood G-band karyotype analysis is typically requested for which of the following reasons?

A. To assess for potential paternity

B. Screening for infectious diseases

C. To investigate mental retardation of unknown etiology

D. To evaluate inherited metabolic disorders

10. What do the dark bands produced by routine GTG banding represent?

A. Gene-rich regions of the chromosome

B. Euchromatin regions

C. AT-rich regions of the chromosome

D. Gene-poor regions of the chromosome

Answers

1. B
2. A
3. C
4. B
5. B
6. C
7. A
8. C
9. C
10. C

Explanations

1. To avoid empty magnification in microscopy, the total magnification should not exceed what value?

A. 500X the N.A. of the objective

B. 1000X the N.A. of the objective

C. 1500X the N.A. of the objective

D. 2000X the N.A. of the objective

Using the total magnification of a microscope efficiently requires an understanding of both the numerical aperture (N.A.) of the objective lens and the resulting image quality at higher magnifications. When the total magnification exceeds 1000 times the numerical aperture of the objective, the risk of encountering empty magnification increases significantly. Empty magnification refers to the situation where increasing the magnification level does not provide any additional useful information about the specimen being observed. This can happen when the resolution limits of the lens system are exceeded, resulting in an enlarged image that does not contain more detail than the original at a lower magnification. The relationship between magnification and numerical aperture is critical—while higher magnifications may seem attractive for finer details, the effectiveness of that magnification is capped by the resolution limit of the microscope optics. Hence, keeping the total magnification at or below 1000 times the N.A. ensures that the benefits of magnification are balanced with the optical limitations, thereby helping to avoid empty magnification and ensuring meaningful observation of the specimen. This principle underlies many best practices in microscopy, guiding users to optimize their imaging techniques.

2. What is a characteristic feature of an inverted microscope?

A. The objectives are located beneath the stage

B. It has a built-in light source

C. It offers higher magnification than standard microscopes

D. It is primarily used for live cell imaging

An inverted microscope is specifically designed with the objectives positioned beneath the stage, which is the characteristic feature that distinguishes it from standard upright microscopes. This configuration allows for greater accessibility to the specimen from above, facilitating the observation of samples in larger containers such as Petri dishes or culture flasks. The unique setup is particularly advantageous for examining live cells, as it enables easy manipulation and viewing without the need to transfer samples to a traditional slide. Although inverted microscopes may have built-in light sources and can be used for live cell imaging, these features are not exclusive to inverted microscopes and can also be found in other types of microscopes. Additionally, while some inverted microscopes may offer high magnification, the characteristic feature that critically defines their design is the location of the objectives underneath the stage.

3. What can be inferred if a single control signal is consistently absent across all cells during a FISH test?

A. The control signal is non-essential

B. Sampling errors occurred

C. The deletion of a specific genomic region

D. Technical issues with the assay

If a single control signal is consistently absent across all cells during a FISH (Fluorescence In Situ Hybridization) test, it suggests that there may be a deletion of a specific genomic region linked to the control signal. In FISH testing, control signals are vital for verifying the successful hybridization of the probe and the integrity of the target genomic region. If a control signal, which is expected to be present, is missing in all analyzed cells, it indicates that the corresponding genomic sequence is likely missing or deleted. This consistent absence points to a structural alteration in the chromosome, such as a deletion, that has affected the targeted region, causing the control signal to not be detected. While other options may seem plausible, such as the potential for a non-essential control signal or technical issues, the key takeaway is that a systematic absence of the control signal across all cells most strongly indicates a specific genomic deletion, confirming that the genomic region in question is no longer present.

4. If a regulatory inspector requests a copy of a lab patient's record, what should the technician do?

A. Provide a copy of the record

B. Deny the inspector a copy of the record

C. Consult with a supervisor

D. Refer the inspector to the patient's physician

When faced with a request from a regulatory inspector for a lab patient's record, the appropriate response involves understanding the legal and ethical implications surrounding patient confidentiality and record management. Providing a copy of the record without following proper procedures can violate privacy laws such as HIPAA (Health Insurance Portability and Accountability Act). Additionally, denying the inspector's request outright may lead to compliance issues and could hinder the regulatory process. The most appropriate action is to consult with a supervisor first. This option ensures that the request is handled according to the facility's policies and legal requirements. Supervisors typically have established protocols for such situations, which may include verifying the inspector's credentials, understanding what specific data is needed, and ensuring that any release of information complies with legal standards. In sum, consulting with a supervisor is the correct action because it safeguards patient privacy, maintains compliance with regulatory standards, and ensures that the technician does not act outside the protocol established by the institution.

5. When capturing a metaphase, what is a likely reason for the technician being unable to focus on the metaphase?

A. The sample is contaminated

B. The camera is not parfocal

C. The microscope is damaged

D. The light source is low

The situation in which a technician is unable to focus on the metaphase can often be attributed to the camera not being parfocal. In microscopy, a parfocal lens is one that remains in focus when the magnification is changed. If the camera system is not parfocal, it means that it may not maintain focus across different magnifications or adjustments. This can lead to difficulties in obtaining a clear image, as the technician may struggle to achieve sharp focus when capturing the metaphase stage of cell division. In cytogenetics, focusing on metaphase chromosomes is crucial for accurate observation and analysis, as this is the stage where chromosomes are most condensed and visible. If the camera system is unable to provide a stable focus, it significantly impairs the ability to capture these important details, which could hinder diagnostic interpretation and the overall quality of the cytogenetic analysis. Other options may introduce various issues, such as contamination potentially affecting sample integrity, damage to the microscope impairing optical function, or a low light source impacting visibility, but they do not specifically relate to the focusing capability of the camera system in terms of maintaining clarity across adjustments in the optical pathway.

