

Activity 4:

Mystery of the disappearing sea star

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Sea stars are disappearing...

Due to climate change, marine species are adapting to dramatic changes in temperature, salinity and pH. These environmental stresses can make organisms more susceptible to disease. In 2012, we noticed that sea stars began to disappear, and it appeared to be a disease.



What changes do you notice in the image on the right?

What do you notice about the rocks below the sea stars in the image on the left?

Why do the sea stars keep the rocks bare? What does that tell you about the sea stars?

If the sea stars are gone what happens to the tide pools?

What other organisms are missing in the image on the right?

Sea stars are disappearing...



What do you notice about the sea star on the left?

What do you notice about its skin? How is it different from the sea star on the right?



What do you notice about these sea stars?

Why do you think the sea stars look like they are melting or falling apart?

Could we be looking at a sickness or illness?

What causes sickness or illness?

Sea stars are disappearing...

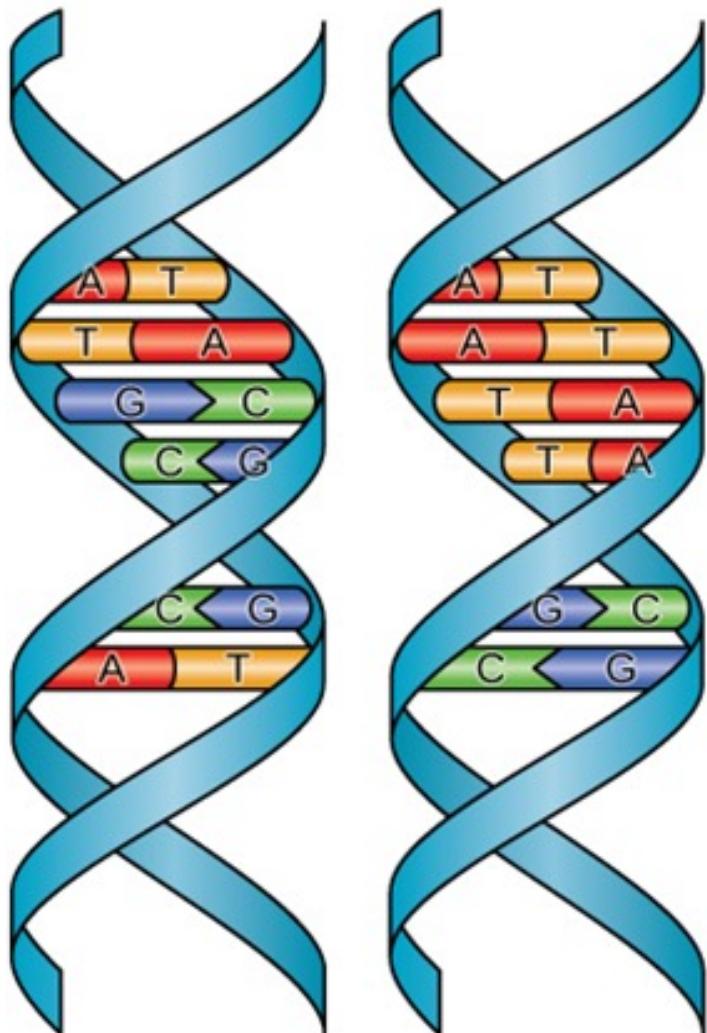
One way scientists identify disease causing pathogens (often viruses or bacteria) is by sequencing their DNA.

Each organism has its own unique sequence of DNA

To the right is a picture of DNA. How would you describe its shape?

Complementary base pairing contributes to this structure. Each DNA molecule has a complementary pair.

A always pairs with T.
C always pairs with G.
These are
Complementary pairs.



Activity 1: Building model DNA

Color Key:



What you will need:

- 1 box of DOTS gumdrops
- 30 toothpicks
- 1 Plate

Step 1:

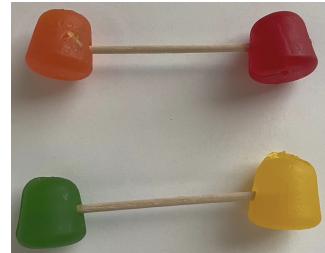
We're going to build a DNA model of the sequence:

ATTCGTA CGCAA

Write the complimentary base pairs below the sequence _____

Step 2:

Use the color key above to connect the complimentary base pairs of the sequence.
Similar to the picture on the right.



