DNA sentences

How are proteins coded for by DNA?

Deoxyribonucleic acid (DNA) is the molecule of life. DNA is one of the most recognizable nucleic acids, a double-stranded helix. The process by which DNA codes for proteins involves enzymes and additional single-stranded nucleic acids, specifically messenger ribonucleic acid (mRNA) and transfer ribonucleic acid (tRNA). All students need to know the steps in protein synthesis in order to understand the mechanics of genetics and how traits are expressed. This activity helps to assess student understanding and/or review the concept. The steps in protein synthesis, transcription from DNA to mRNA, and translation from mRNA to tRNA can be demonstrated by modeling. In this activity, each triplet code of DNA represents a word in a sentence rather than a code for an amino acid. Introns and exons are omitted. The words can be found by transcribing the DNA into mRNA, then translating into tRNA.

Materials

- DNA strand cards and tRNA cards with words on the back (included in this document)
- Transcription/Translation Data Sheet
- Large sheet of paper
- Markers

Teacher instructions

1. Set out DNA strands at a central location in the room.
2. Set out tRNA cards around the perimeter of the room, grouped by first letters of the anticodons (A's together, C's together, etc)
3. Assign sentences to groups. (If all students will practice all roles, each group of four should have four sentences assigned.)

Student instructions

1. Choose one person to be the transcriber. Find the DNA strands assigned located at the table in the center of the room.
2. On the data sheet provided, transcribe the mRNA codons from the DNA strand (without moving the DNA).
3. At the group table, choose a different person to translate the mRNA codons to tRNA anticodons. Write these anticodons on your data sheet.
4. Choose two people to go find the tRNA anticodons around the room. Turn over the anticodons to find the words of the sentence and write that sentence in large print/script on the transcription/translation data sheet. Extension: After groups have translated sentences, research each statement to find evidence to support or refute.

   Hint: The first triplet code is a "start" code, which in eukaryotes, represents the amino acid methionine. For this activity, it is the same triplet code for all and is denoted by the word "START." Each punctuation symbol is represented by different "stop" anticodons.

Reflection

1. How are chromosomes, DNA, genes and proteins related?
2. What area of the cell does the table holding DNA represent in this modeling activity?
3. Why can't the DNA strand be brought back to your group?
4. What area of the cell does your table represent?
5. What do the words represent? The completed sentences?
6. What do you think the consequences might be if an error occurred in the cell as it goes through the process of protein synthesis?

Content designed by EducationProjects.org on behalf of the farmer boards at Ohio Corn & Wheat, Nebraska Corn Board, and Kansas Corn Commission.

AAA

AAC

AAG

AAU

ACA

ACC

ACG

ACU

PESTICIDE

GMOs

SOIL

SUSTAINABILITY

POUNDS/GALLONS/
PERCENT

MOST

SOME

CAN

AGA

AGC

AGG

AGU

AUA

AUC

AUG

AUU

NUTRITION

USE(D)/USING

ETHANOL

CORN

ENERGY/FUEL

DEMAND

.

FROM

CAA

CAC

CAG

CAU

CCA

CCC

CCG

CCU

DROUGHT

FOOD

TO

MAKES/EQUALS

INCREASE(ING)/
IMPROVE(ING)/
MORE

DISTILLER'S
DRIED GRAINS

LAND

DECREASE(S)/
DECREASING/
LESS

CGA

CGG

CGU

CUU

GAA

GAC

GAG

GAU

BIOTECHNOLOGY

MEET(S)

