www.NGSSLifeScience.com

Topic: BLAST Cancer RAS Gene Project

Summary: Students will do a BLAST and learn about how a mutated gene will code for an abnormal protein, affecting the organism's phenotype.

URL: http://www.ncbi.nlm.nih.gov/gene/

NGSS *HS-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.

Time Length: 60 minutes + 30 minutes for CER

Prerequisite Knowledge: Protein synthesis and that mutations in the DNA can cause a change in the protein that is made. A modified protein may change the phenotype. It is highly recommended that students are introduced to the RAS protein and how the cell cycle is regulated prior to this activity.

Materials:

- Laptops with Internet access
- Preferred (students have a google account where two students can type on the same report at the same time)
- Handout of the project

Procedures:

1. You will want to demonstrate how to do a BLAST using a projector before students do a BLAST themselves.
2. Have every student do part 1, the BLAST.
3. For part 2, student will write a Claim Evidence Reasoning paragraph(s) using the following driving question "**How do scientists really know that DNA codes for proteins and those proteins are represented in our traits?**".

Editable DOCX File and Answer Key:

Available at www.ngsslifescience.com

Name: _____ Row: _____

Date:_____ Period:_____

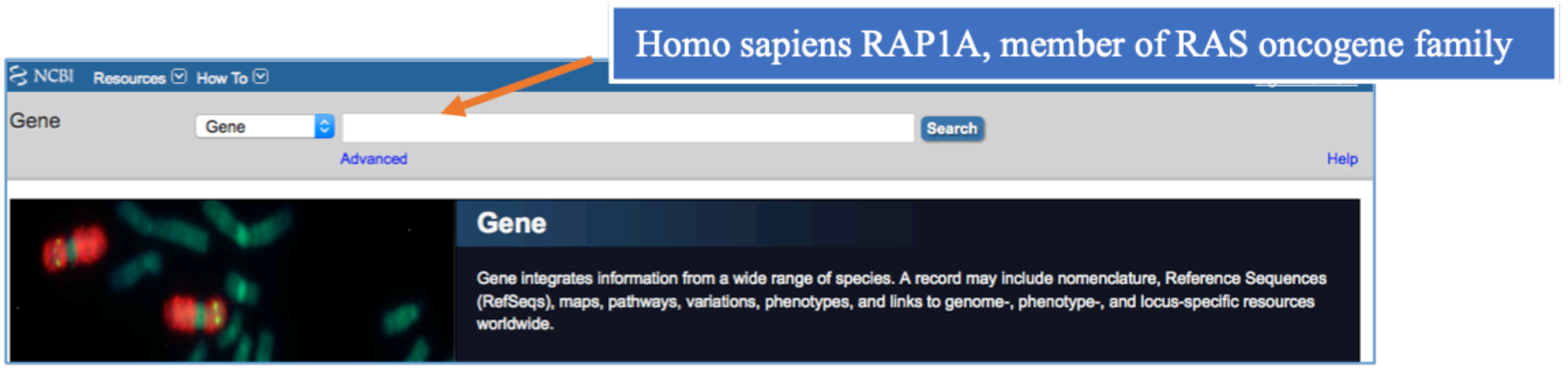
BLAST Cancer Ras Gene Project

Part 1: Gene Look-up Direction:

