Web resources: Internet resources featured in this guide

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Major Genome Browsers

Ensembl
http://www.ensembl.org

NCBI Map Viewer
http://www.ncbi.nlm.nih.gov/mapview/

UCSC Genome Browser
http://genome.ucsc.edu

Additional Genome Browsers

In addition to the genome browsers discussed in this Guide, the reader may find these additional views of the human genome sequence helpful. Each of these sites provides documentation on their scope of coverage and how to examine the data housed at that site.

Celera
http://www.celera.com/genomics/academic/home.cfm

ORNL Genome Channel
http://compbio.ornl.gov/channel/

RIKEN Genomic Sciences Center
http://hgrep.ims.u-tokyo.ac.jp/

Genome annotation

The following sites provide detailed information on annotations at each of the three major genome portals.

Distributed Annotation System
http://www.ensembl.org/Docs/wiki/html/EnsemblDocs/EnsemblDAS.html

Ensembl Science Documentation
http://www.ensembl.org/Docs/wiki/html/EnsemblDocs/ScienceDocumentation.html

NCBI Contig Assembly and Annotation Process
http://www.ncbi.nlm.nih.gov/genome/guide/build.html

UCSC Annotation Database
http://genome.ucsc.edu/goldenPath/help/hgTracksHelp.html

Human Genome Hub and Genome Central

These sites provide jumping-off points to major genome-based web sites. Resources available include trace data archives, access to cDNA and expressed sequence tag data and mapping information used to produce genome assemblies. The web sites of the individual members of the International Human Genome Sequencing Consortium may be accessed through these sites.

Ensembl Human Genome Central
http://www.ensembl.org/genome/central/

NCBI Human Genome Central
http://www.ncbi.nlm.nih.gov/genome/guide/central.html

NHGRI Genome Hub
http://www.nhgri.nih.gov/genome_hub.html

UK HGMP GenomeWeb
http://www.hgmp.mrc.ac.uk/GenomeWeb/genome-db.html

Major public sequence databases

Each of these databases belongs to the International Nucleotide Sequence Database Collaboration. Although all three centers provide separate mechanisms for sequence submission by individual investigators, they exchange data daily. As each member database stores and presents the underlying data using a slightly different format, this data exchange makes all known nucleotide and protein sequence data available to all users, regardless of which of the three databases are queried.

DNA Data Bank of Japan
http://www.ddbj.nig.ac.jp

EMBL Nucleotide Sequence Database
http://www.ebi.ac.uk/embl/index.html

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

Expressed sequence tag clustering databases

The ability to bring together expressed sequence tag, mRNA and other related sequences into gene-oriented clusters often facilitates genomic analysis, since the method groups individual sequences that most likely arise from the same gene or transcript. These three databases provide gene-oriented views of the data, using different algorithms in calculating the individual gene clusters.

STACK
http://www.sanbi.ac.za/Dbases.html

TIGR Gene Indices
http://www.tigr.org/tdb/tgi.shtml

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

Human genetic and physical maps

The databases listed below represent a significant portion of the data underlying current human genome assemblies. Many of these data are available through DDBJ/EMBL/GenBank, but each database contains additional information regarding clones, constructs and similar that is not available through the major sequence repositories. A more extensive list of human genetic and physical maps can also be found through the online *Nucleic Acids Research* Database Collection, at http://nar.oupjournals.org/cgi/content/ full/30/1/1/DC1.

Bacterial artificial chromosome and accession maps
http://genome.wustl.edu/projects/human/index.php?fpc=1

GenAtlas
http://www.citi2.fr/GENATLAS/

Genebridge4 radiation hybrid maps
http://www.sanger.ac.uk/Software/RHserver/RHserver.shtml

GeneMap '99
http://www.ncbi.nlm.nih.gov/genemap99

GenMapDB
http://genomics.med.upenn.edu/genmapdb

Généthon linkage map
http://www.genethon.fr/index_en.html

HuGeMap
http://www.infobiogen.fr/services/Hugemap

Marshfield genetic maps
http://research.marshfieldclinic.org/genetics/Map_Markers/maps/IndexMapFrames.html

RHdb
http://corba.ebi.ac.uk/RHdb

Stanford G3 and TNG radiation hybrid maps
http://www-shgc.stanford.edu/RH/

Genomic Databases and Resources

In addition to the databases listed in the section above, there are numerous useful databases containing human mutation, variation, medical or expression data. This short list is offered as a representative cross-section of the types of database freely available to genome researchers. The reader is referred to the 'lists of lists' found at the Human GenomeHub and Genome Central cites for a more extensive catalog of available resources.

