

12. Which Statement Is True About Nucleic Acids?A. They Are Made By The NucleolusB. They Are The Monomers

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Understanding the fundamental biomolecules that compose all living organisms is essential in biology, and among these, nucleic acids hold a central place. The question posed—"Which statement is true about nucleic acids: A. They are made by the nucleolus or B. They are the monomers"—serves as a gateway to exploring the structure, formation, and function of these vital molecules. To clarify this, we will delve into the nature of nucleic acids, their synthesis, and the misconception surrounding their composition.

What Are Nucleic Acids?

Nucleic acids are large, complex molecules that store and transfer genetic information within living organisms. They are essential for the continuity of life, controlling cellular activities, and transmitting hereditary traits from one generation to the next.

Types of Nucleic Acids

There are two main types:

- **Deoxyribonucleic acid (DNA):** Contains the genetic blueprint of an organism.
- **Ribonucleic acid (RNA):** Plays roles in protein synthesis and gene regulation.

Both types are polymers composed of monomer units called nucleotides.

Basic Structure of Nucleic Acids

Nucleic acids are polynucleotides, meaning they consist of long chains of nucleotides linked together through phosphodiester bonds. Each nucleotide is made of three components:

1. **A nitrogenous base:** Purine or pyrimidine (e.g., adenine, guanine, cytosine, thymine, uracil).
2. **A sugar:** Deoxyribose in DNA and ribose in RNA.
3. **A phosphate group:** Linking nucleotides together.

This structure allows nucleic acids to encode genetic information efficiently.

The Role of the Nucleolus in Nucleic Acid Synthesis

The statement "A. They are made by the nucleolus" suggests that nucleic acids are synthesized in the nucleolus. To evaluate this, it's important to understand the functions of the nucleolus and the processes involved in nucleic acid production.

The Function of the Nucleolus

The nucleolus is a dense, spherical structure within the nucleus of eukaryotic cells. Its primary functions include:

- Ribosomal RNA (rRNA) synthesis
- Assembly of ribosomal subunits

While the nucleolus is crucial for ribosome production, it is not directly involved in the synthesis of all nucleic acids.

Where Are Nucleic Acids Made?

Nucleic acids are synthesized in the nucleus, but their production involves different processes:

- **DNA replication:** Occurs throughout the nucleus during cell division, involving enzymes like DNA polymerase.

- **Transcription (RNA synthesis):** Also occurs in the nucleus, where RNA polymerase synthesizes RNA from a DNA template.

The nucleolus mainly facilitates rRNA gene transcription and ribosome assembly but does not produce all nucleic acids.

Conclusion on the Nucleolus's Role

Therefore, the statement "They are made by the nucleolus" is only partially true if referring specifically to rRNA. However, it is inaccurate to claim that all nucleic acids are produced solely by the nucleolus, as DNA replication and other RNA synthesis occur across the entire nucleus.

Understanding Monomers and Polymers in Nucleic Acids

The alternative statement "B. They are the monomers" implies that nucleic acids are monomers, which is a misconception. To clarify this, let's explore what monomers and polymers are, and how they relate to nucleic acids.

What Are Monomers?

Monomers are small, simple molecules that can join together to form larger, more complex molecules called polymers. In biological systems:

- Nucleotides are the monomers of nucleic acids.
- Amino acids are the monomers of proteins.
- Simple sugars are the monomers of carbohydrates.

Nucleic Acids Are Polymers

Nucleic acids are not monomers; rather, they are long chains of monomers called nucleotides. When nucleotides polymerize through covalent bonds, they form the backbone of DNA and RNA.

Difference Between Nucleotides and Nucleic Acids

Aspect	Nucleotide	Nucleic Acid
Definition	The monomer unit of nucleic acids	The polymer made up of many nucleotides
Composition	Nitrogenous base + sugar + phosphate	Chain of nucleotides linked together

Clarifying the Correct Statement

Based on the above explanations:

- The statement "They are made by the nucleolus" is only partially true if referring specifically to rRNA but is misleading if implying all nucleic acids are synthesized there.
- The statement "They are the monomers" is false because nucleic acids are polymers, not monomers.

