ACTIVITY: Students turn DNA sequences to music and dance

GRADE LEVEL(S): K to 6th

30 minutes. Longer if combine activities.

OVERVIEW: For this lab, students create animals through a DNA Sequence Song or Dance.

DISCIPLINES: Science, genetics, music, visual art

OBJECTIVES: Students will be able to:

- recognize that DNA is the blueprint of living things
- discuss how and why scientists extract and map DNA
- list the first letter of the four DNA chemicals
- discuss how the order of the DNA chemicals determines the genetic makeup of a living thing.
- discuss how scientists use DNA to identify species and in population studies
- compare and contrast the DNA chemicals and musical notes analogy .

MATERIALS:

- Noisemakers **OR** baby, toddler, or kids musical instruments **OR** kids can create the four needed sounds by clapping, snapping, making a popping noise with their mouth, stomping a foot or other silly sounds.
- DNA chemical letters photocopied onto card stock or regular paper. You may want to use a different color for each letter.
- Copies of *Deep-sea DNA Sequences*
- Highlighters (optional)

Optional (see ideas below):

- construction paper
- glue sticks
- crayons or color pencils
- jewelry beads
- yarn or jewelry string to make bracelets or necklaces

WHAT TO DO:

This activity introduces and reinforce the how sequence of the DNA chemicals creates the organism by comparing it to how a sequence of musical notes creates a tune (or sequence of movements creates a dance).

How you utilize this activity depends on the students' ages, the kind of noisemakers and more. It's flexible and easy to incorporate into any class setting. The goal is to have kids having fun and laughing while they learn.

You can:

- Make a DNA band with entire class or divide class into groups of 4, or have kids work individually.
- Pre-assign a sound to each DNA chemical: A, G, T, and C. Hold up a piece of paper that has one of the letter's. Have group make appropriate sound. Run through all the letters and sounds. Once kids have a feel for it, speed up and mix up the letters.
- Use the *Deep-Sea DNA Sequence* examples to "play" the octopus, crustacean, fish or microbe tune. (You may want to choose a section to play, rather than the entire sequence).
- In learning groups, allow each group to make their own DNA chemical sequence and turn it into music. Each group can determine which musical instrument or sound

WHAT TO DO (continued):

represents each letter. Give kids a chance to have fun, create their *DNA Sequence Song,* then share with the class.

- Have kids use precut pieces of paper with A, C, G, or T to put the their DNA Sequence Song in order. When they're finished, have them glue the sequence onto a pice of paper. Then they can play it again and again.
- Create a DNA Sequence Dance. Pre-determine a movement to each DNA chemical: A, G, T, and C. Hold up a piece of paper that has one of the letter's. Have group show their DNA moves. Once kids have a feel for it, speed up, slow down, and mix up the letters.
- After completing above activity, have students trade DNA Sequence Songs so they can try playing others (or move and groove to their DNA Sequence Dance).
- If kids create their own sequence, have them imagine what organism (plant, animal, microbe) they've created. Have them draw their organism and then share where it lives, what it is, and more with the class.

Preparation:

1. Review "DNA and DEEPEND Background Information.

2. Choose the activity or activities from the above list (or create your own) so kids can create their DNA Sequence Song(s) and/or Dance.

3. Choose the versions of "Deep-sea DNA Sequences" that will work best for you and print copies.

4. Photocopy DNA Sequence letters. Cut the DNA Sequence letters apart, use a paper cutter to make this a quicker task. The letters are for the kids to order/create their DNA Sequence Song. If you plan to re-use the activity, use card stock. The quantity depends on number of students, how many "notes" you want them to play, and your allotted time for the activity.

5. Prepare lab area according to your activity plan.

Adapt this activity using beads to create a bracelet or necklace. Kids or the leader can decide which color or shape bead represents each of the four DNA chemical letters (A, C, G, T). Pull a short sequence from the Deep-Sea DNA Sequences or have students create their own. Have students string their bracelet or necklace in that order. Older students can do the reverse and create a short sequence, then write it down the order in letters