Cancer Genome Anatomy Project (CGAP)
http://www.ncbi.nlm.nih.gov/CGAP/

Genome DataBase (GDB)
http://www.gdb.org

HUGO Gene Nomenclature
http://www.gene.ucl.ac.uk/nomenclature

Online Mendelian Inheritance in Man (OMIM)
http://www.ncbi.nlm.nih.gov/Omim

SNP Consortium
http://snp.cshl.org

Sequence-based searching

The following links provide access to the most frequently used tools for performing sequence-based comparisons to human genome data. An extensive list of sequence similarity search tools can be found on the ExPASy web site, at http://us.expasy.org/tools/.

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

BLAT
http://genome.ucsc.edu/cgi-bin/hgBlat?command=start

Ensembl BLAST
http://www.ensembl.org/Homo_sapiens/blastview

SSAHA
http://www.ensembl.org/Homo_sapiens/ssahaview

Model organism databases

This list represents a small subset of the sequencing initiatives on model organisms. Additional information on the progress of numerous model organism sequencing initiatives can be found on the Model Organisms for Biomedical Research web page, at http://www.nih.gov/science/models/. A more extensive list of organismal databases can also be found through the online *Nucleic Acids Research* Database Collection, at http://nar.oupjournals.org/cgi/content/full/30/1/1/DC1.

Arabidopsis thaliana
The *Arabidopsis* Information Resource
http://www.arabidopsis.org

Arabidopsis Genome Initiative
http://mips.gsf.de/proj/thal/db/

Caenorhabditis elegans
AceDB
http://www.acedb.org

WormBase
http://www.wormbase.org/

Drosophila melanogaster
Berkeley *Drosophila* Genome Project
http://www.fruitfly.org/

FlyBase
http://flybase.bio.indiana.edu/

Escherichia coli
EcoGene
http://bmb.med.miami.edu/EcoGene/EcoWeb/

Microbial Genomes
Comprehensive Microbial Resource
http://www.tigr.org/tigr-scripts/CMR2/CMRHomePage.spl

TIGR Microbial Database
http://www.tigr.org/tdb/mdb/

Mouse
Mouse Genome Database/Informatics
http://www.informatics.jax.org/

Rat
Rat Genome Database
http://rgd.mcw.edu

Yeast
Comprehensive Yeast Genome Database
http://mips.gsf.de/proj/yeast/CYGD/db/

Saccharomyces Genome Database
http://genome-www.stanford.edu/Saccharomyces/

S. pombe Genome Sequencing Project
http://www.sanger.ac.uk/Projects/S_pombe/

Zebrafish
Zebrafish Information Network
http://zfin.org

Ethical, legal and social Issues

Although this guide has focused on the mechanics of accessing and using human genome data, it is important to remember that ethical, legal and social issues (ELSI) are becoming increasingly important in this age of genetic and genomic research. The following web sites provide an introduction to important issues related to genome biology as applied to human health and provide a jumping-off point for further information.

DOE ELSI Program
http://www.ornl.gov/hgmis/elsi/elsi.html

Lawrence Berkeley National Laboratory
http://www.lbl.gov/Education/ELSI/

NHGRI ELSI Program
http://www.nhgri.nih.gov/ELSI/

Genetic education

The following sites present basic information on genetics and genomics, much of which is appropriate for elementary and secondary school education, as well as for the college level. Many of these sites offer teaching plans, graphics and other teaching resources that can be freely used in the classroom or lecture hall.

Access Excellence
http://www.accessexcellence.org/

Department of Energy education resources
http://www.ornl.gov/hgmis/education/education.html

Genetics Education Center
http://www.kumc.edu/gec/

NHGRI *Exploring our Molecular Selves* Multimedia Kit
http://www.genome.gov/Pages/EducationKit/

NHGRI Glossary of Genetic Terms
http://www.genome.gov/glossary.cfm