

Practice Protein Synthesis Answer Key

Name _____ Period _____ Date _____

Review and Practice: Protein Synthesis

Part 1. Practicing translation

1. Which amino acids do the following mRNA sequences code for?

G G C
U A C A C G
C A G
U A U A C G
U A G
U A G A C G

2. Which amino acids do the following DNA sequences code for?

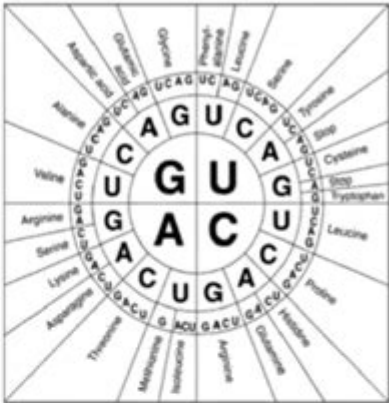
T A C
A A T
T C A
G G C T A C

3. What sequence of mRNA could code for the following amino acids? (Give one possibility)

Cysteine
Tyrosine
Stop

4. What sequence of DNA could code for the following amino acids? (Give one possibility)

Arginine
Tryptophan
Stop



Part 2. How DNA controls the workings of the cell

Below are two partial sequences of DNA bases. Sequence 1 is from a human, and sequence 2 is from a cow. In both humans and cows, the sequence contains the gene to make the protein insulin. Insulin is necessary for the uptake of sugar from the blood. Without insulin, a person cannot digest sugars the same way others can, and they have a disease called diabetes.

Using the DNA sequence, make a complimentary mRNA strand for both the human and the cow. Write the mRNA directly below the DNA strand (remember to substitute Us for Ts in mRNA). Use a codon chart to determine what amino acids are assembled to make the insulin protein in both the cow and the human. Write your amino acid chain directly below the RNA sequence.

Table 1: Human insulin protein sequence

DNA Sequence	CCATAGCACGTTACAACGTGAAGGTAA
mRNA	
Amino Acids	

Table 2: Cow insulin protein sequence

DNA Sequence	CCGTAGCATGTTACAACGCGAAGGCAC
mRNA	
Amino Acids	

Practice Protein Synthesis Answer Key: Mastering the Central Dogma of Molecular Biology

Are you struggling to grasp the intricacies of protein synthesis? Feeling lost in the world of mRNA, tRNA, ribosomes, and codons? You're not alone! Protein synthesis is a fundamental concept in biology, and mastering it is crucial for success in many scientific fields. This comprehensive guide provides a detailed look at protein synthesis, offers practice problems with a complete practice

protein synthesis answer key, and helps you solidify your understanding of this critical process. We'll break down the complex steps into manageable chunks, making it easier to understand and remember. Get ready to conquer protein synthesis!

H2: Understanding the Central Dogma: DNA to RNA to Protein

Before diving into practice problems, let's refresh our understanding of the central dogma of molecular biology. This fundamental principle describes the flow of genetic information within a biological system:

DNA Replication: DNA, the blueprint of life, replicates itself to pass genetic information to daughter cells.

Transcription: The DNA sequence is transcribed into messenger RNA (mRNA). This process occurs in the nucleus of eukaryotic cells. The DNA's genetic code is copied onto a messenger molecule.

Translation: The mRNA molecule travels to the ribosome, where the genetic code is translated into a specific amino acid sequence, forming a polypeptide chain that folds into a functional protein. This occurs in the cytoplasm.

This journey from DNA to protein is the essence of gene expression, and understanding each step is key to comprehending protein synthesis.

H2: Key Players in Protein Synthesis

Several key players are involved in the intricate process of protein synthesis:

DNA: The template containing the genetic code.

mRNA (messenger RNA): Carries the genetic code from DNA to the ribosome.

tRNA (transfer RNA): Each tRNA molecule carries a specific amino acid and recognizes a corresponding codon on the mRNA.

Ribosomes: The cellular machinery that reads the mRNA and links amino acids together.

Amino acids: The building blocks of proteins.

Codons: Three-nucleotide sequences on mRNA that specify a particular amino acid.

Anticodons: Three-nucleotide sequences on tRNA that are complementary to codons.

H2: Practice Protein Synthesis Problems and Answer Key

Let's put your knowledge to the test with some practice problems. Remember to consult your textbook or class notes if needed. The answer key is provided below.