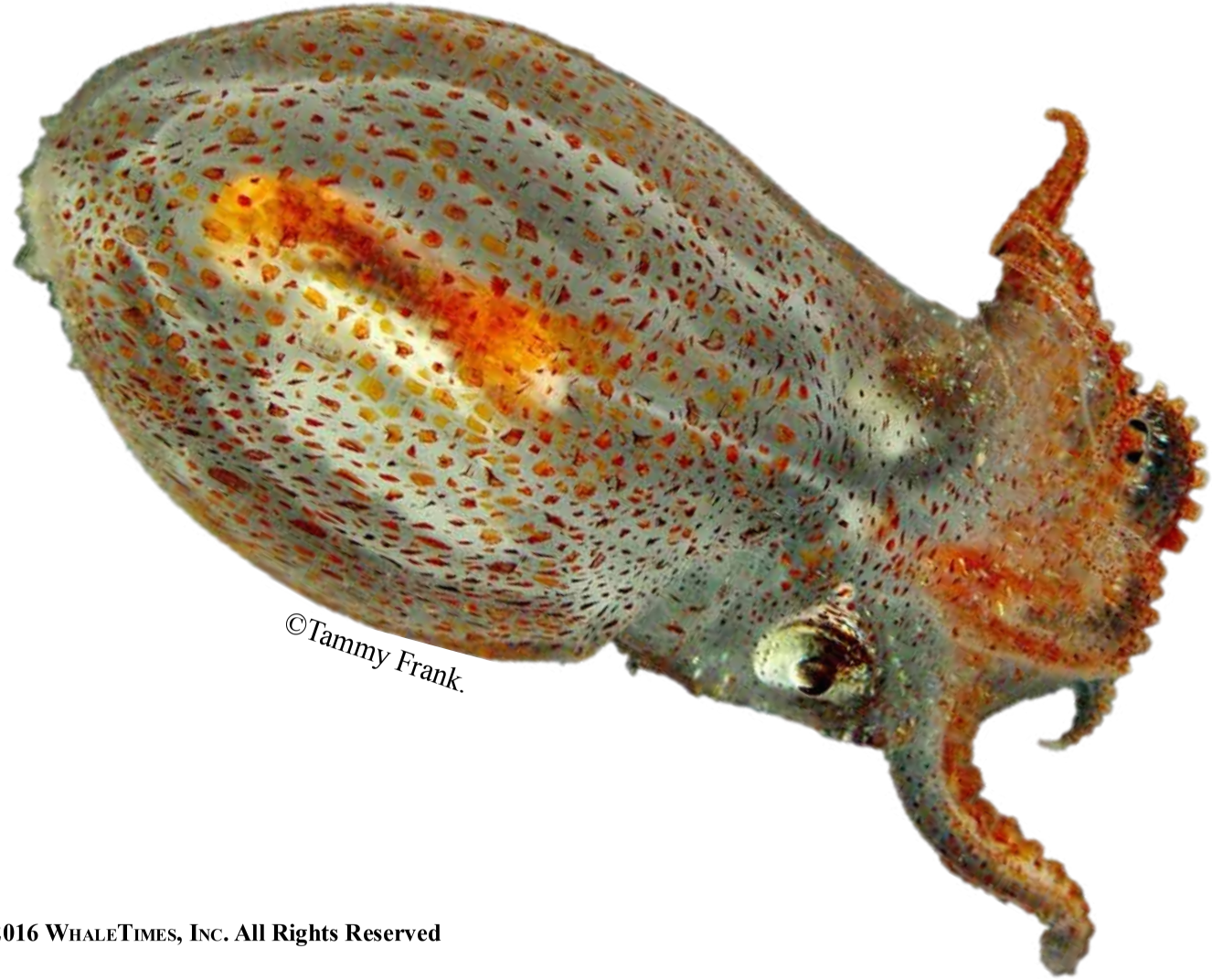
Deep-Sea DNA Sequences

This sequence is a deep-sea octopus species (Japetella diaphana):

ACCTTATATTTTATTTTCGGAATTTGAT-
CAGGATTACTAGGAACATCTCTTAGACTA-
ATAATCCGAACTGAATTAAGACAACCAG-
GATCTTTACTCAATGATGACCAATTATAT
AATGTAATTGTTACTGCCCATGCATTCGTAATA-
ATCTTCTTTTTAGTTATACCTGTAATAATTGGAGGTTTTG-
GAAACTGATTAGTTCCCTTAATATTAGGAGCTCC
TGACATAGCCTTCCCTCGAATAAATAATATA-
AGTTTTTGACTTTTACCTCCATCTCTTACTC-
TACTTCTTATATCTGCTGCAGTAGAAAGAGGT-
GCAGGAACAGGATGAACAGTATACCCCCCTC-
TATCTAGAAATGTATCACATATAGGACCATCT-
GTAGATCTTGCCATTTTTTCTCTTCACTTAGC
TGGGGTATCCTCTATCTTAGGAGCAATTAACTT-
TATTACAACTATTATAAATATACGATGAGA-
AAGAATACAAATAGAACGACTTCCTCTATT
TGTTTGATCTGTACTTATCACCGCAATTCTTT-
TATTACTTTCTCTTCCAGTACTAGCTG-
GAGCTATCACAATACTTCTTACAGATCGTA-
ATTTCAATACAACATTTTTTGACCCAAGTGGAG-
GAGGGGATCCTATTCTTTACCAACACTTATTC