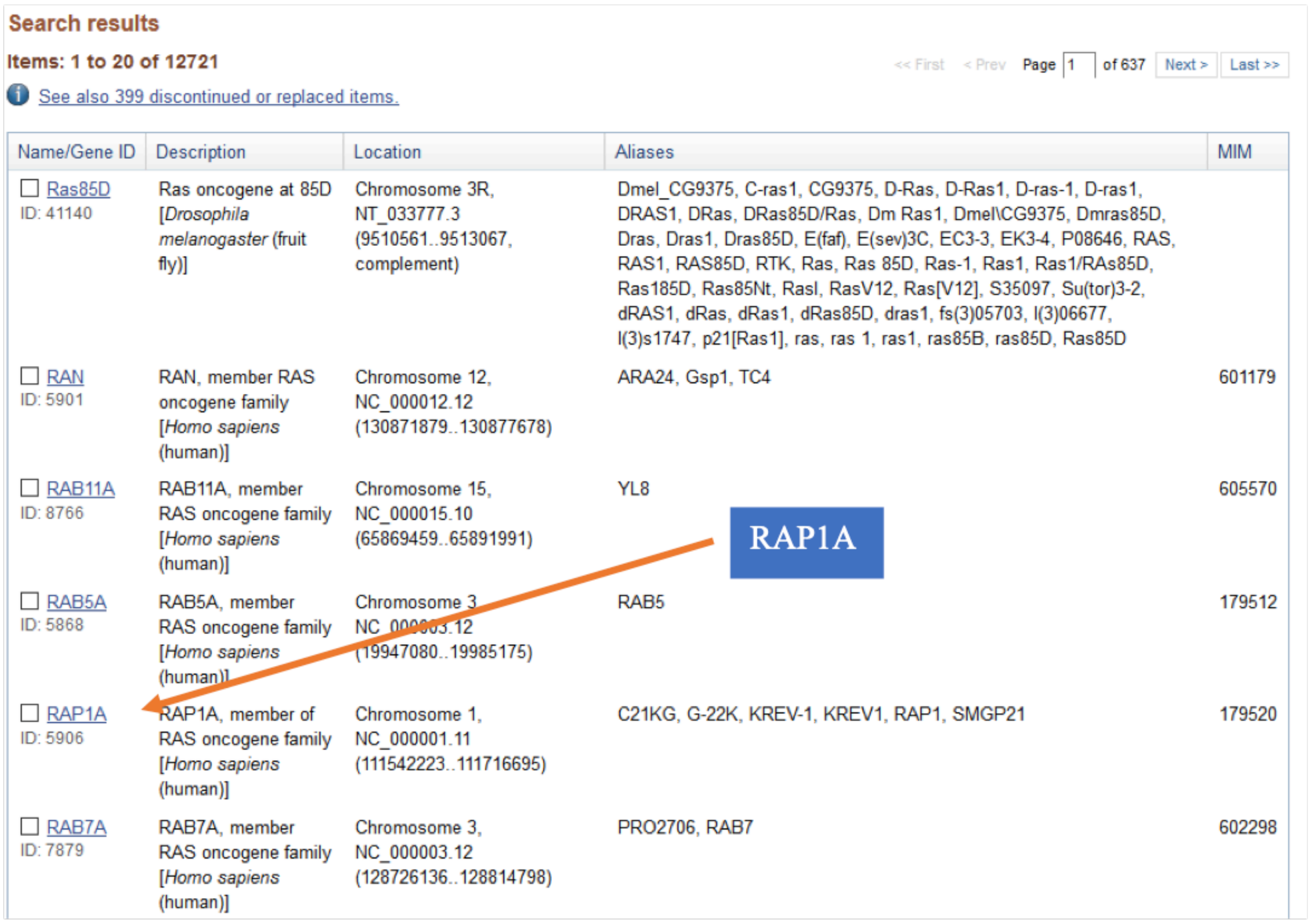
1. Go to the website below to look up a gene.

