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Understanding Protein Molecule Structure Using 3D Models

Lesson Plan for Lower Secondary (Grades 6-8) Biology



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Lesson Objectives



Understand Protein Structure

Students will understand the basic structure of a protein molecule.



Identify Amino Acid Components

Students will identify the components of amino acids and how they form proteins.



Use 3D Models

Students will use 3D models to visualize protein structure and understand its importance in biology.



Materials Needed



3D Printer



3D Printed Models

Amino acids and protein molecules



Molecular Model Kits

Optional



Interactive Software

Optional, if technology is available



Worksheets

With guided questions and diagrams of protein structures



Whiteboard and Markers



Computers or Tablets

Optional



Coloring Materials

Colored pencils or markers



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Lesson Duration and Outline

1

Lesson Duration

2 hours

2

1st Hour

Amino-acid model production: Go to the address <https://www.thingiverse.com/thing:2175399>. There you can find the scenario "The 20 standard amino acids" (License CC BY by [shocksofmighty](#) is licensed under the [Creative Commons - Attribution](#) license). Download all the files, print them on a 3D-printer.

3

2nd Hour

Lecture - Theoretical stage

Introduction (10 minutes)



1

Greeting and Attendance

Welcome students and take attendance.

2

Hook Activity

Show a short video or animation illustrating the structure and function of proteins.

3

Class Discussion

Ask students if they know what proteins are and why they are important for living organisms.

Direct Instruction (15 minutes)

Overview of Proteins

Explain that proteins are essential molecules made up of amino acids that play many roles in the body, such as building tissues, acting as enzymes, and supporting immune functions.