Deep-Sea DNA Sequences

Deep-sea octopus (Japetella diaphana):



Deep-Sea DNA Sequences

This is the DNA sequence for this dragonfish species: (Pachystomias microdon)

CCTCTACCTAGTATTTGGTGCCTGAGCCGGAATAGTCGGGACGGCGTT-
GAGCCTGCTCATTCGAGCAGAGTTGAGCCAACCCGGTGCACTCCTTGGT-
GACGACCAGATTTATAACGTCATCGTTACAGCGCACGCTTTTGTTATAATCTT-
CTTCATGGTAATGCCCATCATAATTGGGGGCTTCGGAAACTGGCTGATTCCCCT-
CATGATCGGCGCTCCTGACATGGCTTTCCCTCGAATGAATAATATGAGCTTCTG-
GCTCTTGCCCCCCTCCTTCCTCCTTCTTCTCGCATCCTCGGGTGTTGAGGCCGGGGC-
GGGGACCGGTTGAACCGTTTATCCCCCACTTGCGGGGAACTTGGCTCACGCCGGAG-
CATCCGTGGACTTAACGATTTTTTCCCTTCATCTGGCAGGGATCTCGTCAATTTTAGGGGCAAT-
TAATTTCATCACCACAATCATTAACATGAAGCCTCCAGCCATCTCGCAATATCAAACCCCTCTTTTC-
GTTTGAGCGGTGCTCATTACTGCGGTGCTCCTCCTTCTGTCCTTGCCTGTCCTTGCGGCTGGCAT-
CACGATGCTGTTAACCGATCGGAACCTCAATACGACTTTCTTTGACCCCGCAGGGGGGGGT-
GACCCAATCCTGTATCAGCATCTG

Dragonfish (Pachystomias microdon)

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Deep-Sea DNA Sequences

GCTTGAGCCGGTATAGTAGGAACTTCCCTTAGTCTTCTCATCCGTGCTGAACTTGGAGAAC-
CAGGAAGCCTAATTGGCAACGATCAAATCTACAATGTTATTGTAACAGCTCATGCCTTCGTA-
ATAATCTTTTTTATAGTAATACCCATTATAATCGGGGGATTCGGAAACTGACTAGTACCCCT-
CATATTAGGAGCCCCCGATATAGCCTTTCCCCGTATAAACAATATAAGATTTTGACTTTTACCTC-
CATCCCTAACCCTACTCCTCTCAAGAGGATTAGTAGAAAGAGGGGTAGGAACAGGCTGAACCGTC-
TACCCCCCTCTAGCAGCAGGCATTGCTCACGCTGGAGCCTCAGTTGATATAGGAATCTTCTCTT-
TACATTTAGCCGGAGTATCCTCAATCTTAGGAGCTGTTAATTTCATTACTACTGTAATTAACATAC-
GAACAAGAGGTATAACAATAGATCGTATCCCTTTATTTGTTTGGTCAGTTTTCCTAACTGCCATTC-
TACTTCTACTTTCCCTCCCAGTTCTCGCAGGAGCAATCACTATACTCCTAACAGACCGTAATTTAAA-
CACCTCCTTCTTCGACCCAACCGGTGGAGGAGACCCAATCCTATACCAACATTTATTC

Deep-sea shrimp species: (Oplophorus gracilirostris)

Deep-Sea DNA Sequences

This is the DNA sequence for the **microbes** that live in the lure and create the light this deep-sea anglerfish species (Melanocetus johnsonii). The anglerfish and luminescent microbes have a *symbiotic* relationship.