Therefore, neither statement is entirely correct in its current form. The accurate understanding is that nucleic acids are polymers composed of monomer units called nucleotides, synthesized through complex cellular processes involving various enzymes and cellular structures.

Summary and Key Takeaways

- Nucleic acids (DNA and RNA) are essential biomolecules that store and transfer genetic information.
- They are polymers made up of monomers called nucleotides, each consisting of a nitrogenous base, a sugar, and a phosphate group.
- The nucleolus plays a vital role in synthesizing rRNA and assembling ribosomal subunits, but it does not produce all nucleic acids.
- Nucleic acid synthesis (DNA replication and transcription) occurs throughout the nucleus, involving different enzymes and processes.
- The statement claiming nucleic acids are monomers is incorrect; they are polymers constructed from nucleotide monomers.

Final Thoughts

Understanding the nature of nucleic acids is fundamental to grasping genetic mechanisms and molecular biology. Recognizing that nucleic acids are polymers composed of nucleotides clarifies their structure and function within cells. While the nucleolus is crucial for specific aspects of nucleic acid

production, especially rRNA, it is not the sole site of nucleic acid synthesis. Accurate knowledge of these molecular details enhances our comprehension of life's molecular foundations and informs various fields, from genetics to biotechnology.

In conclusion, the correct perspective is that nucleic acids are complex polymers made from nucleotide monomers, and their synthesis involves various cellular components and processes beyond just the nucleolus.

Frequently Asked Questions

What is the primary function of nucleic acids in biological systems?

Nucleic acids store and transfer genetic information, with DNA carrying the genetic blueprint and RNA involved in protein synthesis.

Are nucleic acids made by the nucleolus?

No, nucleic acids are not made by the nucleolus; they are synthesized in the nucleus but not specifically by the nucleolus itself.

Are nucleic acids considered monomers?

No, nucleic acids are polymers made up of monomers called nucleotides.

What are the building blocks of nucleic acids?

The building blocks are nucleotides, which consist of a sugar, a phosphate group, and a nitrogenous base.

Which statement is true about nucleic acids: they are made by the nucleolus or they are monomers?

The correct statement is that nucleic acids are made of monomers called nucleotides; they are not made by the nucleolus.

How do nucleotides differ from nucleic acids?

Nucleotides are the monomeric units that assemble to form nucleic acids like DNA and RNA.

Additional Resources

12. Which Statement Is True About Nucleic Acids? A. They Are Made By The Nucleolus B. They Are The Monomers

Understanding the fundamental building blocks of life is essential to grasping the complexities of biology. Among these building blocks, nucleic acids play a pivotal role, carrying the genetic blueprint that defines every organism. Yet, misconceptions often arise regarding their origin and structure. A common question posed by students and enthusiasts alike is: Which statement is true about nucleic acids? Is it that they are made by the nucleolus, or that they are the monomers? To answer this accurately, it's vital to explore the nature of nucleic acids, their synthesis, and their structural composition.

What Are Nucleic Acids?

Nucleic acids are large, complex molecules that store and transfer genetic information in living organisms. They are essential for the growth, development, reproduction, and maintenance of life. The two primary types of nucleic acids are:

- Deoxyribonucleic acid (DNA): Carries the hereditary blueprint of an organism.
- Ribonucleic acid (RNA): Plays crucial roles in protein synthesis and gene regulation.

These molecules are distinguished by their unique structures, functions, and their roles in the central dogma of molecular biology: DNA → RNA → Protein.

The Role and Location of the Nucleolus

Before delving into the specific statements, it's important to clarify the role of the nucleolus within the cell. The nucleolus is a dense, spherical structure found within the nucleus of eukaryotic cells. Its primary functions include:

- Ribosomal RNA (rRNA) synthesis: The nucleolus is the site where rRNA is transcribed.
- Ribosome assembly: It assembles ribosomal subunits, which are later transported out of the nucleus to form functional ribosomes in the cytoplasm.