ONE

YIELD

CLEAN

DENT

BUSHEL

AND

GCA

GCG

GCU

GUA

GUU

UAA

UAC

UAG

WILL

MARGINAL

OUR

QUALITY

LIFE

WATER

CO_2

START

UAU

UCC

UCG

UGA

UGC

UGG

UGU

UUA

IS/ARE

FOR

PRODUCE(S)/
PRODUCTS/
PRODUCTION

THE

MOLECULE

POVERTY

DNA

GROW

UUC

UUG

UUU

17.5/56/2.8/40

TOLERANT

OF/ON

1 TAC AGT CCG TAG TGA ATT

2 TAC AGT TCC GAC ATC ATG AGG ATT

3 TAC AAA CCC AGC ATT

4 TAC TTA TCC TCG TGG TTT TAA ATT

5 TAC CGG CCC CGT ATT

6 TAC CGG CCG AAC AGA ATT

7 TAC AAA GCG CGA TCG CCC ATA TAT CAA ATT

8 TAC AAA CCG TGC GAG CCC AAG ATT

9 TAC AAA ACG TGT TTT GCA CCT ATT

10 TAC ACT AGG TCC CAC TTC ATT

11 TAC CTT GAT TTT AGG AGA TAT AGT CAG TTG ACC TTT CCA ATT

12 TAC AGG AGT CGA TCG ATA TAT ATC GAG CAA ATT

13 TAC CTT GAT TTT AGG CAG TTG ACC ATT

14 TAC CTT GAT TTT AGG CAG TTG ACC TTT AGT ATT

15 TAC AAA TGT CCC CAA TTT CCG CCT ATT

16 TAC CGG CCG ATC AGA ATT

17 TAC CGG CCG TAG TGA ATT

18 TAC CGG CCC GTT GAG GTT GCT ATT

19 TAC TTG ACC TTT AGG TCC AGA CAT TGA AGT ATT

20 TAC GAA AGG TGA ACA AGG TGA ATT

Transcription/translation group data sheet

Sentence number: _____

Transcriber name: _____

mRNA codons:

Translator: _____

tRNA codons:

Sentence: _____

tRNA runner name: _____

tRNA runner name: _____

Transcription/translation group data sheet

Sentence number: _____

Transcriber name: _____

mRNA codons:

Translator: _____

tRNA codons:

Sentence: _____

tRNA runner name: _____

tRNA runner name: _____

Key: Sentences with DNA codes

1. Ethanol decreases CO2 production.
   TAC AGT CCG TAG TGA ATT
2. Ethanol is clean energy from corn.
   TAC AGT TCC GAC ATC ATG AGG ATT
3. GMOs improve nutrition.
   TAC AAA CCC AGC ATT
4. DNA is the molecule of life.
   TAC TTA TCC TCG TGG TTT TAA ATT
5. Biotechnology increases yield.
   TAC CGG CCC CGT ATT
6. Biotechnology decreases pesticide use.
   TAC CGG CCG AAC AGA ATT
7. GMOs will meet the increasing demand for food.
   TAC AAA GCG CGA TCG CCC ATA TAT CAA ATT
8. GMOs decrease poverty and increase sustainability.
   TAC AAA CCG TGC GAG CCC AAG ATT
9. GMOs can grow on marginal land
   TAC AAA ACG TGT TTT GCA CCT ATT
10. Some corn is drought tolerant.
    TAC ACT AGG TCC CAC TTC AAT
11. One bushel of corn used for ethanol makes 17.5 pounds of distiller's dried grains.
    TAC CTT GAT TTT AGG AGA TAT AGT CAG TTG ACC TTT CCA ATT
12. Corn ethanol meets the demand for fuel and food.
    TAC AGG AGT CGA TCG ATA TAT ATC GAG CAA ATT
13. One bushel of corn equals 56 pounds.
    TAC CTT GAT TTT AGG CAG TTG ACC ATT
14. One bushel of corn makes 2.8 gallons of ethanol.
    TAC CTT GAT TTT AGG CAG TTG ACC TTT AGT ATT
15. GMOs grow more food on less land.
    TAC AAA TGT CCC CAA TTT CCG CCT ATT
16. Biotechnology decreases energy use.
    TAC CGG CCG ATC AGA ATT
17. Biotechnology decreases CO2 production.
    TAC CGG CCG TAG TGA ATT
18. Biotechnology improves water and soil quality.
    TAC CGG CCC GTT GAG AAT GCT ATT
19. 40% of corn is used to produce ethanol.
    TAC TTG ACC TTT AGG TCC AGA CAT TGA AGT ATT
20. Dent corn produces most corn products.
    TAC GAA AGG TGA ACA AGG TGA ATT

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