GTTTGATCCTGGCTCAGATTGAACGCTGGCGGCAGGCCTAACA-
TACTTTCTTTGCTGACGAGTGGCGAACGGGTGAGTAATG-
ACAGTTGGAAACGACTGCTAATACCGCATGAT-
GGGCTTCTCGCGTCAGGATGGGCCCAGTT-
CACCAAGGCGACTATCCCTAGCTGGTTTGAGA-
GAGACACGGTCCAGACTCCTACGGGAG-
GGGCGCAAGCCTGATGCAGCCATGCCGCGT-
GTAAAGCACTTTCAGCAGTAAGGAAGGT-
ATTTGACGTTAATTGCAGAAGAAGCACCG-
GCGGTAATACGGAGGGTGCGAGCGTTAATC-
CATGCAGGCGGTCTGTTAAGCAAGATGTGAA
GCATTTTGAACTGGCAGGCTAGAGTCTT-
TAGAATTTCAGGTGTAGCGGTGAAATGCG-
GAAGGAATACCAGTGGCGAAGGCGGCCCCCT-
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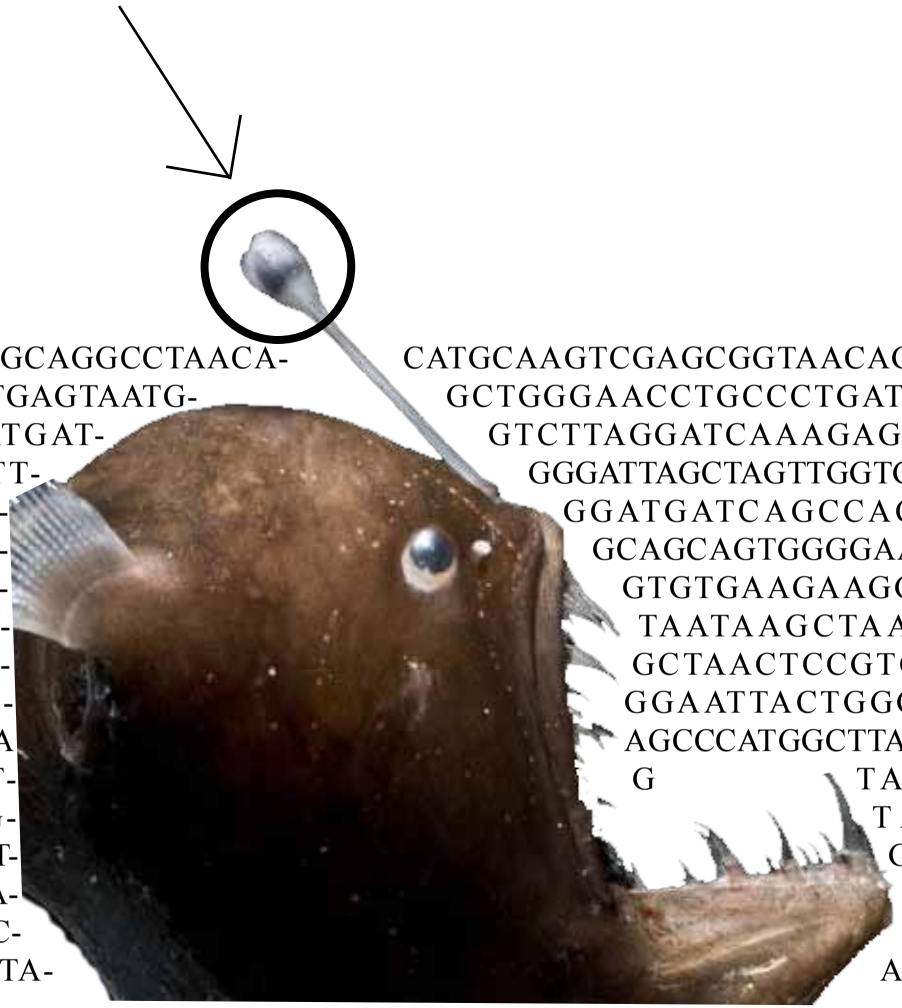
GTTGTGGCCTTGAGCCGTGGCTTTCGGAGCTA-



CATGCAAGTCGAGCGGTAACAGGAAGAAAGTT-
GCTGGGAACCTGCCCTGATGTGGGGGATA-
GTCTTAGGATCAAAGAGGAGGACCTTC-
GGGATTAGCTAGTTGGTGAGGTAATGGCT-
GGATGATCAGCCACACTGGAACT-
GCAGCAGTGGGGAATATTGCACAAT-
GTGTGAAGAAGGCCTTCGGGTT-
TAATAAGCTAATACCTTATTA-
GCTAACTCCGTGCCAGCAGCC-
GGAATTACTGGGCGTAAAGCG-
AGCCCATGGCTTAACCTAGGAACT-
G TAGAGGGGGG-
TAGAGATCT-
GGACAAAGACT-
CAGGATTAG-
TACTTGGAG-
ACGCGTTAAG-

