Spitty Pudding

Unit: **Structure and Function of Life**	**Utah SEEd Standard / NGSS Performance Expectation:** Construct an explanation based on evidence that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen and that the matter taken into an organism is broken down and recombined to make macromolecules necessary for life functions. Emphasize that molecules are often transformed through enzymatic processes and the atoms involved are used to make carbohydrates, proteins, fats/lipids, and nucleic acids. (LS1.C) • The relationship between the carbon, hydrogen, and oxygen atoms from sugar molecules formed in or ingested by an organism are those same atoms found in amino acids and other large carbon-based molecules. • That larger carbon-based molecules and amino acids can be a result of chemical reactions between sugar molecules (or their component atoms) and other atoms.	**Time: 2 days** **Day 1: Background information and planning investigation** **Day 2: Carry out investigation**

Access to all material for this lesson: Lesson Folder

Anchor Phenomenon	How does pudding react to our saliva?
Driving Question(s)	How can you modify the activity that we just performed to further investigate carbohydrates and enzymes?
Performance Task	Students will plan and carry out an investigation to produce data showing the relationship between the food we ingest for energy and the molecules our body is made of.

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Lesson Summary: Students will be investigating what happens to the matter in macromolecules by doing a teacher led experiment then developing their own experiment.			
	Time	**Guiding Question / Learning Objective**	**How are students answering the guiding question or meeting the learning objective?**
 **Engage**	30-40 minutes	- What are the primary biological macromolecules? - Which ones are found in pudding? - How does pudding react to our saliva? - What energy comes from pudding, and where does it go?	- Verify prior knowledge, introduce the phenomenon - Saliva pudding demonstration ○ Questions/observations, demonstration analysis, and discussion. (See Student Handout)
 **Explore**	10-20 minutes	What is the driving question of your investigation plan? (Student determined)	Students will plan an investigation to produce data on how macromolecules are processed by the body and the role enzymes play in the process.
 **Explain**	5-10 minutes	Students will review and justify their lab and lab procedures.	Review the various student investigation plans and driving questions. Discuss possible obstacles or extensions of the plans discussed.
 **Elaborate**	Day 2, 30-45 minutes	Students will carry out an investigation/experiment	Students will carry out their investigation plan, record the data, and begin to make connections through analyzing their data.
 **Evaluate**	10-15 minutes	Review lab and answer post-lab questions on a worksheet	Students answer questions followed by a class review.

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Three Dimensions Focused on in This Lesson		
Disciplinary Core Idea: **NGSS Appendix E** • The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6) **• As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6),(HS-LS1-7)**	**Science and Engineering Practices:** **NGSS Appendix F** **Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.**	**Crosscutting Concept:** **NGSS Appendix G** **In grades 9-12, students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems.**
Learning Objectives 1. The relationship between the carbon, hydrogen, and oxygen atoms from sugar molecules formed in or ingested by an organism are those same atoms found in amino acids and other large carbon-based molecules. 2. Larger carbon-based molecules and amino acids can result from chemical reactions between sugar molecules (or their component atoms) and other atoms.		
Related Knowledge and Skills from Prior Grades		
Disciplinary Core Idea: **NGSS Appendix E** **Plants use the energy from light to make sugars through photosynthesis. Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy.** **Strand BIO.2: STRUCTURE AND FUNCTION OF LIFE** **Living cells are composed of chemical elements and molecules that form macromolecules.**	**Science and Engineering Practices:** **NGSS Appendix F** **Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.**	**Crosscutting Concept:** **NGSS Appendix G** **In grades 6-8, students learn matter is conserved because atoms are conserved in physical and chemical processes. They also learn within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.**
Connections to Mathematics and ELA/Literacy Standards		

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• **ELA/Literacy Standards: RST.11-12.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • **WHST.9-12.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • **WHST.9-12.5:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. • **WHST.9-12.9:** Draw evidence from informational texts to support analysis, reflection, and research.	**Mathematics Standards:**

Materials

Handouts	Lab Supplies	Other Resources
Spitty Pudding Lab Report (PPT version) Spitty Pudding Lab Report (Word version) Pudding Lab Student Handout Peer Review	- Instant pudding -- 3.4oz per 30 students - Milk (to make the instant pudding) - 2oz/3oz cups – 2 per student - Small plastic spoons – 2 per student - Additional items selected by students for day 2. See notes in the “Explore” section below	Teacher Slides (Spitty Pudding) Introduction to Enzymes How your digestive system works (video)

