

Biotechnology resources

By Judith L. Hart and Gary E. Hart

A look at the advances in biotechnology

Enormous advances in the level of understanding the basic life processes that occur in microorganisms, plants, and animals have occurred in recent years, and this knowledge is being utilized for numerous and diverse purposes. The use of DNA fingerprinting in criminal trials has become routine; higher animals (e.g., sheep) have been cloned; mutant forms of human genes that cause diseases have been identified, isolated, and sequenced; hardy vine-ripened tomatoes have been produced by genetic engineering; sequencing of the genomes of man and rice is progressing rapidly; and the possible misuse of medical information about individual patients is a subject of legitimate concern. These topics and other aspects of biotechnology, such as the patenting of DNA sequences and of biological processes, are of interest not only to scientists but also to the public in general. The World Wide Web contains a great deal of information about them; this article presents an overview of this information.

Major Guides—good places to begin

- **Infomine: Biological, Agricultural, and Medical Science.** Seventy selected biotechnology sites are listed in the Infomine Directory of Scholarly Internet Resource Collections, maintained by the University of California at Riverside. Each site is accompanied by a summary, making the directory invaluable as an introductory source. Many of the sites are comprehensive sources, which focus on specific topics ranging from biomedical engineering to food science and technology and labo-

ratory products. Access: http://lib-www.ucr.edu/search/ucr_balsearch.html.

- **The Biotechnology Information Center (BIC).** BIC, which is part of the National Agricultural Library, provides access to information services and publications related to agricultural biotechnology. Among the extensive collection of biotech-related Web sites and government documents

are: U.S. Government Agencies, Biotech./Bioscience Resource Indexes, Industry/Commercial Biotech. Resources, Biotechnology-Public Perceptions/Information, Professional Scientific Societies, Databases and Research Resources, Biotechnology Programs/Institutions (U.S.), and International Biotechnology Sites. Access: <http://www.nal.usda.gov/bic/>

- **InfoBiotech Canada.** This site is unique in that it is the result of cooperation between the three major players in biotechnology: academia, government, and industry. Information sources are global, as well as Canadian. Access: <http://www.ibc.nrc.ca/ibc/>.

- **The World Wide Web Virtual Library: Biotechnology.** The WWW Virtual Library biotechnology resources (a public service of Cato Research Ltd.) covers biotechnology, pharmaceutical development, genetic engineering, medical-device development, and related fields. A comprehensive index of links by subject categories is provided, including Products and Services, Companies Producing Pharmaceuticals, and Pharmacology and Toxicology. Access: <http://www.cato.com/biotech/>.



Research

• **The World Wide Web Virtual Library: Genetics.** This Web site is a subject catalogue covering genetics. Listings are by organism, and bacteria, cattle, dog, fungus, humans, mosquito, plants, transgenic, and general are among the approximately two-dozen organismal categories. Included within most of these are direct links to Web sites devoted to genome projects, databases, stock centers, and major conferences, with the listings for humans and plants being the most extensive. *Access:* http://www.ornl.gov/TechResources/Human_Genome/genetics.html.

• **Agriculture Genome Information System (AGIS).** AGIS provides information related to genomic research, including databases, conferences, publications, courses, tools, and related links on agriculturally important plants, animals, and microorganisms. The AGIS server is produced cooperatively by the Department of Plant Biology of the University of Maryland and the Genome Informatics Group of the USDA National Agricultural Library. *Access:* <http://probe.nalusda.gov/>.

• **GrainGenes.** A genetic database for wheat, barley, rye, oat, and sugarcane, GrainGenes lists genes, alleles, gene products, DNA probes, genetic and physical maps of chromosomes, and numerous other types of genetic information. Also included are bibliographic citations and the addresses and interests of researchers. It is supported by the USDA National Agricultural Library's Plant Genome Program and numerous individual scientists. *Access:* <http://wheat.pw.usda.gov/>.

• **The Genome Database.** The Genome Database is the official central repository for genomic mapping data resulting from the Human Genome Initiative, which is a worldwide research effort to sequence the human genome and determine the location and sequence of all human genes. It includes genes, clones, other molecular markers, linkage and physical maps, mutations, and numerous other types of data, but it does not currently store human sequence data or raw mapping data (such as pedigrees or genotypes), which are available

from other sources. The Genome Database is hosted by the Johns Hopkins University School of Medicine. *Access:* <http://gdbwww.gdb.org/>.