Problem 1: Given the following DNA sequence: 3'-TACGTTAGCT-5', what is the corresponding mRNA sequence? What is the resulting amino acid sequence? (Use a standard codon chart)

Problem 2: If a tRNA molecule has the anticodon 3'-UAC-5', what codon on the mRNA does it recognize? What amino acid does it carry?

Problem 3: Explain the role of ribosomes in protein synthesis. What are the two ribosomal subunits?

H3: Practice Protein Synthesis Answer Key

Problem 1 Answer:

mRNA sequence: 5'-AUGCAAUCGA-3' (Remember that mRNA is synthesized in the 5' to 3' direction and uses uracil (U) instead of thymine (T))

Amino acid sequence: Met-Gln-Ser (Using a standard codon chart)

Problem 2 Answer:

mRNA codon: 5'-AUG-3' (complementary to the anticodon)

Amino acid: Methionine (Met)

Problem 3 Answer:

Ribosomes are the protein synthesis machinery. They bind to mRNA and tRNA, facilitating the peptide bond formation between amino acids. The two ribosomal subunits are the small (30S) and large (50S) subunits in prokaryotes and the small (40S) and large (60S) subunits in eukaryotes.

H2: Troubleshooting Common Challenges in Understanding Protein Synthesis

Many students find certain aspects of protein synthesis challenging. Here are some common difficulties and how to overcome them:

Memorizing the Genetic Code: Use flashcards or mnemonic devices to learn the codons and their corresponding amino acids.

Understanding the Role of tRNA: Visualize tRNA as a "translator" that carries the correct amino acid to the ribosome based on the mRNA codon.

Following the Steps: Break down the process into smaller, more manageable steps: transcription, initiation, elongation, and termination.

H2: Beyond the Basics: Expanding Your Knowledge

Once you have a solid grasp of the fundamentals, you can delve deeper into more advanced concepts such as:

Post-translational modifications: Proteins often undergo modifications after synthesis to become fully functional.

Regulation of gene expression: The process of controlling which genes are expressed and when.

Mutations and their effects on protein synthesis: How changes in the DNA sequence can affect the final protein product.

Conclusion

Mastering protein synthesis is a significant step in understanding molecular biology. By working through practice problems and reviewing the key concepts, you can build a strong foundation in this critical area of biology. This guide, complete with a practice protein synthesis answer key, provides a comprehensive roadmap to success. Remember to actively engage with the material, practice regularly, and seek help when needed. Good luck!

FAQs

1. What is the difference between transcription and translation? Transcription is the process of copying DNA into mRNA, while translation is the process of using mRNA to synthesize a protein.
2. What are the three stop codons? UAA, UAG, and UGA. These codons signal the end of translation.
3. How many amino acids are commonly found in proteins? There are 20 standard amino acids.
4. What is a polysome? A polysome (or polyribosome) is a complex of several ribosomes translating a single mRNA molecule simultaneously, increasing the efficiency of protein synthesis.
5. Can errors occur during protein synthesis? Yes, errors such as mutations in the DNA sequence or mistakes during translation can lead to the production of non-functional or even harmful proteins.

practice protein synthesis answer key: Biology for AP® Courses Julianne Zedalis, John Eggebrecht, 2017-10-16 Biology for AP® courses covers the scope and sequence requirements of a typical two-semester Advanced Placement® biology course. The text provides comprehensive coverage of foundational research and core biology concepts through an evolutionary lens. Biology for AP® Courses was designed to meet and exceed the requirements of the College Board's AP® Biology framework while allowing significant flexibility for instructors. Each section of the book includes an introduction based on the AP® curriculum and includes rich features that engage students in scientific practice and AP® test preparation; it also highlights careers and research opportunities in biological sciences.

