Lesson Title: DNA and gene coding
Subject / Grade Level: Biology 11th grade

SAN DIEGO TEACHER RESIDENCY LESSON PLANNING TEMPLATE

CONTEXT

Provide context for the lesson. How, if at all, does it fit within a unit? Who are the learners? How long will the lesson last?

Students are currently preparing projects for exhibition in December. We are teaching only mini-lessons to provide deeper context to their overall project. Projects include topics on sight, water consumption/homeostasis, food allergies, and the heart. This is a mini lesson on DNA and a basic introduction to base pairs coding for specific traits.

GOALS

What are your goals for the activity? Specifically, by the end of the activity, what will students know, feel, understand, and/or be able to do?

Students will be able to explain how an individual's DNA codes for specific traits.
Students will understand the molecular makeup of DNA and how it consists of base pairs and how those base pairs code for genes.
Students will successfully work in groups to complete the task
Students will be able to draw real life implications and comparisons to the material including the applications of DNA and the limitations to DNA in forensics.

STANDARDS

If applicable, provide specific standards that the lesson will target. Indicate if the standard is being introduced (I), practiced (P), or assessed (A) in this lesson. Possible standards frameworks: CA CCSS, NGSS, ELD, and/or Learning for Justice.

SEP: Developing and using Models: Develop and/or use a model to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
SEP: Developing and using Models: Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena and move flexibly between model types based on merits and limitations.
DCI: LS1.A. Structure and Function
PEs: H S-LS1-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

ANTICIPATORY PLANNING

Put yourself in the shoes of your students. Where in the lesson do you anticipate that they will struggle, and why? What questions, about procedures and/or about the content, do you anticipate that they might pose? How will you respond? (Math teachers can also use this more comprehensive anticipato`ry planning resource.)

This is an introduction to all things DNA and genes. For most students this will be new information with limited context

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coming into this activity. The mini lesson before the activity will hopefully be sufficient to provide context for the activity, but I could see some questions clarifying genes, base pairs and their roles.
Ex. - Q:" I don't understand, these simple molecules form groups of threes and make things happen in our body?
A:" It's a little more complex, the base pairs, in groups of threes, code for an amino of which there are about 20 that are coded for in genes. These make up longer strands of proteins, which then make things happen in your body."

- Q: "How do the chemicals know where in DNA to copy" A: " Excellent question. There are start and stop sequences, 3 base pairs long, that indicate where copying should happen. This is all happening really fast and constantly in most cells in your body, so it's a very complicated process that scientists are still studying specifics of."

Once the context is present, and because it's a group assignment, the DNA building activity should not be challenging, though I will be circulating through the room to assure understanding.

PROCEDURE

Please provide specific descriptions of all activities, including what the teacher(s) will be saying and doing and what the students will be doing. *Remember that the person doing the doing & talking is the one doing the learning!*

Launch: How will the teacher spark curiosity, get students actively engaged right away, and help students understand the purpose and process of what they will be doing during the lesson? - 10 minutes total

Start of lesson: First slide is a gif of a rotating DNA strand - Assessment of prior knowledge (3 minutes)
- question posed to students: "What is this and what do you know about it? Take two minutes to jot down your thoughts on your note catcher, question #1. Write anything you can think of related to this."

Now take two minutes and talk with your group and share with them what you wrote down. (2 minutes)
What is something you talked about with your group - each group tell me something that was shared. (5 minutes)

Notecatcher:
https://docs.google.com/document/d/1tHNaR17rvqRIF7aG2YmyaA-nCcdh41y5vsEg91hkL50/edit?usp=sharing

Explore: How will students engage in the "meat" of the lesson?

We're now going to watch a 5 minute long video.
Please use the note catcher to follow along with the information. (5 minutes)

Definitions from notecather: (7 minutes)

2. Deoxyribose Nucleic Acid: **DNA**
3. Shape: **spiral ladder**
4. **Amino Acids** are tiny chemicals. There's about **20** different kinds, each with their own **Shape**.
5. **Amino Acids ...Proteins.....Living Cells .... Tissue ..... Organs .....**
6. **4** different kinds of chemicals
7. **Genetic Code**
8. **RNA** Partial copies of DNA
9. RNA Code **3** letters at a time.... Form a perfectly shaped **Protein**

