Lab 4: Polymorphisms and Mutations

Part 1: Using the UCSC Genome Browser to Visualize Polymorphisms and Mutations

In this lab, we will use the UCSC Genome Browser to visualize polymorphisms in the HLA-A and H2A proteins. By the end of this lab, you will have a better idea of sequence conservation and how conservation differs across proteins.

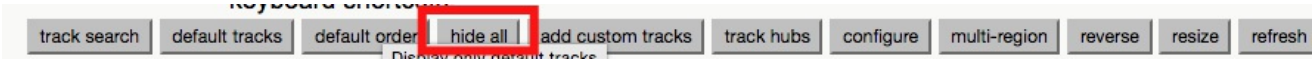
Exploring HLA-A

First, we will learn a little bit about the HLA-A gene.

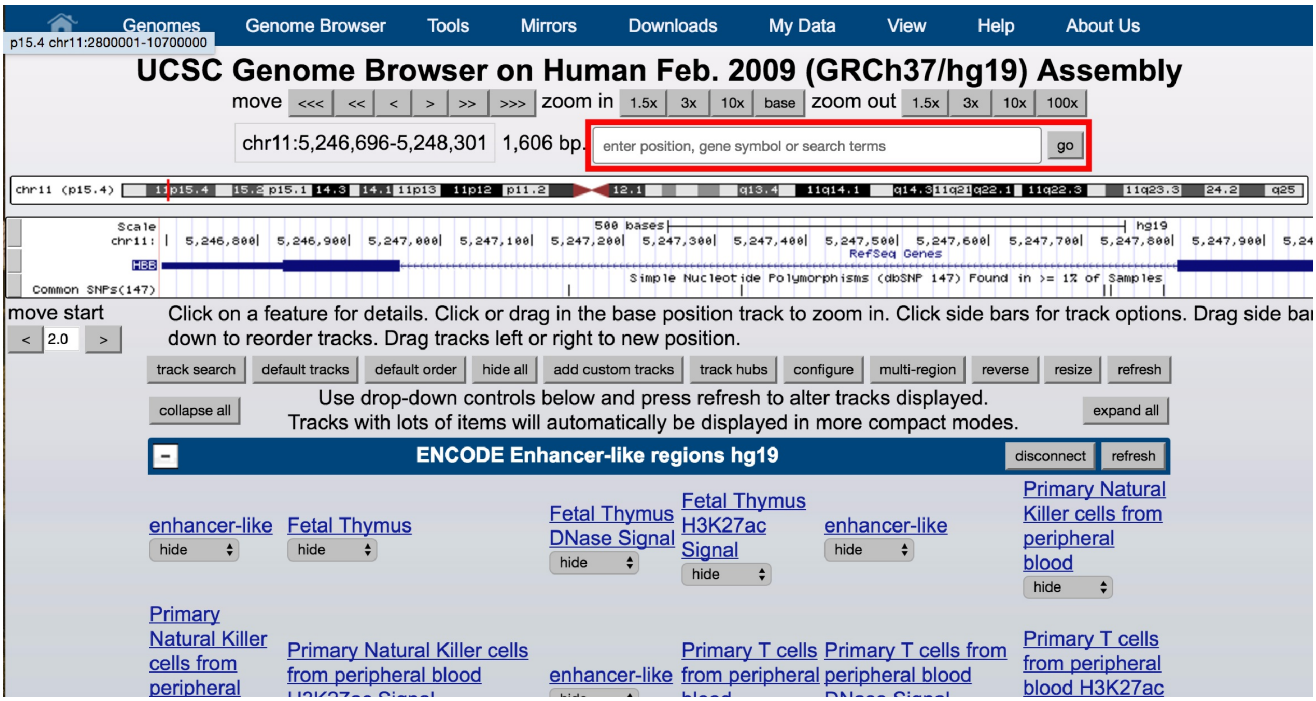
1. To access the UCSC Genome Browser, go to UCSC Genome Browser.

2. Click on 'Genome Browser', highlighted in red in the image.

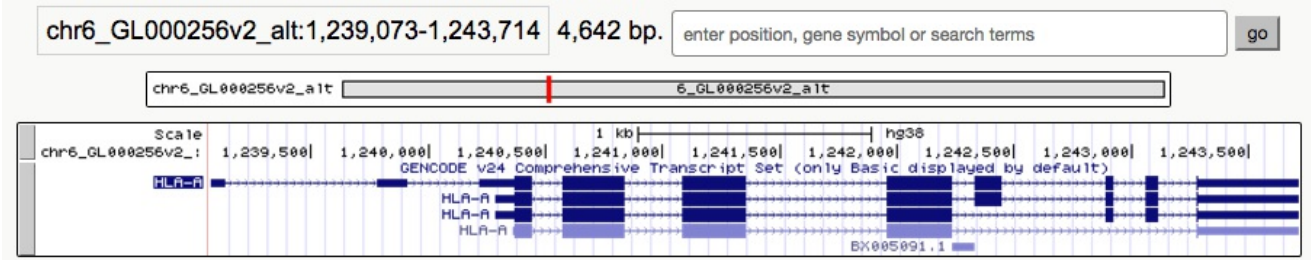
3. To reset the view and hide unused tracks, click the **hide all** button below the viewer.