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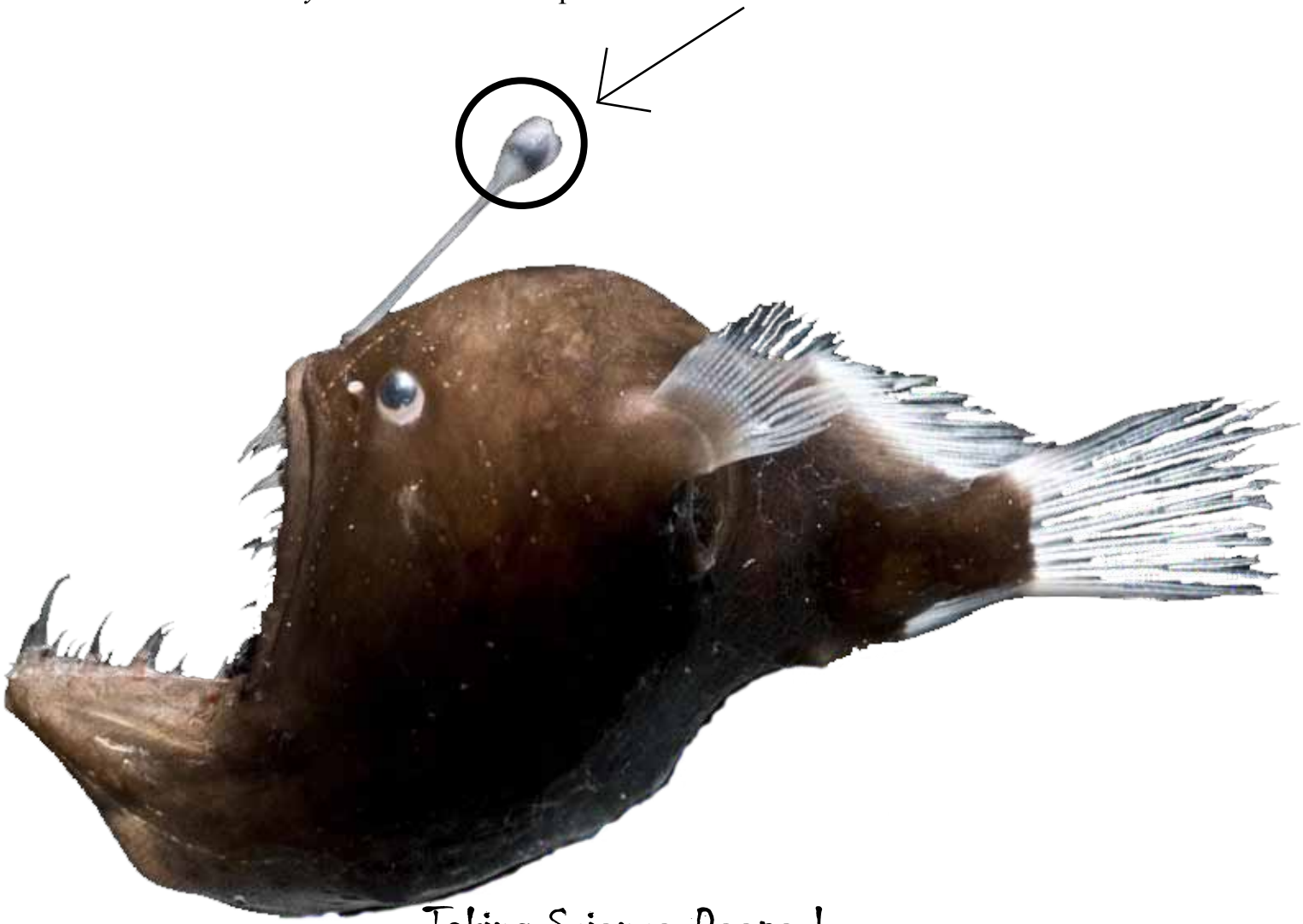
Deep-Sea DNA Sequences

Microbes live in the lure and create the light (bioluminescence) for this deep-sea anglerfish. The anglerfish and luminescent microbes have a *symbiotic* relationship.