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practice protein synthesis answer key: Human Biochemistry Gerald Litwack, 2021-11-28
Selected for Doody's Core Titles® 2024 in Biochemistry Human Biochemistry, Second Edition provides a comprehensive, pragmatic introduction to biochemistry as it relates to human development and disease. Here, Gerald Litwack, award-winning researcher and longtime teacher, discusses the biochemical aspects of organ systems and tissue, cells, proteins, enzymes, insulins and sugars, lipids, nucleic acids, amino acids, polypeptides, steroids, and vitamins and nutrition, among other topics. Fully updated to address recent advances, the new edition features fresh discussions on hypothalamic releasing hormones, DNA editing with CRISPR, new functions of cellular prions, plant-based diet and nutrition, and much more. Grounded in problem-driven learning, this new edition features clinical case studies, applications, chapter summaries, and review-based questions that translate basic biochemistry into clinical practice, thus empowering active clinicians, students and researchers. - Presents an update on a past edition winner of the 2018 Most Promising New Textbook (College) Award (Texty) from the Textbook and Academic Authors Association and the PROSE Award of the Association of American Publishers - Provides a fully updated resource on current research in human and medical biochemistry - Includes clinical case studies, applications, chapter summaries and review-based questions - Adopts a practice-based approach, reflecting the needs of both researchers and clinically oriented readers

practice protein synthesis answer key: Principles of Biology Lisa Barteo, Walter Shiner, Catherine Creech, 2017 The Principles of Biology sequence (BI 211, 212 and 213) introduces biology as a scientific discipline for students planning to major in biology and other science disciplines. Laboratories and classroom activities introduce techniques used to study biological processes and provide opportunities for students to develop their ability to conduct research.

practice protein synthesis answer key: Computer Assisted Modeling National Research Council, Division on Earth and Life Studies, Commission on Life Sciences, Committee on Computer-Assisted Modeling, 1987-02-01 In much of biology, the search for understanding the relation between structure and function is now taking place at the macromolecular level. Proteins, nucleic acids, and polysaccharides are macromolecule--polymers formed from families of simpler subunits. Because of their size and complexity, the polymers are capable of both inter- and intramolecular interactions. These interactions confer upon the polymers distinctive three-dimensional shapes. These tertiary configurations, in turn, determine the function of the macromolecule. Computers have become so inextricably involved in empirical studies of three-dimensional macromolecular structure that mathematical modeling, or theory, and experimental approaches are interrelated aspects of a single enterprise.

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William Clarke, Mark Marzinke, 2020-06-11 Contemporary Practice in Clinical Chemistry, Fourth Edition, provides a clear and concise overview of important topics in the field. This new edition is useful for students, residents and fellows in clinical chemistry and pathology, presenting an introduction and overview of the field to assist readers as they in review and prepare for board certification examinations. For new medical technologists, the book provides context for understanding the clinical utility of tests that they perform or use in other areas in the clinical laboratory. For experienced laboratorians, this revision continues to provide an opportunity for exposure to more recent trends and developments in clinical chemistry. - Includes enhanced illustration and new and revised color figures - Provides improved self-assessment questions and end-of-chapter assessment questions

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Dudek, Rd, Cdn, Bs, Susan G. Dudek, 2013-04-22 The Seventh Edition of this nursing-focused nutrition text has been updated to reflect the latest evidence-based practice and nutrition recommendations. Written in a user-friendly style, the text emphasizes what the nurse really needs to know in practice. Maintaining its nursing process focus and emphasis on patient teaching, this edition includes features to help readers integrate nutrition into nursing care such as sample Nursing Process tables, Case Studies in every chapter, and new Interactive Case Studies online. This is the tablet version which does not include access to the supplemental content mentioned in the text.

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Roush, James Wise, 2023-05-12 Black & white print. Concepts of Biology is designed for the typical introductory biology course for nonmajors, covering standard scope and sequence requirements. The text includes interesting applications and conveys the major themes of biology, with content that is meaningful and easy to understand. The book is designed to demonstrate biology concepts and to promote scientific literacy.

practice protein synthesis answer key: Improving Healthcare Quality in Europe

Characteristics, Effectiveness and Implementation of Different Strategies OECD, World Health Organization, 2019-10-17 This volume, developed by the Observatory together with OECD, provides an overall conceptual framework for understanding and applying strategies aimed at improving quality of care. Crucially, it summarizes available evidence on different quality strategies and provides recommendations for their implementation. This book is intended to help policy-makers to understand concepts of quality and to support them to evaluate single strategies and combinations of strategies.

practice protein synthesis answer key: A Framework for K-12 Science Education

National Research Council, Division of Behavioral and Social Sciences and Education, Board on Science Education, Committee on a Conceptual Framework for New K-12 Science Education