• **National Center for Biotechnology Information (NCBI).** NCBI is a component of the National Library of Medicine, which is part of the U.S. National Institutes of Health. Its mission is to develop new information technologies, namely computerized databases and analysis tools, which will aid in the understanding of fundamental molecular and genetic processes that control human health and disease. Among the links available at the NCBI Web site are those to various programs and activities of the NCBI, several database services, several databases (including those for expressed sequence tags, sequence tagged sites, and GenBank), a gene map of the human genome, and the cancer genome anatomy project. *Access:* <http://www.ncbi.nlm.nih.gov/>.

• **GenBank—National Center for Biotechnology Information (NCBI).** GenBank is the U.S. National Institutes of Health genetic sequence database, an annotated collection of all publicly available DNA sequences. As of October 1997, it lists over one billion bases in almost two million sequence records. Maintained by NCBI, it is part of the International Nucleotide Sequence Database Collaboration, which also includes the DNA DataBank of Japan and the European Molecular Biology Laboratory. *Access:* <http://www.ncbi.nlm.nih.gov/Web/Genbank/index.html>.

• **Protein Data Bank (PDB).** The protein database is an archive of experimentally determined three-dimensional structures of biological macromolecules. Maintained by the Brookhaven National Laboratory, it includes browsing and searching tools, documentation, a list of Mirror Sites, and direct access to related Web sites. *Access:* <http://www.pdb.bnl.gov:80/>.

• **The Transgenic/Targeted Mutation Database (TBASE).** Large numbers of transgenic animals for use in basic and applied science have been produced and analyzed throughout the world. TBASE presents organized information on these animals and on the targeted mutations that they contain. It is maintained by the Division of Biomedical Information Sciences of the Johns Hopkins University School of Medicine. *Access:* <http://www.bis.med.jhmi.edu/Dan/tbase/tbase.html>.



Education

- **Access Excellence.** Genetech, Inc. sponsors this Web site as a national education program in biotechnology for high school biology teachers. This online network for colleagues and scientists allows teachers to keep abreast of new scientific information, issues and ethics, biotech careers, teaching partnerships and activities, online projects, and classrooms of the future. *Access:* <http://www.vt.edu:10021/cals/cses/chagedor/>.

- **BioTech Biosources Database: Indiana University.** This searchable database, maintained by Indiana University, offers educational resources related to biotechnology. The aim of this site is "to serve everyone from high school students to professional researchers." Included are BioTech's life science dictionary, a Biotechnology Resource Database, educational guides on a variety of biotech-related topics, annotated links to literature, professional and bioinformatics resources, and Internet searching tools. *Access:* <http://biotech.chem.indiana.edu/>.

- **1997-1998 BIO's Citizens' Guide to Biotechnology.** The Biotechnology Industry Organization's educational guide was created to inform citizens about the biotechnology industry. It addresses the questions, "What is biotechnology? How is it benefiting society today? and What will it offer in the future?" Topics included are the State of the Industry (industry facts and figures), Health Care, Agriculture, Environment, Industrial, and other areas in which biotechnology is used. *Access:* <http://www.bio.org/whatis/citizen1.dgw/34273959c4c12b3d#toc>.

- **Primer on Molecular Genetics.** This primer from the Department of Energy is maintained by the Human Genome Management Information System of Oak Ridge National Laboratory. It is an excellent introduction to molecular genetics and topics related to mapping and sequencing the human genome, and it is available in acrobat (pdf) format. *Access:* <http://www.bis.med.jhmi.edu/Dan/DOE/intro.html>.

- **BIO Online: Research and Education: Education Resources.** This comprehensive list of Web sites on biotechnology education resources is maintained by the Biotechnology Industry Organization (BIO). Links include other educational collections, reference tools, newsletters, listservs, etc. *Access:* <http://bio.com/resedu/educate.html>.

Patents

- **Ag Biotechnology Patents and New Technologies.** This BIC site provides a searchable database for full-text biotechnology patents for 1994 and 1995. Also available are patent titles for the 4th quarter of 1995 and the 1st-3rd quarters of 1996. Useful Web tools for searching patents are linked, as are other patent resources such as a BIC "Biotechnology: Patenting Issues Bibliography," with 134 citations to articles and monographs from AGRICOLA covering 1990-July 1996. *Access:* http://www.nal.usda.gov/bic/Biotech_Patents/.