4. Type in **HLA-A** in the search bar, highlighted in red.



5. In the resulting list of **Known Genes**, click on the first option. This should redirect you back to the browser.



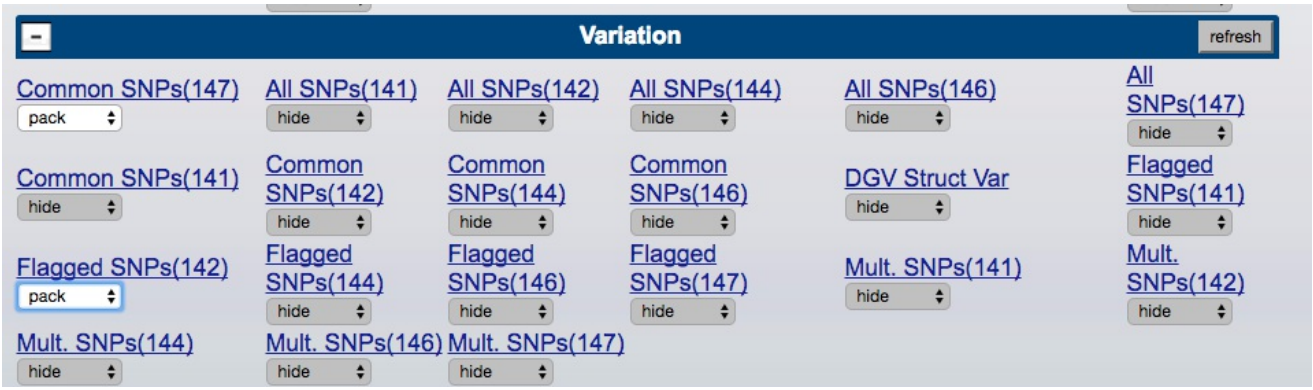
6. In the HLA-A track, click on the label for HLA-A. This should redirect you to a new screen. Given the information on this screen, answer the following questions.

Questions: Exploring HLA-A

1. What does 'HLA' stand for? **Note:** You may of to use external resources to find this.
2. What is the location (chromosome and position) of HLA-A?
3. How long is the gene?
4. How many exons does HLA-A have?
5. Out of the exons, describe the peptides resulting from the 2nd, 3rd and 4th exons of HLA-A. (e.g., exon 2 encodes for peptide ~BLANK~).
6. What important roles do HLA-A play? **Note:** If you find that this page does not provide enough information on the HLA-A gene, google to find more information.

Now, let's navigate back to the browser to explore variation of HLA-A.

1. Navigate back to the Genome Browser viewer by clicking the back arrow.
2. Scroll down to track options, below the visualization.
3. Navigate to the Variation section.
4. Toggle 'Common SNPs' and 'Flagged SNPs' to 'squish', as shown in the image.



5. Scroll back up to the visualization to view HLA-A and associated SNPs.

Questions: HLA-A SNP Density

1. What is a SNP?
2. What is a common SNP? A flagged SNP?
3. Make sure you are zoomed out so that you can see the whole HLA-A gene. In what areas to you see the highest density of SNPs? Is there any reasoning behind this SNP distribution?
4. Do you see a greater density in any particular exons? If so, which two exons have the highest SNP density?
5. Navigate to Microbiology Book, and find **Figure 2**. Read the caption and look at the Figure. What can you say about the exons with the greatest SNP density and the function of the domains that they produce?

Now, zoom in to HLA-A and click on any SNP. This should take you to a new page.

Questions: HLA-A SNP Search

1. Let's get more information on the specific SNP you clicked on. What is the reference allele for this SNP?
2. What, if any, is the **Function** of this SNP? What does this function mean?

Exploring H2A.

Now, we will explore H2A.

1. Navigate back to the Genome Browser Viewer by clicking the back button.
2. Type in **H2A** in the search bar.
3. In the resulting list of **Known Genes**, click on the **second** option, called HIST3H2A. This should redirect you back to the browser.
4. In the H2A track, click on the label for HIST3H2A. This should redirect you to a new screen. Given the information on this screen, answer the following questions.

Questions: Exploring H2A

1. What does 'HIST3H2A' stand for? **Note:** You may of to use external resources to find this.
2. What is the location (chromosome and position) of H2A?
3. How long is the gene?
4. What important roles does H2A play? **Note:** If this page does not provide enough information on the H2A gene, google to find more information.

Now, let's navigate back to the browser to explore variation of H2A. Make sure that Common SNPs and Flagged SNPs are still being displayed.

Questions: H2A SNP Density

Navigate back to the Genome Browser Viewer by clicking the back arrow in your browser.

1. Zoom out to see the whole H2A gene. In what areas, if any, to you

see the highest density of SNPs?

2. How does the SNP distribution in H2A compare to the distribution of HLA-A? Are there any reasons you can think of for why these distributions may differ?