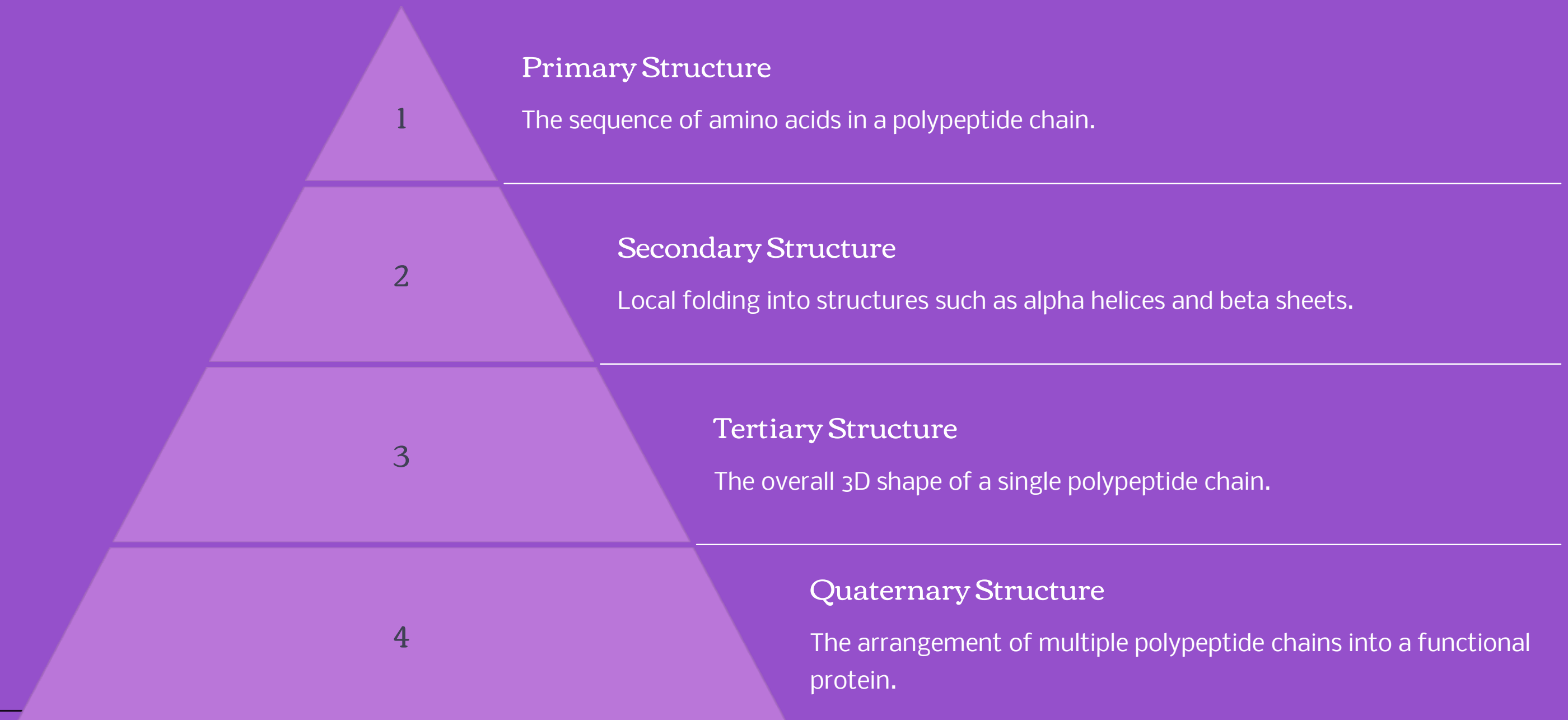
Introduction to Amino Acids

Explain that amino acids are the building blocks of proteins. Describe the general structure of an amino acid: a central carbon (alpha carbon) bonded to an amino group (NH_2), a carboxyl group (COOH), a hydrogen atom, and a variable side chain (R group).

Introduction to 3D Models

Show the 3D printed models of amino acids you have created and explain how they connect to form proteins. Briefly describe the process of peptide bond formation and how amino acids link together in a chain to form polypeptides.

Protein Structure Levels





Guided Practice (20 minutes)

Hands-On Exploration with 3D Models

Divide students into small groups and distribute 3D models of amino acids and protein structures. Have students build a simple polypeptide chain using the models, connecting amino acids through peptide bonds.

Worksheet Activity

Hand out worksheets with diagrams of protein structures. Have students label the parts of an amino acid and the different levels of protein structure. Include questions about the function of proteins and how their structure determines their function.

Interactive Protein Modeling Software (Optional)

If technology is available, allow students to explore interactive protein modeling software on computers or tablets. Assign tasks such as visualizing different protein structures and identifying alpha helices and beta sheets.



Independent Practice (10 minutes)

Coloring Activity

Provide students with coloring materials and blank diagrams of protein structures. Ask students to color each part of the amino acid and different levels of protein structure according to a color key provided.

Worksheet Questions

Complete additional questions on the worksheet about the structure and function of proteins.



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Conclusion (5 minutes)



1

Review

Summarize the key points of the lesson: the structure of amino acids, how they form proteins, and the different levels of protein structure.

2

Q&A

Open the floor for any questions from students.

3

Exit Ticket

Ask students to write down one new thing they learned about proteins and one question they still have. Collect exit tickets as they leave.

Assessment and Differentiation

Assessment

Formative: Observation during guided practice, checking for understanding and providing immediate feedback.

Summative: Graded worksheet to assess individual understanding of protein structure and function.

Differentiation

For Advanced Students: Provide more detailed models or diagrams of protein structures and discuss complex concepts such as protein folding and denaturation.

For Struggling Students: Offer additional visual aids and one-on-one support. Simplify tasks and focus on the basic understanding of amino acids and primary protein structure.



Homework and Reflection

Homework

Assign a task where students create a poster or a 3D model of a protein, labeling each level of structure and describing its function. Encourage students to research a specific protein and write a short report on its structure and function in the body.

Reflection

After the lesson, reflect on what went well and what could be improved. Adjust future lessons based on student understanding and feedback.



**THANK YOU FOR
YOUR TIME**