http://www.ncbi.nlm.nih.gov/gene/

2. In the search box, type Homo sapiens RAP1A, member of RAS oncogene family.

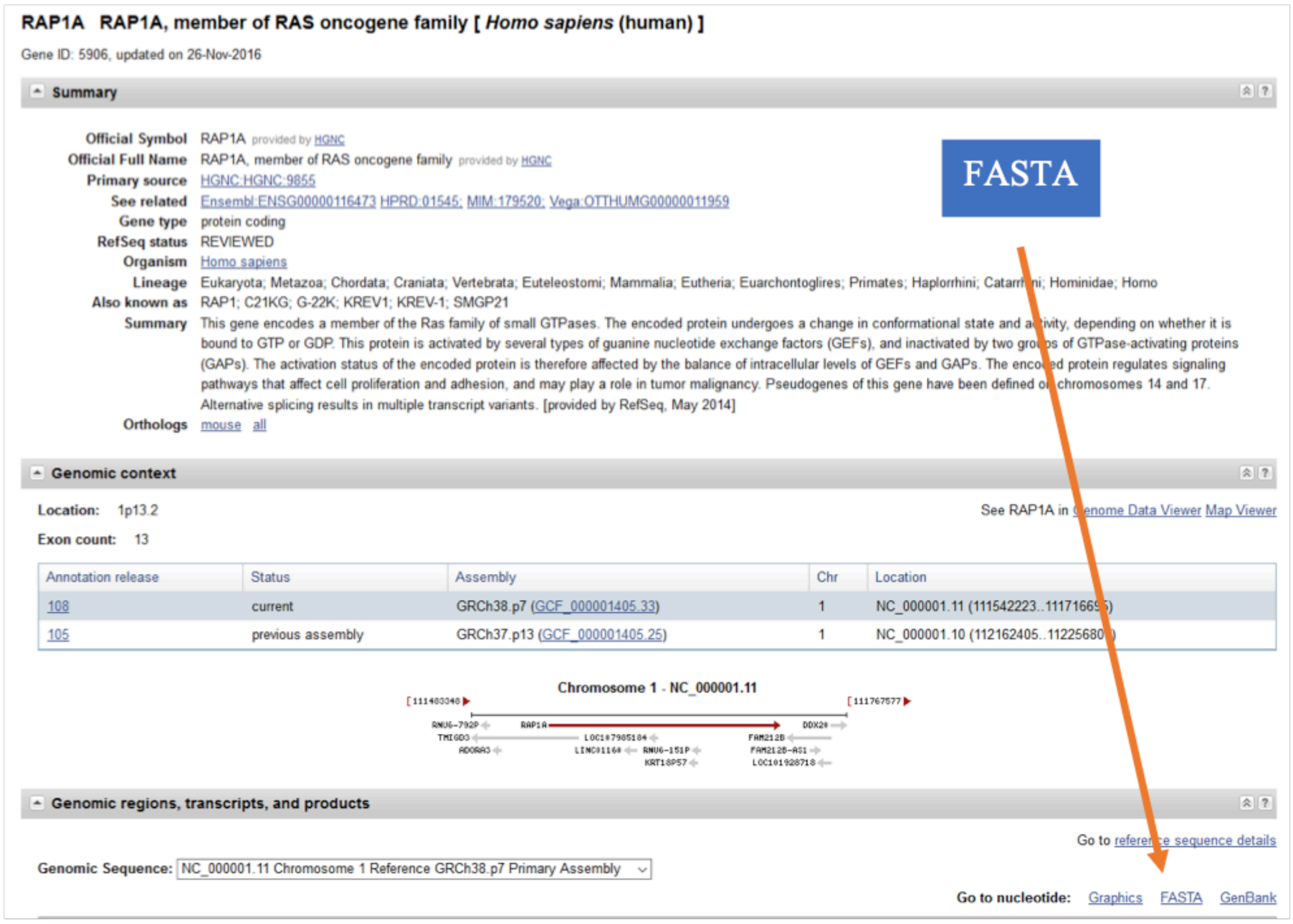


3. In the search results, click on the RAP1A link.

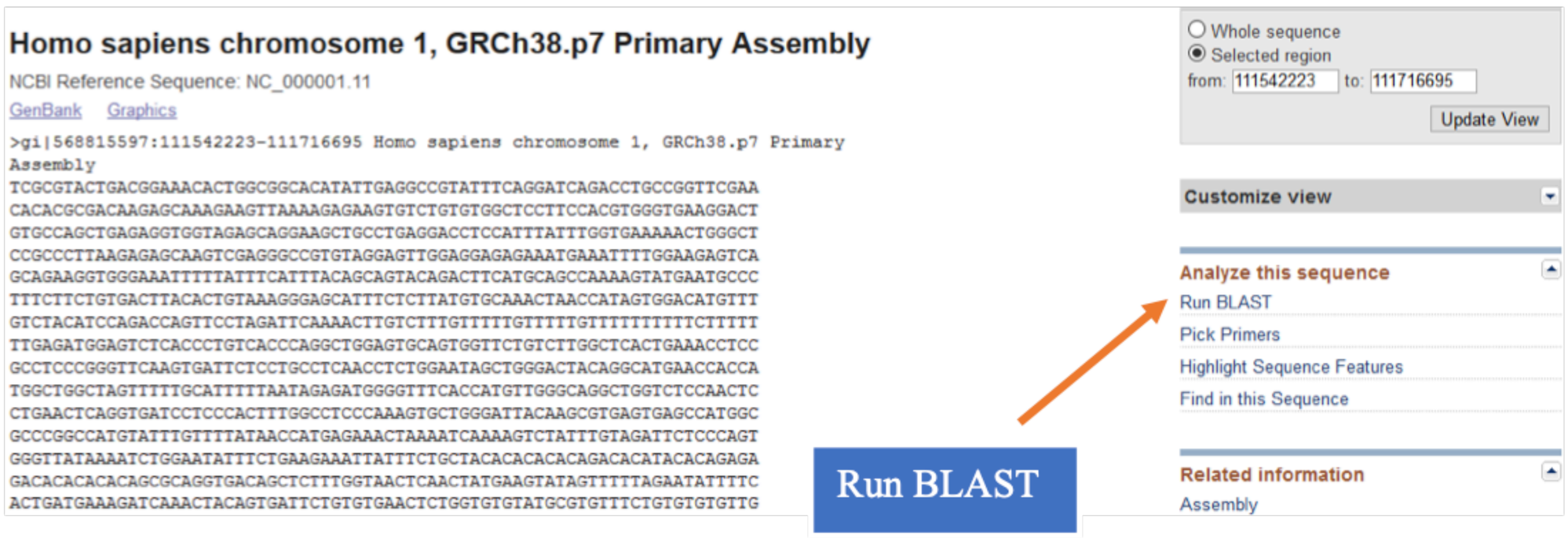


Name/Gene ID	Description	Location	Aliases	MIM
Ras85D ID: 41140	Ras oncogene at 85D [*Drosophila melanogaster* (fruit fly)]	Chromosome 3R, NT_033777.3 (9510561..9513067, complement)	Dmel_CG9375, C-ras1, CG9375, D-Ras, D-Ras1, D-ras-1, D-ras1, DRAS1, DRas, DRas85D/Ras, Dm Ras1, Dmel\CG9375, Dmras85D, Dras, Dras1, Dras85D, E(faf), E(sev)3C, EC3-3, EK3-4, P08646, RAS, RAS1, RAS85D, RTK, Ras, Ras 85D, Ras-1, Ras1, Ras1/RAs85D, Ras185D, Ras85Nt, Rasl, RasV12, Ras[V12], S35097, Su(tor)3-2, dRAS1, dRas, dRas1, dRas85D, dras1, fs(3)05703, l(3)06677, l(3)s1747, p21[Ras1], ras, ras 1, ras1, ras85B, ras85D, Ras85D	
RAN ID: 5901	RAN, member RAS oncogene family [*Homo sapiens* (human)]	Chromosome 12, NC_000012.12 (130871879..130877678)	ARA24, Gsp1, TC4	601179
RAB11A ID: 8766	RAB11A, member RAS oncogene family [*Homo sapiens* (human)]	Chromosome 15, NC_000015.10 (65869459..65891991)	YL8	605570
RAB5A ID: 5868	RAB5A, member RAS oncogene family [*Homo sapiens* (human)]	Chromosome 3 NC_000003.12 (19947080..19985175)	RAB5	179512
RAP1A ID: 5906	RAP1A, member of RAS oncogene family [*Homo sapiens* (human)]	Chromosome 1, NC_000001.11 (111542223..111716695)	C21KG, G-22K, KREV-1, KREV1, RAP1, SMGP21	179520
RAB7A ID: 7879	RAB7A, member RAS oncogene family [*Homo sapiens* (human)]	Chromosome 3, NC_000003.12 (128726136..128814798)	PRO2706, RAB7	602298

