Honors Biology
Unit 6: Evolution

Due by Thursday April 27/Friday April 28!

Name: _____ Period: _____

Lab 23: BLASTing Through Evolutionary Relationships

Introduction:

The Basic Local Alignment Search Tool (BLAST) is an online program created by National Center for Biotechnology Information (NCBI). With this tool, scientists can take DNA sequences they have isolated from different organisms and enter them into the Search Tool. The program then compares the DNA sequence to all known sequences in the database (it's like Google for DNA sequences!). The scientist can then identify what protein(s) can be transcribed and translated from the DNA sequence. The scientist can also compare the DNA sequence to sequences in related organisms. In this activity, you will explore the basics of this tool and how to use it. Follow the steps listed to explore how NCBI's BLAST system works!

DNA Sequence #1

Go to the Lab 23 page and copy and paste the Sequence #1 into the query box on the BLAST page and "BLAST"!

a. How many nucleotides are in the searched sequence? _____

b. How many blast hits resulted from this query or search? _____

c. Use one of the sequence results with a query cover of 100% to answer the following:

1) What organism is this from? (Give the scientific and common name)

_____

2) What protein is made from this DNA sequence? _____

3) What does this protein do for this organism? _____

_____

DNA Sequence #2

Go to the Lab 23 page and copy and paste the Sequence #1 into the query box on the BLAST page and "BLAST"!

a. How many nucleotides are in the searched sequence? _____

b. How many blast hits resulted from this query? _____

c. Use the sequence results with a query cover of 100% to answer the following:

1) Two very related organisms have this sequence in their DNA. What are they? (Just give common names.)

_____

2) What protein is made from this DNA sequence? _____

3) What does this protein do for these organisms? _____

_____

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DNA Sequence #3

Go to the Lab 23 page and copy and paste the Sequence #1 into the query box on the BLAST page and "BLAST"!

a. How many nucleotides are in the searched sequence? _____

b. How many blast hits resulted from this query? _____

c. Use one of the sequence results with a query cover of 100% to answer the following:

1) What organism is this from? (Give the scientific and common name)

_____

2) What protein is made from this DNA sequence? _____

3) What does this protein do for this organism? _____

_____

DNA Sequence #4

Go to the Lab 23 page and copy and paste the Sequence #1 into the query box on the BLAST page and "BLAST"!

a. How many nucleotides are in the searched sequence? _____

b. How many blast hits resulted from this query? _____

c. Use one of the sequence results with a query cover of 100% to answer the following:

1) What organism is this from? (Give the scientific and common name)

_____

2) What protein is made from this DNA sequence? _____

3) What does this protein do for this organism? (You shouldn't have to look this one up!)

_____

4) This protein is found in many other organisms. Give the scientific and common name for one particular organism that has the given query cover (meaning has a certain percentage of DNA similar to humans).

I. 99% Query Cover: _____

II. 98% Query Cover: _____

III. 81% Query Cover: _____

IV. 47% Query Cover: _____

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V. 26% Query Cover: _____

VI. 25% Query Cover: _____

5) How are all these organisms related? What is similar between them all? _____

_____

Analyzing Genetic Relationships:

We have previously learned that organisms that share common ancestry share genetic similarities. The more closely related, the higher the percent similarity. The less closely related, the lower the percent similarity. For example, catalase, an enzyme that breaks down hydrogen peroxide (H_2O_2) to water and oxygen gas. Most eukaryotic organisms and some prokaryotic organisms produce catalase. Below is a table that shows the percent similarity of four organisms compared to the human catalase gene. **Use this data to complete a phylogenetic tree with these following organisms, including humans, in the space below!**

Species	**Gene Percentage Similarity with *Homo sapiens* (humans)**
Roundworm (*Caenorhabditis elegans)*	68.2%
Chimpanzee *(Pan troglodytes)*	99.6%
Fruit fly *(Drosophila melanogaster)*	72.4%
Dog *(Canis lupis familiaris)*	91.3%

Now create a cladogram on the next page given the table below. Then answer the questions that will compare your phylogenetic tree and your cladogram.

	Mammal	Eukaryotic Cells	Hands	Bipedal	Eyes
Human	+	+	+	+	+
Fruit fly		+			+
Roundworm		+			
Dog	+	+			+
Chimpanzee	+	+	+		+

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Cladogram:

Now create a phylogenetic tree showing the evolutionary relationships of the six organisms from DNA Sequence #4. Your tree should include humans and the organisms that are 99%, 98%, 81%, 47%, 26%, and 25% similar to the human sequence.

Conclusion Question:

In 2 to 3 COMPLETE sentences, describe what you learned from this activity. In one more COMPLETE sentence, describe why you think this search tool is important for scientists who work in genetics and study evolution?

_____

_____

_____

_____

Lab 23 Score:						
1	1.5	2	2.5	3	3.5	4