6. Phytohemagglutinin (PHA) stimulates which type of cells into division?

A. B-cell lymphocytes

B. Natural killer cells

C. T-cell lymphocytes

D. Monocytes

Phytohemagglutinin (PHA) is a plant-derived lectin primarily known for its ability to stimulate the division of T-cell lymphocytes. It acts by binding to specific carbohydrates on the surface of these cells, leading to their activation and subsequent proliferation. This property makes PHA a valuable tool in immunological research and clinical applications, especially in studying T-cell responses. T-cell lymphocytes play a critical role in the immune response, and their activation is essential for various immunological functions, including the response to infections and the destruction of cancer cells. Therefore, the correct choice emphasizes PHA's specific and effective stimulation of T-cells, underscoring the importance of this lectin in research involving cellular immune responses.

7. Which banding technique should be used if the addition of nonhomologous material to the q-arm of chromosome 16 is suspected?

A. C-banding

B. Q-banding

C. FISH

D. G-banding

When the addition of nonhomologous material to the q-arm of chromosome 16 is suspected, C-banding is the appropriate technique to use due to its ability to highlight specific regions of chromosomes. C-banding specifically targets the heterochromatic regions of chromosomes, particularly the centromeric areas and some terminal regions, allowing for the identification of additional chromatin material that may have been incorporated into a chromosome. This technique would be beneficial in cases where structural abnormalities are suspected, as it can reveal insights about the presence of extra genetic material that is not normally seen in a standard karyotype. In contrast, other techniques like G-banding generally provide a more extensive view of the entire chromosomal structure and are more useful for examining banding patterns for the entire chromosome rather than specifically targeting the heterochromatic regions. Q-banding focuses on detecting specific patterns in the q-arm, while FISH (Fluorescence In Situ Hybridization) applies probes to visualize specific DNA sequences, which might not be necessary unless a more detailed investigation of specific genes is required. Using C-banding allows the technologist to ascertain whether there has been an anomalous addition of genetic material in a focused and reliable way.

8. Which ingredient is not considered necessary in modified medium?

A. Amino acids

B. Glucose

C. Antibiotics

D. Salts

In the context of cell culture and modified media formulations, antibiotics are typically not considered a necessary ingredient. While antibiotics can be beneficial in preventing bacterial contamination in culture systems, they are not essential for the basic growth and maintenance of cells. The primary objective of a modified medium is to supply the nutrients and components necessary for cell growth, repair, and division, such as amino acids, glucose, and salts. Amino acids are crucial for protein synthesis, providing the building blocks for cellular function and growth. Glucose serves as a primary energy source, vital for cellular metabolism and proliferation. Salts are important for maintaining osmotic balance and providing essential ions for various biochemical processes. In contrast, antibiotics might be used selectively in certain situations to address specific contamination concerns but are not a fundamental requirement for the growth of cells in a modified medium. Therefore, their inclusion is often based on the specific needs of the experiment or cell type rather than as a standard necessity for all modified media.

9. Peripheral blood G-band karyotype analysis is typically requested for which of the following reasons?

A. To assess for potential paternity

B. Screening for infectious diseases

C. To investigate mental retardation of unknown etiology

D. To evaluate inherited metabolic disorders

Peripheral blood G-band karyotype analysis is primarily utilized to identify chromosomal abnormalities that may be linked to various genetic conditions. In cases where there is mental retardation of unknown etiology, karyotyping serves as a crucial tool for investigating potential underlying genetic causes. This analysis allows for the detection of structural abnormalities (such as translocations, deletions, or duplications of chromosomal regions) and numerical abnormalities (such as aneuploidies) that may contribute to cognitive impairments. When examining individuals with intellectual disabilities or developmental delays, identifying any chromosomal anomalies can provide insight into the diagnosis and help in understanding the patient's condition, guiding management and providing reproductive counseling to families. Thus, the use of G-band karyotype analysis in this context is well established and has the potential to uncover genetic syndromes previously unrecognized that could explain the patient's symptoms.

10. What do the dark bands produced by routine GTG banding represent?

A. Gene-rich regions of the chromosome

B. Euchromatin regions

C. AT-rich regions of the chromosome

D. Gene-poor regions of the chromosome

The dark bands produced by routine GTG (Giemsa-Trypsin-Giemsa) banding represent regions that are rich in adenine-thymine (AT) base pairs, which often correlate with gene-poor areas of the chromosome. During the banding process, chromosomes are treated with trypsin and then stained with Giemsa dye; the AT-rich regions absorb the dye more strongly, leading to the formation of these dark bands. These bands are important for the identification and classification of chromosomes during cytogenetic analysis, as they provide a framework for recognizing specific chromosomal abnormalities. The presence of dark bands typically indicates less transcriptionally active regions, which contributes to the assessment of gene density and overall genomic structure. In contrast, the other choices relate to regions that are not characterized by the dark bands produced by GTG banding. Gene-rich regions and euchromatin regions are usually lighter in appearance due to their composition (higher GC content or being more transcriptionally active), whereas gene-poor regions, while they may seem similar to dark bands, specifically refer to the lower density of genes rather than the AT richness that characterizes the dark bands.