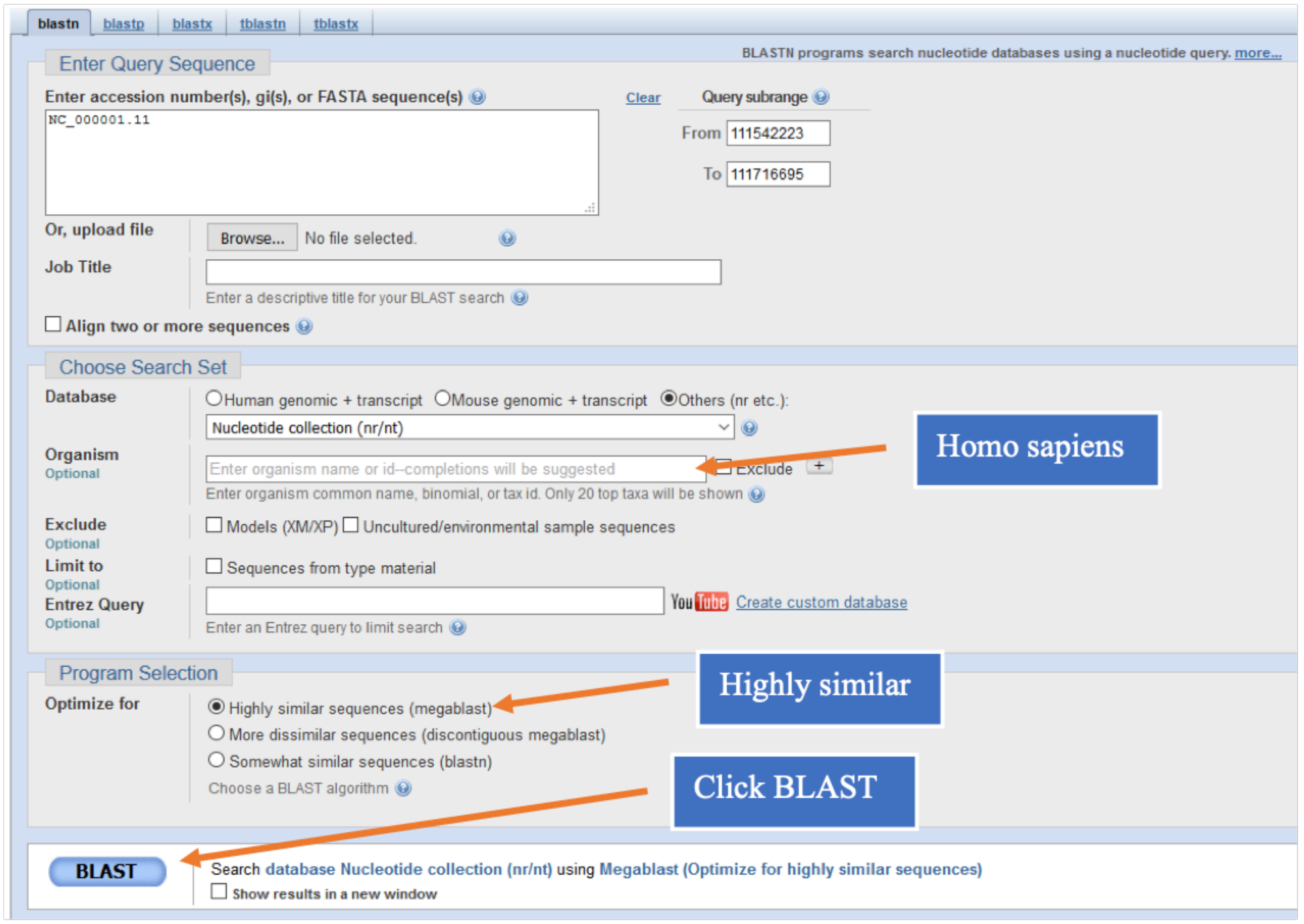
4. On the RAP1A [Homo sapiens (human)] page, you will see a link in the third section down “Genomic regions, transcripts, products”. Click on the FASTA link.