Standards, 2012-02-28 Science, engineering, and technology permeate nearly every facet of modern life and hold the key to solving many of humanity's most pressing current and future challenges. The United States' position in the global economy is declining, in part because U.S. workers lack fundamental knowledge in these fields. To address the critical issues of U.S. competitiveness and to better prepare the workforce, A Framework for K-12 Science Education proposes a new approach to K-12 science education that will capture students' interest and provide them with the necessary foundational knowledge in the field. A Framework for K-12 Science Education outlines a broad set of expectations for students in science and engineering in grades K-12. These expectations will inform the development of new standards for K-12 science education and, subsequently, revisions to curriculum, instruction, assessment, and professional development for educators. This book identifies three dimensions that convey the core ideas and practices around which science and engineering education in these grades should be built. These three dimensions are: crosscutting concepts that unify the study of science through their common application across science and engineering; scientific and engineering practices; and disciplinary core ideas in the physical sciences, life sciences, and earth and space sciences and for engineering, technology, and the applications of science. The overarching goal is for all high school graduates to have sufficient knowledge of science and engineering to engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter the careers of their choice. A Framework for K-12 Science Education is the first step in a process that can inform state-level decisions and achieve a research-grounded basis for improving science instruction and learning across the country. The book will guide standards developers, teachers, curriculum designers, assessment developers, state and district science administrators, and educators who teach science in informal environments.

practice protein synthesis answer key: *Historical Painting Techniques, Materials, and Studio Practice* Arie Wallert, Erma Hermens, Marja Peek, 1995-08-24 Bridging the fields of conservation, art history, and museum curating, this volume contains the principal papers from an international symposium titled Historical Painting Techniques, Materials, and Studio Practice at the University of Leiden in Amsterdam, Netherlands, from June 26 to 29, 1995. The symposium—designed for art historians, conservators, conservation scientists, and museum curators worldwide—was organized by the Department of Art History at the University of Leiden and the Art History Department of the Central Research Laboratory for Objects of Art and Science in Amsterdam. Twenty-five contributors representing museums and conservation institutions throughout the world provide recent research on historical painting techniques, including wall painting and polychrome sculpture. Topics cover the latest art historical research and scientific analyses of original techniques and materials, as well as historical sources, such as medieval treatises and descriptions of painting techniques in historical literature. Chapters include the painting methods of Rembrandt and Vermeer, Dutch 17th-century landscape painting, wall paintings in English churches, Chinese paintings on paper and canvas, and Tibetan thangkas. Color plates and black-and-white photographs illustrate works from the Middle Ages to the 20th century.

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practice protein synthesis answer key: Pre-mRNA Processing Angus I. Lamond, 2014-08-23
In the past fifteen years have seen tremendous growth in our understanding of the many post-transcriptional processing steps involved in producing functional eukaryotic mRNA from primary gene transcripts (pre-mRNA). New processing reactions, such as splicing and RNA editing, have been discovered and detailed biochemical and genetic studies continue to yield important new insights into the reaction mechanisms and molecular interactions involved. It is now apparent that regulation of RNA processing plays a significant role in the control of gene expression and development. An increased understanding of RNA processing mechanisms has also proved to be of considerable clinical importance in the pathology of inherited disease and viral infection. This volume seeks to review the rapid progress being made in the study of how mRNA precursors are processed into mRNA and to convey the broad scope of the RNA field and its relevance to other areas of cell biology and medicine. Since one of the major themes of RNA processing is the recognition of specific RNA sequences and structures by protein factors, we begin with reviews of RNA-protein interactions. In chapter 1 David Lilley presents an overview of RNA structure and illustrates how the structural features of RNA molecules are exploited for specific recognition by protein, while in chapter 2 Maurice Swanson discusses the structure and function of the large family of hnRNP proteins that bind to pre-mRNA. The next four chapters focus on pre-mRNA splicing.

practice protein synthesis answer key: Master the PCAT Peterson's, 2012-07-15
Master the PCAT is an in-depth review that offers thorough preparation for the computer-based exam. After learning about the structure, format, scoring and score reporting, and the subtests and question types, you can take a diagnostic test to learn about your strengths and weaknesses. The next six parts of the eBook are focused on detailed subject reviews for each subtest: verbal ability, reading comprehension, biology, chemistry, quantitative ability, and writing. Each review includes practice questions with detailed answer explanations. You can take two practice tests to track your study progress. The tests also offer detailed answer explanations to further improve your knowledge and understanding of the tested subjects. The eBook concludes with an appendix that provides helpful information on a variety of careers in pharmacy and ten in-depth career profiles.