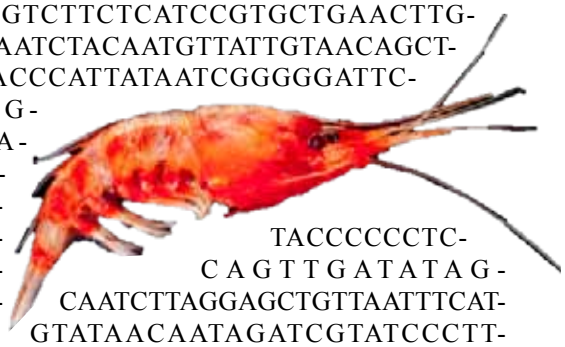


Deep-Sea DNA Sequences

This sequence is a deep-sea octopus species (Japetella diaphana):

ACCTTATATTTTATTTTCGGAATTTGATCAGGATTACTAGGAACATCTCTTAGACTAAT
AATCCGAACTGAATTAAGACAACCAGGATCTTTACTCAATGATGACCAATTATAT
AATGTAATTGTTACTGCCCATGCATTCGTAATAATCTTCTTTTTAGTTATACCTG-
TAATAATTGGAGGTTTTGGAAACTGATTAGTTCCCTTAATATTAGGAGCTCC
TGACATAGCCTTCCCTCGAATAAATAATATAAGTTTTTGACTTTTACCT
CCATCTCTTACTCTACTTCTTATATCTGCTGCAGTAGAAAGAGGT
GCAGGAACAGGATGAACAGTATACCCCCCTCTATCTAGAAATGTATC
ACATATAGGACCATCTGTAGATCTTGCCATTTTTTCTCTTCACTTAGC
TGGGGTATCCTCTATCTTAGGAGCAATTAACTTTATTACAACTATTAT
AAATATACGATGAGAAAGAATACAAATAGAACGACTTCCTCTATT
TGTTTGATCTGTACTTATCACCGCAATTCTTTTATTACTTTCTCTTCCAG-
TACTAGCTGGAGCTATCACAATACTTCTTACAGATCGTAATTTCAATACA
ACATTTTTTGACCCAAGTGGAGGAGGGGATCCTATTCTTTACCAACACTTATTC

This is the DNA sequence for this deep-sea shrimp species: (Oplophorus gracilirostris)



GCTTGAGCCGGTATAGTAGGAACTTCCCTTAGTCTTCTCATCCGTGCTGAACTTG-
GAGAACCAGGAAGCCTAATTGGCAACGATCAAATCTACAATGTTATTGTAACAGCT-
CATGCCTTCGTAATAATCTTTTTTATAGTAATACCCATTATAATCGGGGGATTC-
GGAAACTGACTAGTACCCCTCATATTAG-
GAGCCCCCGATATAGCCTTTCCCCGTATA-
AACAATATAAGATTTTGACTTTTACCTC-
CATCCCTAACCCTACTCCTCTCAAGAGGATTAG-
TAGAAAGAGGGGTAGGAACAGGCTGAACCGTC- TACCCCCCTC-
TAGCAGCAGGCATTGCTCACGCTGGAGCCT- CAGTTGATATAG-
GAATCTTCTCTTTACATTTAGCCGGAGTATCCT- CAATCTTAGGAGCTGTTAATTTCAT-
TACTACTGTAATTAACATACGAACAAGAG- GTATAACAATAGATCGTATCCCTT-
TATTTGTTTGGTCAGTTTTCCTAACTGCCATTCTACTTCTACTTTCCCTCCCAGTTCTCGCAG-
GAGCAATCACTATACTCCTAACAGACCGTAATTTAAACACCTCCTTCTTCGACCCAACCGGT-
GGAGGAGACCCAATCCTATACCAACATTTATTC

This is the DNA sequence for this dragonfish species: (Pachystomias microdon)

CCTCTACCTAGTATTTGGTGCCTGAGCCGGAATAGTCGGGACGGCGTTGAGCCTGCTCATTC-
GAGCAGAGTTGAGCCAACCCGGTGCACTCCTTGGTGACGACCAGATTTATAACGTCATCGT-
TACAGCGCACGCTTTTGTTATAATCTTCTTCATGGTAATGCCCATCATAATTGGGGGCTTCG-
GAAACTGGCTGATTCCCCTCATGATCGGCGCTCCTGACATGGCTTTCCCTCGAATGAATA-
ATATGAGCTTCTGGCTCTTGCCCCCCTCCTTCCTCCTTCTTCTCGCATCCTCGGGTGTTGAG-
GCCGGGGCGGGGACCGGTTGAACCGTTTATCCCCCACTTGCGGGGAACTTGGCTCAC-
GCCGGAGCATCCGTGGACTTAACGATTTTTTCCCTTCATCTGGCAGGGATCTCGTCAATTT-
TAGGGGCAATTAATTTCATCACCACAATCATTAACATGAAGCCTCCAGC-
CATCTCGCAATATCAAACCCCTCTTTTCGTTTGAGCGGTGCT-
CATTACTGCGGTGCTCCTCCTTCTGTCCTTGCCTGTCCTT-
GCGGCTGGCATCACGATGCTGTTAACCGATCGGAACCT-
CAATACGACTTTCTTTGACCCCGCAGGGGGGGGT-
GACCCAATCCTGTATCAGCATCTG