ENGAGE

1. (**Slide 3**) Show the picture of pudding ingredients. Ask students to record observations and wonderings about the image. Ask students, "What is in pudding?" (show **slide 4** and ask) "What macromolecules are in pudding?" "What are the components of macromolecules (monomers and elements)?" 2. Review the structure of macromolecules (**slide 5**) and the monomer and polymer of carbohydrates. 3. (**Slides 6 & 7**) Give students 2 cups of pudding and 2 spoons. They will label cups 1 and 2. Have them make and record observations of both cups. 4. Have students spit in cup #2 and mix the saliva and pudding. Have them mix cup #1 with a different spoon (no saliva). 5. Measure the mass of cup #1 and cup #2 from any student in class and record the data on their worksheet. 6. Wait 5-10 minutes while the enzyme in the saliva works on the carbohydrates in the pudding. 7. Review enzymes (**slides 8-10**). a. Ask students questions that will get them thinking about how their food is processed, such as, "When you eat a caramel apple sucker, why doesn't it always stay sticky in your mouth, but when you eat steak, it can stay stuck in your teeth?" 8. Ask: "How do individual organisms get energy from their food?" 9. Show the TedEd video on digestion and ask the question again now that students have more information. 10. After the video, students can look at their pudding cups and record observations. 11. Measure the masses of the pudding cups again and have students record that data. 12. Students answer questions 6-9 on their worksheets. 13. Make sure students understand what is happening to the matter in their pudding cups. The matter is still the same; it is just broken down now, which is why the mass of the pudding cups stayed the same.	**Teacher Tips** - Use a shaker bottle to make pudding quickly; shake the bottle until resistance is felt (means pudding is set.) Or use premade snack packs. - Use small bathroom cups and place about 1-2 tablespoons of pudding in each cup. - One box of pudding mix will make approximately 28-30 small cups of pudding - Have students think of things like lemons; it will help them salivate. - After 5-10 minutes, the cup with the saliva should be liquid and runny because the starch molecules have broken down. - In a small class, each student can have 2 cups. In larger classes, some students might need to work with a partner with one cup each. - Understand how your scales are calibrated. The masses should be the same before and after the 10 minutes. - Students can measure their cups, or you can do one as a class.

EXPLORE

1. Put students into groups. 2. Ask students to identify ways to modify the pudding activity to further investigate carbohydrates and how they break down. a. With their groups, students should identify a research question to investigate. 3. Show students the list of materials available to them so they can plan their investigation. 4. Give them the Lab Report Template so they can fill out their research question and hypothesis. The teacher will approve these before allowing students to continue. 5. Students will need to identify needed materials and write a step-by-step procedure. 6. Students will need to obtain a signature on their lab procedure from a class peer.	**Teacher Tips** - Materials that students need will vary based on their investigation plans - Try to focus student's questions on what is happening to the matter.

EXPLAIN

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End of day 1 or beginning of day 2 1. After students have their investigation procedures written down and materials identified, discuss with groups or as a class why they chose the procedures. 2. Make sure students justify why the procedures they identify will help them answer their research question. 3. Have students peer review each other's procedures to ensure they are written well enough so that another lab group could perform their experiment.	**Teacher Tips** - Experiments should be based on a carbohydrate and an enzyme.

ELABORATE

Day 2 1. Students will carry out the investigations that they have planned 2. They will record any data, make any graphs/charts applicable, and write a conclusion for their investigation 3. Students will also need to finish the questions from the "**Spitty Pudding**" document and the follow-up questions from the lab sheet.	**Teacher Tips** - Ensure you know how well your scales are calibrated for when students measure the mass of their pudding cups. - If students need ideas for what chart to draw, the lab sheet references the chart from the spitty pudding worksheet.

EVALUATE

1. Review results with students and have them answer post-lab questions on their lab sheet. 2. Students should be able to explain that enzymatic processes break down macromolecules and then recombine them to create needed materials like proteins.	**Teacher Tips** - Review each question as a class (popcorn review, draw names, etc.)

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS

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