practice protein synthesis answer key: Protein Biosynthesis in Eukaryotes R. Perez-Bercoff, 2012-07-01
The word *protein*, coined one and a half century ago from the *Proteios* (proteios = of primary importance), underlines the primary importance ascribed to proteins from the time they were described as biochemical entities. But the unmatched complexity of the process involved in their biosynthesis was (understandably) overlooked. Indeed, protein biosynthesis was supposed to be nothing more than the reverse of protein degradation, and the same enzymes known to split a protein into its constituent amino acids were thought to be able, under adequate conditions, to reconstitute the peptide bond. This oversimplified view persisted for more than 50 years: It was just in 1940 that Borsook and Dubnoff examined the thermodynamical aspects of the process, and concluded that protein synthesis could not be the reverse of protein degradation, such an uphill task being thermodynamically impossible ••• The next quarter of a century witnessed the unravelling of the basic mechanisms of protein biosynthesis, a predictable aftermath of the Copernican revolution in biology which followed such dramatic developments as the discovery of the nature of the genetic material, the double helical structure of DNA, and the determination of the genetic code. Our present understanding of the sophisticated mechanisms of regulation and control is a relatively novel acquisition, and recent studies have shed some light into the structure and organization of the eukaryotic gene.

practice protein synthesis answer key: *Meiosis and Gametogenesis*, 1997-11-24 In spite of the fact that the process of meiosis is fundamental to inheritance, surprisingly little is understood about how it actually occurs. There has recently been a flurry of research activity in this area and this volume summarizes the advances coming from this work. All authors are recognized and respected research scientists at the forefront of research in meiosis. Of particular interest is the emphasis in this volume on meiosis in the context of gametogenesis in higher eukaryotic organisms, backed up by chapters on meiotic mechanisms in other model organisms. The focus is on modern molecular and cytological techniques and how these have elucidated fundamental mechanisms of meiosis. Authors provide easy access to the literature for those who want to pursue topics in greater depth, but reviews are comprehensive so that this book may become a standard reference. Key Features* Comprehensive reviews that, taken together, provide up-to-date coverage of a rapidly moving field* Features new and unpublished information* Integrates research in diverse organisms to present an overview of common threads in mechanisms of meiosis* Includes thoughtful consideration of areas for future investigation

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that biology teachers will recognize. Biology Inquiries provides a pool of active learning lessons to choose from with valuable tips on how to implement them.

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practice protein synthesis answer key: Principles of Exercise Biochemistry J. R. Poortmans, 2004 This unique volume provides a comprehensive review of the biochemistry of exercise. Written by internationally renowned experts, the publication has been completely revised and updated. The present edition follows the new concepts of applied biochemistry which have emerged recently in the scientific literature. Genomics, proteomics, and metabolomics are nowadays common terms used to the elucidation of gene function, expression of proteins and comprehensive analysis of all the metabolites in a tissue. The major steps of biochemistry are considered in active survey in this new 3rd edition of an already acclaimed publication. The book is a valuable source for all exercise biochemists and physiologists, sports physicians, graduate students in physical education and physical therapy, and postgraduate research fellows.

practice protein synthesis answer key: Effect of High Temperature on Crop Productivity and Metabolism of Macro Molecules Amitav Bhattacharya, 2019-06-14 Effect of High Temperature on Crop Productivity and Metabolism of Macro Molecules presents a comprehensive overview on the direct effect of temperatures defined as high, a definition which increasingly includes a great number of geographic regions. As temperature impacts the number of base growth days, it is necessary to adapt plant selection, strategize planting times, and understand the expected impact of adaptive steps to ensure maximum plant health and crop yield. Global warming, climate change and change in environmental conditions have become common phrases in nearly every scientific seminar, symposium and meeting, thus these changes in climatic patterns constrain normal growth and reproduction cycles. This book reviews the effect of high temperature on agricultural crop production and the effect of high temperature stress on the metabolic aspects of macro molecules, including carbohydrates, proteins, fats, secondary metabolites, and plant growth hormones. - Focuses on the effects of high temperature on agriculture and the metabolism of important macro-molecules - Discusses strategies for improving heat tolerance, thus educating plant and molecular breeders in their attempts to improve efficiencies and crop production - Provides information that can be applied today and in future research

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