- **U.S. Patent and Trademark Office.** The USPTO Patent Bibliographic Database covers 1976 to the present. A click on related Web sites takes one to a page that lists links to other government sites and intellectual property offices in other countries. *Access:* <http://www.uspto.gov/>.

Regulations

- **Biotechnology and Scientific Services (BSS) Home Page.** BSS is a component of the USDA's Animal and Plant Health Inspection Service (APHIS). Categories of information listed on the Table of Contents are Biotechnology Permits Database, APHIS Documents and Reports, How to Apply for Permits, Notifications, and Petitions, Biosafety Resources, Reference Material, and How to Get Additional Information. *Access:* <http://www.aphis.usda.gov/bbep/bp/>.

- **Information Systems for Biotechnology.** Maintained by Virginia Tech, this site "provides information on agricultural and environmental biotechnology research, product development, regulatory issues, and biosafety." It offers Monthly News Reports, a list of searchable databases, U. S. Government Documents, Risk Assessment Information, as well as links to other resources. *Access:* <http://gophish.biochem.vt.edu/>.

- **Biosafety Information Network and Advisory Service (BINAS).** BINAS, a service of the United Nations Industrial Development Organization, is involved in the monitoring of worldwide developments in regulatory issues in biotechnology. This is a good source for links to national and international Internet sites that focus on biosafety. U. S. links include the Environmental Protection Agency's Office of Pollution Prevention and Toxins TSCA Biotechnology Program, the Biotechnology page of the United States Food and Drug Administration,

the National Biological Impacts Assessment Programme, and the Agricultural Genome Information Server. *Access:* <http://binas.unido.org/binas/>.

Industry/Commercial

- **BIO—Biotechnology Industry Organization.** The Home page of BIO, an organization that “represents more than 720 biotechnology companies, academic institutions, state biotechnology centers and other organizations in 47 states and more than 20 countries.” *Access:* <http://www.bio.org/>.

- **National Biotech Register.** This registry of 2,200 biotechnology companies is categorized by the research and product development focuses of the companies. *Access:* <http://www.barryinc.com/bio/>.

- **BioSpace.** A searchable site index assists one in finding information in BioSpace. The internal search engine allows one to search the entire site or specific areas (job postings, news archives, company profiles, and a calendar of events). Other features include top news stories of the day and an exhibit hall for companies and organizations. *Access:* <http://www.biospace.com/>.

Scientific Societies/Associations

- **Professional Scientific Societies (BIC).** This listing of links to the Home pages/servers of professional societies reflects the broad range of disciplines involved in biotechnology.

A few of the links provided are: American Association of Bioethics, The Genetics Society of

America, Institute of Food Technologists, Society for In-Vitro Biology, Society for Industrial Microbiologists, and Union of Concerned Scientists. *Access:* <http://www.nal.usda.gov/bic/www.html#scisoc>.

- **Biotechnology Associations (InfoBiotech Canada).** Forty-eight associations with an interest in biotechnology are listed on this page. The location of the majority of organizations is in the United States and Canada. *Access:* <http://www.ibc.nrc.ca/cgi-bin/ibc/update-filter?key=assoc>.

E-Journals/Newletters

- **Biotechnology News/Newsletters/Journals.** This feature of the BIC Web server

provides a compilation of communication Web sites on biotechnology. News sites mentioned include the Yahoo! Biotechnology Company News. Included under “Other Collections” of Newsletters/Journals are links to collections with a broader focus, such as: **Pedro’s BioMolecular Research Tools** (*Access:* http://www.public.iastate.edu/~pedro/rt_journals.html); and **Bioline Publications** (*Access:* <http://www.bdt.org.br/bioline/>). *Access:* <http://www.nal.usda.gov:80/bic/Newsletters/>.

- **BioTech Literature Resources—Indiana University.** The unique feature of this collection of Web sites for journals, newsletters, and paper archives is that it is annotated. *Access:* <http://biotech.chem.indiana.edu/pages/literature.html>.

- **Biotechnology Journals and Periodicals (BIO).** The Biotechnology Industry Organization’s collection of biotechnology journals and periodicals is an alphabetical list of links to over 80 titles. *Access:* <http://www.bio.org/library/welcome.dgw>.