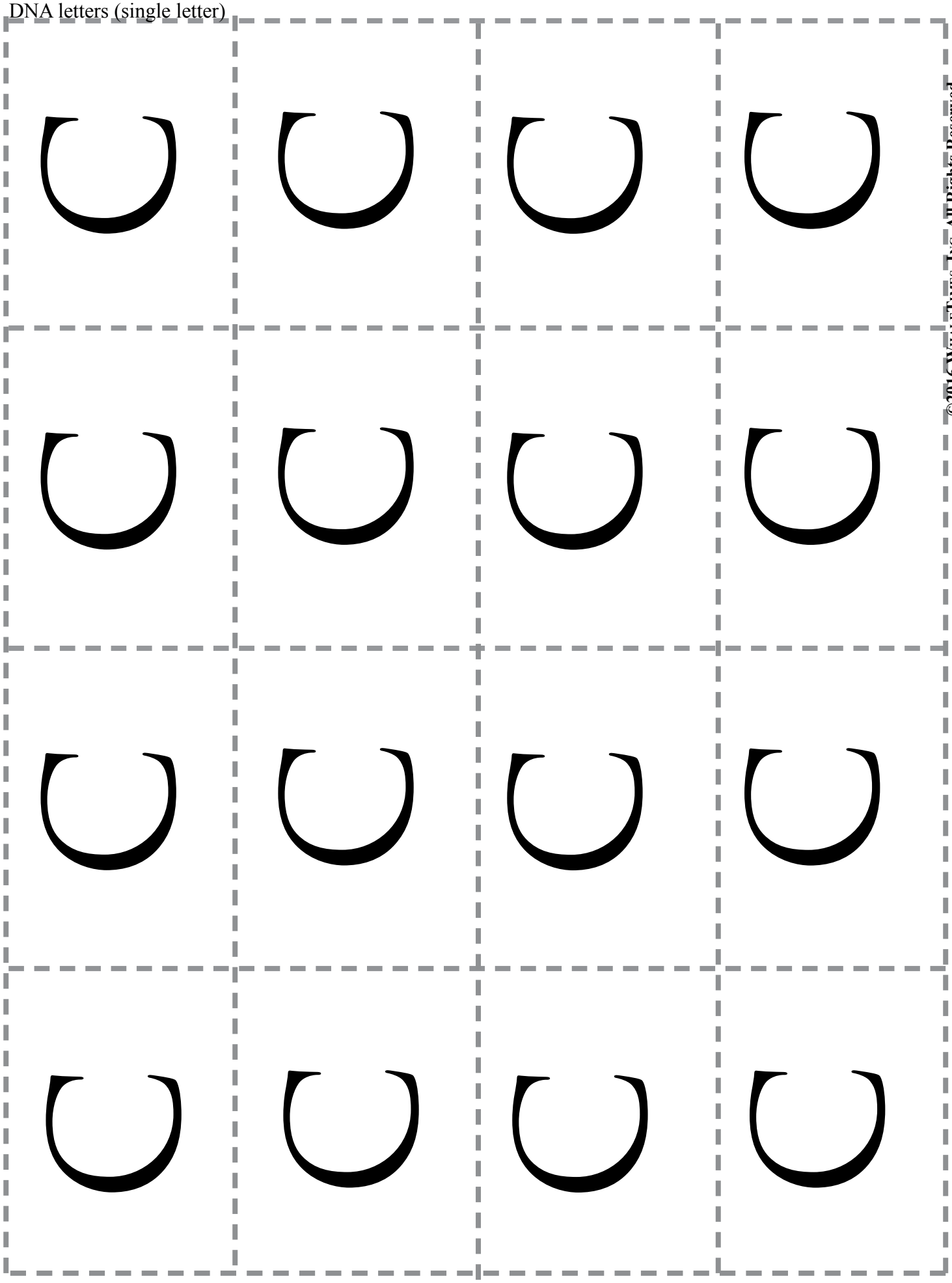
DNA letters (set)