Key Point: The nucleolus is intimately involved in the production of rRNA and ribosome assembly, not directly in the synthesis of nucleic acids like DNA or RNA.

Analyzing the Statements

Let's examine the two statements in detail:

- A. They Are Made By The Nucleolus
- B. They Are The Monomers

Statement A: Are Nucleic Acids Made by the Nucleolus?

Clarifying the claim:

This statement suggests that nucleic acids are synthesized or produced by the nucleolus.

The truth about nucleic acid synthesis:

- DNA synthesis: Occurs during DNA replication, which primarily takes place in the nucleus but is not confined solely to the nucleolus. It involves DNA polymerases and occurs throughout the nucleus.
- RNA synthesis: Specifically, rRNA is transcribed in the nucleolus. However, other RNA types, such as messenger RNA (mRNA) and transfer RNA (tRNA), are synthesized in the nucleoplasm (the remainder of the nucleus), not exclusively in the nucleolus.

Conclusion:

- Partially true for rRNA: The nucleolus is indeed the site for rRNA synthesis.
- False for overall nucleic acids: DNA and other RNA types are not made by the nucleolus but elsewhere in the nucleus.

Therefore, the statement that nucleic acids are made by the nucleolus is not entirely accurate. The nucleolus is involved specifically in rRNA synthesis, but it does not produce all nucleic acids.

Statement B: Are Nucleic Acids the Monomers?

Understanding what "monomers" means:

In chemistry and biology, monomers are small units that can join together to form larger molecules called polymers. For example:

- Amino acids are monomers that polymerize to form proteins.
- Nucleotides are monomers that polymerize to form nucleic acids.
- Simple sugars (monosaccharides) are monomers for polysaccharides.

Nucleic acids as polymers:

Nucleic acids (DNA and RNA) are polymers, composed of repeating units called nucleotides.

Are nucleic acids themselves monomers?

- No. Nucleic acids are not monomers; they are polymers.
- Their monomers are nucleotides, which consist of three parts:
 - A nitrogenous base (adenine, thymine, cytosine, guanine, uracil)
 - A five-carbon sugar (deoxyribose in DNA, ribose in RNA)
 - A phosphate group

Conclusion:

- Nucleic acids are not monomers; they are polymers made up of monomers called nucleotides.

Clarifying Common Misconceptions

The confusion often arises because of terminology and the functions of different cellular structures. To avoid misunderstanding:

- Nucleic acids are polymers, not monomers.
- The nucleolus is involved in the production of rRNA, a component of ribosomes, but does not synthesize all nucleic acids.

Summarizing the Truth

Based on scientific understanding:

- Statement A ("They are made by the nucleolus") is partially true but misleading if interpreted broadly. It is true for rRNA but false for DNA and other RNA types.
- Statement B ("They are the monomers") is incorrect, as nucleic acids are polymers, not monomers.

Therefore, neither statement fully captures the accurate description of nucleic acids. However, in the context of common misconceptions, the more precise correction is that nucleic acids are not monomers but polymers made from monomers called nucleotides.

The Big Picture: Nucleic Acids in Biology

Understanding the true nature of nucleic acids is vital for appreciating their role in life processes:

- They encode genetic information in sequences of nucleotides.
- Their synthesis involves complex enzymatic processes, primarily in the nucleus.
- The nucleolus contributes specifically to ribosomal RNA production, which is essential for protein synthesis.

Final Thoughts

In summary, the statement "They are made by the nucleolus" is only partially true, applicable specifically to rRNA, but not to all nucleic acids like DNA or other types of RNA. The statement "They are the monomers" is incorrect because nucleic acids are polymers composed of nucleotide monomers.

Understanding these distinctions is crucial for students of biology and life sciences, as it helps clarify the processes underlying genetic information flow and cellular function. Recognizing that nucleic acids are complex molecules built from smaller units, and that their synthesis involves multiple cellular components, provides a clearer picture of molecular biology's intricacies.

References

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In conclusion, the correct understanding is that nucleic acids are polymers made up of nucleotide monomers, and while the nucleolus plays a vital role in rRNA synthesis, it does not produce all nucleic acids.

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