

WWW GUIDE

Resources for molecular biology

Jon Nakamoto

The world of molecular biology on the Internet is a bit like a good library mixed together with a well-stocked hardware store—you can spend your time learning (mostly for free), or you can pick up the tools you need for everyday work as well as a few items you barely know how to use. This month brings some excellent educational resources, as well as a few online databases and analysis tools worth a bookmark or two.

An outstanding site for science educators is the Natural History of Genes (NHG) Web site at <http://raven.umnh.utah.edu/index.html>. For those of us who've pondered the best way to get the next generation excited about molecular biology and prepared to deal with it, here, finally, is a blueprint for teaching important concepts via hands-on experiments. Projects range from simple (DNA isolation) to more complex (mutation detection and the study of bioluminescence). In addition, the NHG provides tips for teaching, complete directions for teachers, handouts for students, and a source for organisms (e.g., yeast) or special supplies needed for the experiments. For example, an experiment designed to teach about homeotic genes requires the use of two types of flour beetles, both of which the NHG project can provide. There are even simple experiments described which can be done in the kitchen at home.

Even though it's been a year since Dolly the sheep was cloned from the udder of an adult ewe, I still get asked about this cloning business on a regular basis. I now point intelligent laypersons to the Science Explained site at <http://www.synapse.ndirect.co.uk/science/clone/index.html>. This primer on Dolly provides a solid background of the history behind the field of nuclear transfer, as well as descriptions of the fits and starts which finally led to success at the Roslin Institute. You can link directly from Science Explained to the full-text of the *Nature* article about Dolly, complete with beautiful photographs of the cells used as well as pictures of Dolly herself. Or go to the Roslin Institute Online site

(<http://www2.ri.bbsrc.ac.uk/library/research/cloning/dollyman.html>) to read a brief but interesting account of the media frenzy that unfolded around Dolly.



Figure 1. Students can match up chromosome pairs at the Natural History of Genes, <http://raven.umnh.utah.edu/units/karyotyping/index.html>

Databases

Moving from educational resources to interesting databases, thanks to the Sanger Center there's yet another completed genome sequence available for your browsing pleasure—*Mycobacterium tuberculosis* (4.4 million bases). Take some time to look at the functional classification of TB protein-coding genes (http://www.sanger.ac.uk/Projects/M_tuberculosis/Gene_list). It's intriguing to see how an organism divides its genes among various metabolic categories (would you believe 360 genes just to produce the cell envelope?). Or perhaps those 606 unknown genes may pique your interest. If you're an eager collector, you can download the entire sequence by FTP (at <ftp://ftp.sanger.ac.uk>, in the pub/tb/sequences directory). There's also a scoreboard here which notes the current status of other sequencing projects at this location; looks like the fission yeast (*S. pombe*) sequence is due any day now.

In case you don't have one of those giant wall posters of metabolic pathways on hand, try the Metabolic Pathways site at <http://www.genome.ad.jp/kegg/metabolism.html>. Pick your favorite area of metabolism and click away: This site is surprisingly fast and responsive. If you click on carbohydrate metabolism, then glycolysis, you'll see all the familiar pathways you studied so hard in school. Use the pull-down menu to choose a species (e.g., *E. coli*); if the DNA sequence is available for one of the enzymes in the pathway you're studying, its EC # will be marked in green and you can click on the enzyme to reach the sequence database. If you click on one of the metabolic intermediates rather

than an enzyme, you'll pull up a picture of its chemical structure.

Proliferating rapidly are online databases of specific mutations in various diseases where researchers across the world can pool their findings. A good place to start is the Locus-specific Mutation database at the Institute of Medical Genetics in Cardiff (http://www.uwcm.ac.uk/uwcm/mg/oth_mut.html). About 70 different databases are listed, each corresponding to a different human disease and gene (although a few, such as p53, have more than one database in the world). This is also a good place to search for the newest gene-disease connections.

If you're doing mutation analysis, but your pet disease or gene doesn't have its own database yet, consider the possibility of starting a database yourself. However, pay a visit first to the EMBL-European Bioinformatics Institute at <http://www2.ebi.ac.uk/mutations/recommendations/> for recommendations on how to setup and organize the database, how to distribute the information (e.g., plain ASCII is the best way to ensure cross-platform compatibility), how to organize sequence variation data, and how to publicize your site.

For those involved in mutation hunting, the MUTATION newsgroup is useful, if only because you can get the newsletter of the HUGO mutation database initiative delivered to you electronically. Here you'll find announcements of new mutation databases, interesting new sites and tools for mutation analysis, and descriptions of important meetings. Traffic on the newsgroup is otherwise relatively light, with just a handful of messages each week; rather than browsing, a more efficient method is to search the archives with carefully chosen search terms; try this at <http://www.bio.net/hypermail/MUTATION/>.

Finally, where do you send a sample for clinical DNA analysis if you're looking for a particular mutation? How can you find the lab that specializes in DNA testing for specific and uncommon disease, say, Gorlin basal cell carcinoma syndrome? Go to the UCSD WWW Biochemical Genetics Test list (<http://biochemgen.ucsd.edu/wbgtests/wbgtests.html>) and search for the desired DNA test from the list of labs across the country. While this list is not absolutely comprehensive, the labs included are of uniformly high quality. ///

Jon Nakamoto is ??? in the department of ???, University of California, Los Angeles (jnakamot@ucla.edu). Copyright 1998, Science and Engineering Network News (www.senn.com). Excerpted from SENN vol. 4, no. 8.