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

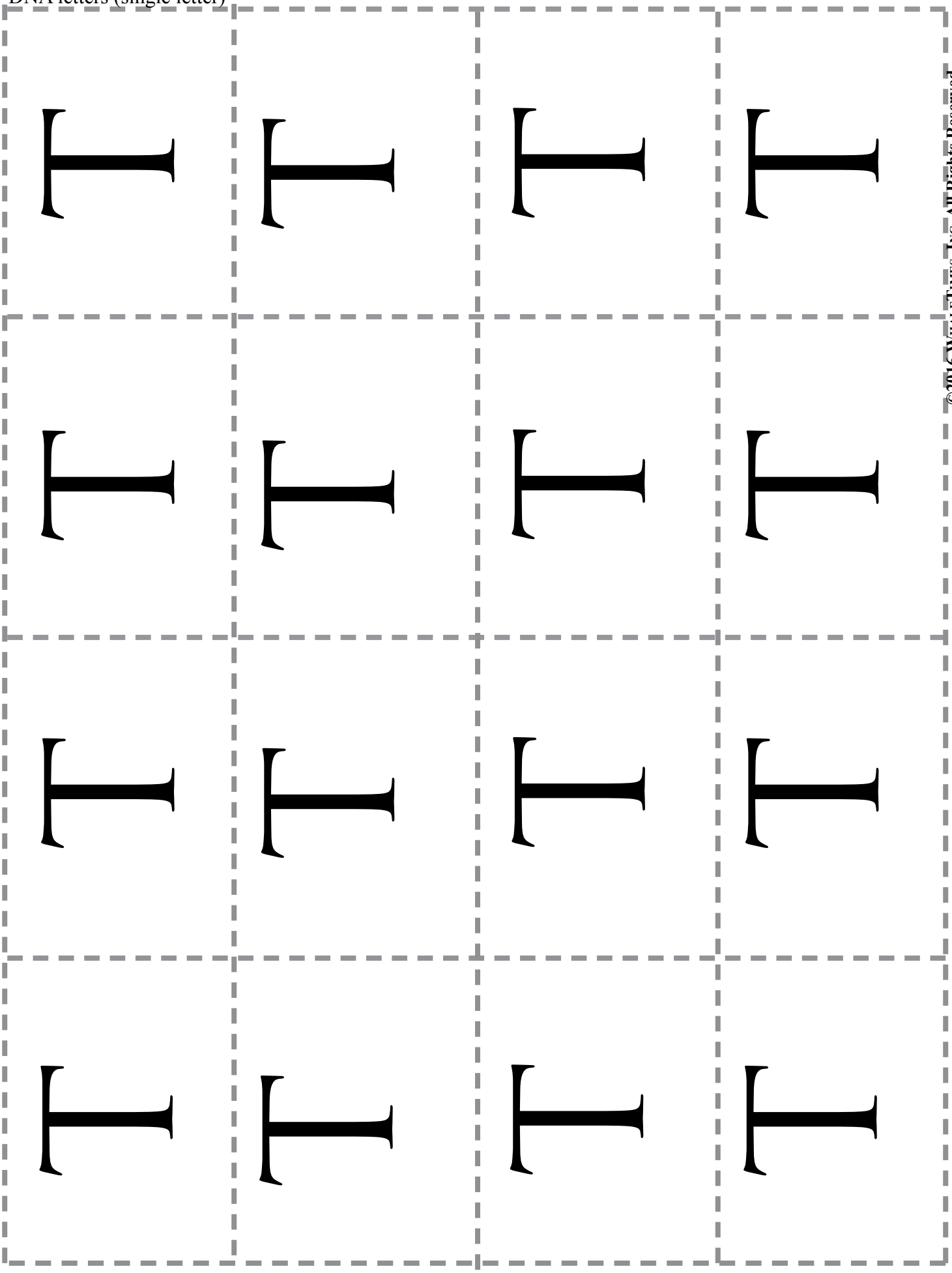
DNA letters (single letter)

A	A	A	A
A	A	A	A
A	A	A	A
A	A	A	A

DNA letters (single letter)



DNA letters (single letter)



DNA letters (single letter)

G	G	G	G
G	G	G	G
G	G	G	G
G	G	G	G