Step 3:

After all complimentary base pairs have been connected, use toothpicks to build the sequences.



Step 4:

Twist the DNA to form the double helix

Let's talk a bit more about how we can use the structure of DNA to solve biological mysteries.

And how we are going to design an experiment to find the cause of the sea star sickness.

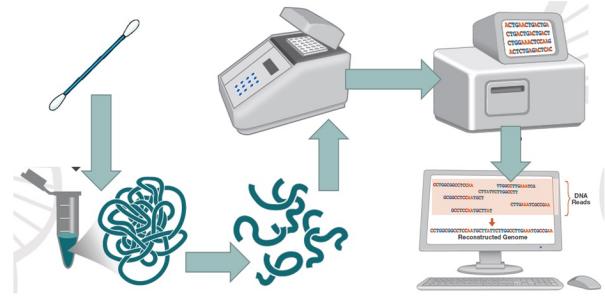
Activity 2: Matching DNA sequences

Food for thought:

We leave clues of our presence by leaving DNA behind. Your hair, skin, fingernails and all parts of you contain DNA or the instructions to make you. Other organisms also leave DNA behind too and we can detect it.

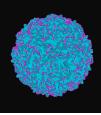
Steps to sequence DNA:

1. Take DNA samples
2. Isolate DNA
3. Sequence
4. Compare DNA sequences



The Unknown sequence you have found to be much more numerous in sick sea stars than healthy sea stars. We want to find out who the Unknown sequence belongs to because that organism could be the cause of the sickness. We will compare sequences and we will record which ones match and which ones don't.

Step 1: Try pairing the unknown sequence with the 5 known sequences. Record the number matches and mismatches in the table below.

Organism	Matches	Mismatches
 Pacific Purple Sea Urchin		
 Giant Green Anemone		
 California Mussel		
 Giant Kelp		
 Densovirus		

Summary and final thoughts

From today's activities, you learned about:

Sea star wasting disease

DNA structure

Identifying pathogens using DNA sequences

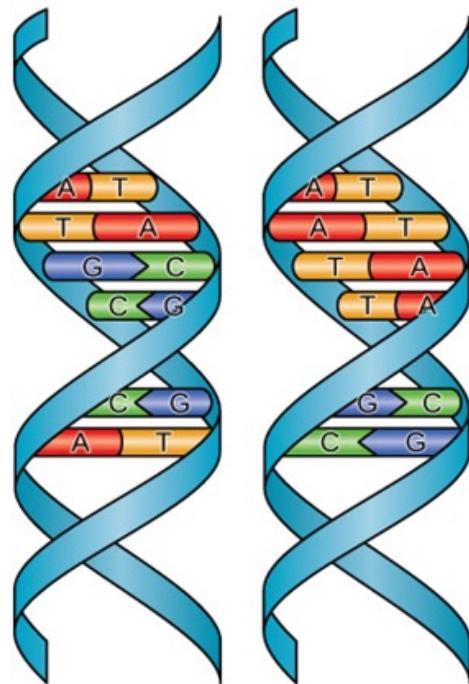


We learned about the structure of DNA:
molecules (A, T, C, and G),
complimentary pairing, double helix

We learned the structure of DNA allows us to compare sequences between organisms.

We also learned that we can detect organisms in an environment because they leave DNA behind.

We solved the mystery of the sea star wasting disease and found the cause, a denso virus.



Outlook on sea star populations today:

Today we know the virus is not a problem for sea stars and their populations are recovering, but we also know that as the climate warms it could become a problem again. Check this website (<https://marine.ucsc.edu/data-products/sea-star-wasting/#id-guides>) for a place to record your citizen science observations of sea star health. This helps sea stars by keeping track of sea star wasting disease.