One of the remarkable aspects of the Human Genome Project has been the public nature of its data. Because the project's data comes from scores of different labs, it has been necessary from the beginning to organize the Project's sequence data in a way that allows access to researchers anywhere. Although many of the Project's features are too demanding for most high school students, tools used to access the data have improved to the point where they can easily be used by students.

This past Spring, I used a "scavenger hunt" approach to the Genome for students in my college freshman biology classes at Brown. I’ve modified the approach a bit to make it useful for high school students, and you may want to try it in your classroom.

The tools and documents for the scavenger hunt have been placed on a website that Joe Levine and I have established to support our Biology textbooks. The web address is:

http://www.millerandlevine.com

We've set the website up in such a way that users can go directly to our publisher’s internet support pages for each of our textbooks.

The website also includes links to other resources you may find useful. We’ve placed a link to the new PBS evolution TV series, for example.

The Scavenger Hunt approach allows students to explore the Genome resources at their own pace, but also gives them the guidance to structure their initial efforts to make sense of the enormous amount of data. The website contains all of the tools and links that you’ll need to allow your students access to the Human Genome Data set.
We've also constructed a page on the site, which we update regularly, that links to teaching and learning resources that document the Human Genome Project.

http://www.millerandlevine.com/genome-resources.html

We especially recommend the "Exploring our Molecular Selves" learning kit, which you can order for your classroom through the link to this page.

Classroom Tools for Exploring the Human Genome:

Because they were designed for researchers, not for educators, at first glance many of the websites that serve as entry points to Genome data can be confusing and intimidating. Don’t let that scare you away. As usage of the sites has increased, the labs that maintain these pages have made them easier to use and understand. They’ve now reached a point where they can be used in an intuitive way by most people with a basic understanding of molecular biology.

I’ve written a brief "Tour Guide" to the Genome that explains how simple searches can be carried out to locate and identify genes, how specific locations in each human chromosome can be examined, and how DNA sequences can be located in the 3 billion base pairs of the sequence.

Additional copies of the guide are available in PDF format from the millerandlevine web site. You should feel free to copy and distribute the guide to students and teaching colleagues for educational purposes.

Entry Sites for Genome Exploration

Our web site contains direct links to three entry points for Genome data. All three allow a user to enter the name of a gene and locate its sequence in the data. The UCSC site has the most direct connection to the actual DNA sequences, and the NCBI site has the most useful interface for revealing the biological functions of a gene, if any are known.

The three sites I’ve chosen are among the most widely-used gateways to genome data, and have interfaces that should enable you and your students to explore the genome in a number of ways. You could, for example, simply choose one of the human chromosomes to explore, and assign a student to research what is known about each of the first 15 or 20 genes you come across. You might also make a list of specific genes mentioned in your course or textbook, and hunt down each of them using the web site and the Guide.

A Strategy for Genome Exploration — The Scavenger Hunt

Once you get the hang of using the genome exploration tools, you should be able to make a list of genes, DNA sequences, and chromosomal locations for your students to explore and investigate:

I’ve posted a set of 8 such "Targets" for a web-based scavenger hunt on our website. You are welcome to use these in your classes, and I invite you to make up your own assignments to supplement these.

[Send me the best ones, and I’ll post them with credit to the source]
The Scavenger Hunt Assignments Promote Open-Ended Inquiry

I've written the assignments for the hunt in a way that encourages open inquiry on the part of student investigators. For example, in one of the assignments students are told that half of the students in their school lack a copy of a gene called "PRY." They are then asked to find the gene and figure out why:

A typical "assignment" page from the web site is shown here:

Each one has a "starting point" that gives the background for the search, and a series of questions that can be answered only when the student has actually found the gene or target sequence.

Can you guess why half of your students probably do not have the PRY gene? My hope is that when students have answered the obvious questions asked in the hunt they will continue to explore, looking at genes next to the ones they've found and investigating their functions.

Joe Levine and I will do our best to keep the guide, the links, and the scavenger hunt targets up to date in the months and years ahead. We will add to the genome searching guide, and try to expand the range of activities available to your students.

If you have questions, suggestions, or comments on the Genome Searching Guide or our web site, please contact me directly:

Kenneth_Miller@Brown.edu