Lesson Title: DNA and gene coding
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10. DNA is: **A molecular blueprint for a living thing**

Clarifying Questions (5 minutes)
What questions do we have about what we just watched?
Why is DNA so important
What were the letters we noticed in the DNA?
Anyone know what these 4 letters are called?
Does anyone know what letter is different in RNA?
Does anyone know what the name for these letters are?
New Terms:
Genotype vs. Phenotype
Template and Coding/Complementary Strand

Break (5 minutes)

How Genotype codes for Phenotype
Activity: (20 Minutes)
Students will use an identity card with five traits and the base pair combination for that phenotype. Using keys they will build models of DNA strands using gumdrops, different colors representing different base pairs.

How many base pairs code for an amino acid?
Three is the magic number. With this activity we're going to pretend that just three base pairs code for a physical trait or phenotype, but just know this is simplistic. It's far more complicated than this. You are going to use your code along with your identity card to come up with that individual's simplified DNA strand. How many gumdrops should make up the DNA strand?
(hopefully they'll say 30, but most likely they will say 15, and I will need to remind them that DNA is 2 strands)

Utilize current group roles for splitting tasks:

- **Project Manager:** Assemble gumdrops into final spiral ladder
- **Materials Manager:** Assure your group has all the correct materials building your DNA strand
- **Exhibit Text Manager:** Assure your codon translation is correct
- **Aesthetics Manager:** Make sure your gumdrops are in the correct order

Trading Strands: (5 minutes)
When the build is complete they will pass the DNA strand up to the next lab group: ex. 1 to 2, 2 to 3, 3 to 4. Groups will then identify the genotypes and phenotypes present in this individual. This may be a challenge because of the complementary strand. When the group believes they know the phenotype, they can check with the original group to see if they were correct.

Classroom CSI - If time allows (5 minutes)

Lesson Title: DNA and gene coding
Subject / Grade Level: Biology 11th grade

Pairs will receive an envelope with a genotype and a "crime." Students must decode their suspect and draw a quick sketch of what they believe the suspect looks like. They will then find the matching identity card hung somewhere in the room and attach it to their paper.

Optional Video Links for further CSI information
: https://www.youtube.com/watch?v=7onjVBsQwQ8

Optional Video for RNA Transcription:
https://www.youtube.com/watch?v=gG7uCskUOrA

Links
Video: https://www.youtube.com/watch?v=zwibgNGe4aY
Activity: https://www.teachengineering.org/activities/view/cub_biomed_lesson09_activity2

Drop your anchor: How will students synthesize, share their learning with each other and/or with the teacher, and make connections to future lessons?

Wrap up and clarifying questions (7 minutes)
How is DNA evidence really used?
What are the limitations to this model?
Write at least one thing you'd like to learn more about, and at least one question you still have.

DIFFERENTIATION/ACCOMMODATION
How might you provide multiple means of representation, multiple means of expression, and multiple means of engagement? Consider how you will meet the needs of three specific focus students, labelled below.

Special Needs / IEP: Video will be subtitled, Notecatcher will include instructions and scaffolding. Circulating during group work for clarifying questions and assistance when needed.

Emerging Bilingual: Videos will be subtitled, instructions will be written. Circulating during group work for clarifying questions

Ready for challenge: Activity will allow for deeper thought, working in groups allows for leadership roles.

INFORMAL ASSESSMENT
How will you access students' thinking throughout the lesson? What are key moments to check for understanding?

During launch after the DNA GIF, circulating through the groups to hear what is being said and what the class discussion afterwards is like.
After the video, the review of terms and concepts to check for understanding.

Lesson Title: DNA and gene coding
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FORMAL ASSESSMENT

How will you know if your students meet the goals of the lesson? What artifacts of student work will you collect?

Their note catchers will serve as an assessment tool.
The last question of the note catcher asks for something they are still wondering about, and a question they still have

MATERIALS & PREP

What materials will you need to prepare ahead of time? How will the room be set up? What other logistical considerations do you want to plan for? Provide links to documents and/or slides if applicable.

Projector
Computer with slide deck
Speakers

DNA Strand Build
Per Group:

- 30 gumdrops
- 25 toothpicks
- Person Traits card
- Gene key
- Paper plate

Per student:

- Clipboard
- CSI sheet
- Note catcher
- Pencil