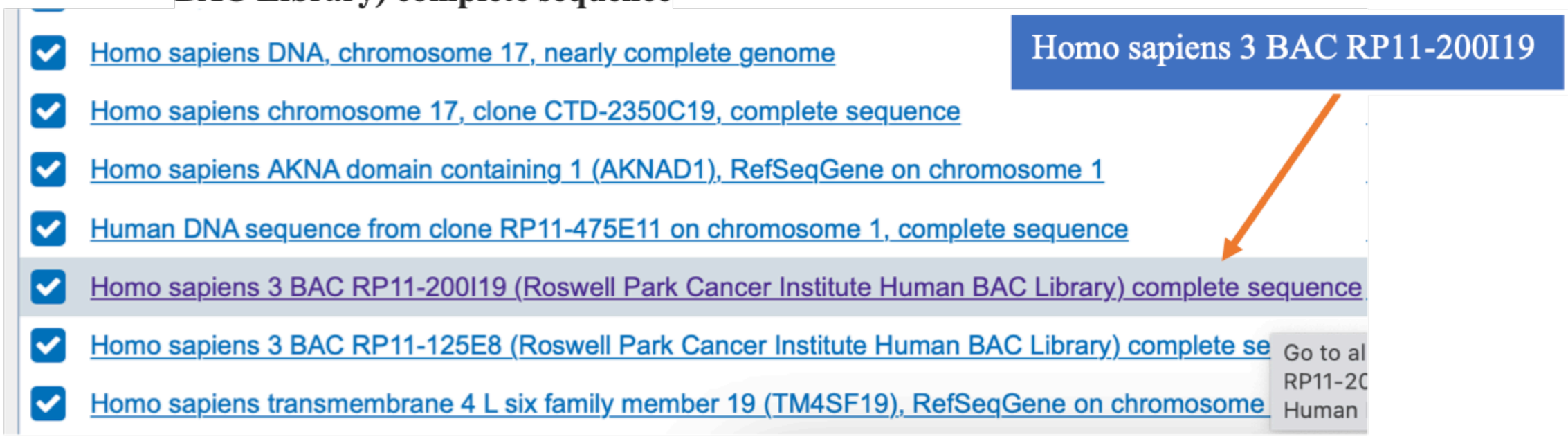
5. On this page, you will see the entire gene and all of its nitrogen bases (letters). Click on the link titled “Run BLAST”. On the next page, click the BLAST button at the bottom of the screen



6. Type in homo sapiens for the organism and select optimized for highly similar sequences. Click the BLAST button.



7. It may take a few seconds to run the DNA comparison search, but once you get to the results page, scroll down to the descriptions section. Listed here are hemoglobin genes that have been sequenced. Scroll down the list until you get to
   Homo sapiens 3 BAC RP11-200I19 (Roswell Park Cancer Institute Human BAC Library) complete sequence



8. Example: Look on first line Query 3473 (normal RAS) for a mutation with subject 49793 (mutated gene). A missing line represents when a nitrogen base is added or deleted

(change in the letter). When the query has a **-**, then a DNA base "C" was inserted as the mutation.

DNA bases can change like C is changed into a T, causing a substitution mutation.

9. Try to find other mutations in the gene comparison. How many total mutations did you find? _____

10. Find seven more mutations and enter in their location and which letter was changed and the type of mutation; substitution, insertion, or deletion.

Query: 3413 **Letter: C** **Sbjct: 49733** **Letter: T** **Mutation Type: substitution**	Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____
Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____	Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____
Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____	Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____
Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____	Query: _____ Letter: ___ Sbjct: _____ Letter: ___ Mutation Type: _____

Name: _____ Row: _____

Date:_____ Period:_____

DNA to Proteins CER

Part 2: Background Info

Cancer is caused by uncontrolled cell growth. Usually a tumor is formed from this uncontrolled growth. The RAS gene is a proto-oncogene that when working normally can cause a cell to divide. In order for a RAS gene to be turned on, is usually requires a signal molecule to turn it on.

Question: How do scientists really know that DNA codes for proteins and those proteins are represented in our traits?

Write a **C**laim **E**vidence **R**eason paragraph to answer this question. *Your claim answers the question above. Your evidence needs to be based on real information you found in the cancer RAS gene research. Your reasoning needs to include scientific concepts learned in class.*