Discussion Groups

- **Directory of Scholarly and Professional E-Conferences.** Compiled by Diane K. Kovacs and associates, this directory is a searchable database of scholarly and professional electronic conferences. The subject keyword “biotechnology” finds:

- **GENTECH.** a discussion group on the impacts of genetic engineering (Subscription address: GENTECH_REQUEST@tribe.ping.de).

- **GEN-ETHICS.** a moderated list devoted to ethical, legal, and policy issues and the Human Genome Project (Subscription address: listserv@acor.org).

- **GENTALK.** a moderated list for teachers and students to discuss genetics and genetic engineering (Subscription address: listserv@usa.net).

- **HUM-MOLGEN.** a moderated list to discuss the Human Genome Project and human molecular genetics (Subscription address: listserv@nic.surfnet.nl). *Access:* <http://n2h2.com/KOVACS/>.

- **Newsgroups (InfoBiotech Canada).** This is a list of newsgroups that can be accessed through a browser’s news server. *Access:* <http://www.ibc.nrc.ca/ibc/newsgroups.html>.

Issues/Bioethics

- **Issues and Ethics (Access Excellence).**

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BLACKWELL'S *Collection Manager*

In June 1997 Blackwell's introduced Collection Manager, the first interactive presentation of collection interest profiles.

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For more information contact:
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Join ACRL President's Midwinter discussion forum: Enduring values for the new millennium

Are you concerned that the commercialization of electronic information may erode equitable access to information for academic library patrons? Do you spend sleepless nights wondering whether the commitment of academic librarians to intellectual freedom will be compromised by protests against explicit materials on the Internet? Do you worry about how academic librarians will uphold our service values, our professional neutrality, and the tenets of fair use in today's political and economic climate?

If so, make plans to attend the ACRL President's Discussion Forum "Enduring Val-

ues for the New Millennium" at the ALA Midwinter Meeting in New Orleans. This discussion forum, to be moderated by Shelley Phipps of the University of Arizona, will explore ACRL President Lee Hisle's theme of values for the electronic information age. Scenarios will be presented, and attendees will have the opportunity to engage in group discussions about values important to academic librarians. "Enduring Values for the New Millennium" will take place Monday, January 12, 9:30-11:00 a.m. Check the official conference program for exact meeting room location.

example of a traditional value being challenged. Librarians traditionally have been open to all ideas and have provided materials to support divergent viewpoints to all users. Our collection policies and our standards for reference service reflect the value of open access in all academic libraries. However, the value reflected by this commitment to access, without consideration of the impact of content now pits many rank and file librarians, along with a significant number of scholars from other fields, against the stated ALA position on intellectual freedom with regard to Web access.

Should we leave content decisions to parents when so many children are without parental guidance, especially in a society marked by two-income families and single-parent households? Should librarians take a more active role in deciding what is available to minors or students on the Internet? If so, does that lessen the importance of our long-held value of intellectual freedom? We have always limited access to traditional materials through the use of selection policies, special collections, and the like. For some, however, a similar policy related to materials available online is seen as the antithesis of intellectual freedom.

These questions—few with easy answers—are what attracted me to the theme. Opportunities to discuss the values of librarianship will occur during the course of the year, and I hope you will have the opportunity to join your colleagues to consider—to think about—the values of librarianship. ■

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This Web page provides links to documents related to issues and ethics, the Human Genome Project, Principles of Genetic Engineering, and the State of the Art. *Access:* <http://www.gene.com/ae/AB/IE/>.

- **Public Perception Issues in Biotechnology.** The goal of this Web site is "to provide information on communication of biotechnology issues and the impact of biotechnology on society." Issues covered are scientific, regulatory, educational, and commercial, with a focus on issues related to agriculture and the environment. *Access:* <http://www.vt.edu:10021/cals/cses/chagedor/percep.html>.

- **Biotechnology: Public Perceptions—Public Information (BIC).** A collection of Web sites and documents that deal with bioethics and public attitudes and perceptions towards biotechnology. *Access:* <http://www.nal.usda.gov/bic/www.html#percep>.

- **Center for Biotechnology Policy and Ethics.** This center at Texas A&M University "was created in 1990 as a specific response to ethical and political challenges facing the development of new genetic technologies, especially in the food, agricultural and natural resource sectors." Through discussion groups, conferences, and workshops, this forum for interdisciplinary research brings together individuals and organizations involved in biotechnology and its impact on society. *Access:* <http://www.tamu.edu/cbpe/>. ■