Broad Institute

The Eli and Edythe L. Broad Institute is a collaboration of the Massachusetts Institute of Technology, Harvard University and its affiliated hospitals, and the Whitehead Institute for Biomedical Research.

Between July 1, 2005 and June 30, 2006, the Broad Institute's efforts were met with success on several fronts. The Broad Institute received a generous gift of a second $100 million from Eli and Edythe Broad. The institute also expanded to a second building. Broad researchers helped to decode and analyze the full genetic sequence of human chromosomes 8, 11, 15, 17, and 18 as well as the genomes of multiple strains of the fungus *Aspergillus*, the domestic dog, and much more. Researchers published papers in some of the most prestigious journals, including *Nature*, *Cell*, *Nature Genetics*, and many others. In addition, researchers received grants, awards, and other accolades for their dedicated research and impressive accomplishments. *Science* and *Nature Medicine* recognized the Broad's research contributions as some of the top discoveries of 2005.

Mission

The Broad Institute's scientific mission is to create tools for genomic medicine and make them broadly available to the scientific community, and to apply these tools to propel the understanding and treatment of disease.

Its organizational mission is to enable collaborative projects that cannot be accomplished solely within the traditional setting of individual laboratories, and to empower scientists through access to cutting-edge tools.

Accomplishments and Future Projects

In November, the Broad Institute of MIT and Harvard received a second $100 million gift from Eli and Edythe Broad to support the Broad's unique model for collaborative science. In the spring of 2006, the Broad Institute expanded into a second building at 7 Cambridge Center, which officially opened May 30.

During the year, Broad researchers successfully participated in projects to sequence the genomes of mammals, viruses, parasites, and more. This work included the completion of a canine genome sequencing project, work that promises to shed light on genes underlying diseases in both dogs and humans. The Broad's microbial research center participated in an international effort to sequence thousands of dengue virus genomes. Researchers also created a detailed catalogue of mitochondrial proteins to probe normal mitochondrial biology and its role in human disease.

The Broad also continued its commitment to public outreach, initiating a summer lecture series, Midsummer Nights' Science, which is open to the public. Broad Institute director Eric Lander participated in a broadcast of NOVA ScienceNOW and explained the technique of RNA interference, and in June, Broad scientists were featured in the debut of *Science* magazine's virtual seminar series. High school students were invited

to participate in genomic research, and National Cancer Institute Integrative Cancer Biology Program labs offered undergraduates fellowships in cancer research.

Over the course of the year, several highly successful software programs and algorithms were developed at the Broad. These include Gene Set Enrichment Analysis, software that allows researchers to analyze whole networks of gene interactions. In addition, an algorithm that interprets data from DNA microarrays, known as probe-level allele-specific quantification, was developed.

One of the most noteworthy research advances was the completion of a detailed map of common human genetic variation, an effort known as the International Haplotype Map (HapMap) Project. The genetic map, led by an international consortium that included several Broad Institute researchers, was made publicly available to researchers worldwide to accelerate efforts to associate genetic variants with human disease. In the spring, milestones and future perspectives on the HapMap were discussed at a meeting held at the Broad.

Major Publications

- Discovery of a new drug target for melanoma, *Nature* (July)
- Comparison of the genomes of humans and chimpanzees as part of the Chimpanzee Sequencing and Analysis Consortium, *Nature* (August)
- The evolution of non-gene regions in chromosome 18, *Nature* (September)
- Meta-analysis of genetic factors contributing to bipolar disorder, *American Journal of Human Genetics* (September)
- Gene Set Enrichment Analysis software, *Proceedings of the National Academy of Sciences* (October)
- Patterns of genetic variation in the HapMap, *Nature, Nature Genetics, Public Library of Science Biology, Genome Research* (October)
- Comprehensive comparison of chimp and human DNA, *Nature* (2005)
- Genome sequence, comparative analysis and haplotype structure of the domestic dog, *Nature* (December)
- Common deletion polymorphisms in the human genome, *Nature Genetics* (December)
- Sequencing of *Aspergillus nidulans* and comparative analysis with *A. fumigatus* and *A. oryzae*, *Nature* (December)
- Conserved noncoding sequences are selectively constrained and not mutation cold spots, *Nature Genetics* (December)
- Microarray-based method for monitoring yeast overexpression strains reveals small-molecule targets in TOR pathway, *Nature Chemical Biology* (January)
- DNA sequence and analysis of human chromosome 8, *Nature* (January)

- A large family of ancient repeat elements in the human genome is under strong selection, *Proceedings of the National Academy of Science* (February)
- Human chromosome 11 DNA sequence and analysis including novel gene identification, *Nature* (March)
- A lentiviral RNAi library for human and mouse genes applied to an arrayed viral high-content screen, *Cell* (March)
- Analysis of the DNA sequence and duplication history of human chromosome 15, *Nature* (March)
- A common genetic variant 10kb upstream of INSIG2 is associated with adult and childhood obesity, *Science* (April)
- A bivalent chromatin structure marks key developmental genes in embryonic stem cells, *Cell* (April)
- DNA sequence of human chromosome 17 and analysis of rearrangement in the human lineage, *Nature* (April)

Honors and Awards

- GenePattern, a gene expression analysis software package developed at the Broad, received Bio-IT's World Best Practices award (July).
- Broad associate member David Sabatini was recognized as a Distinguished Young Scholar and received a grant of up to $1 million over five years from the W.M. Keck Foundation (July).
- Broad-affiliated researcher Sekar Kathiresan was awarded a Doris Duke Clinical Scientist Development Award (January).
- Editors at *Science* and *Nature Medicine* included Broad-based research in their picks of top discoveries (December).
- Four physician-scientists from the Broad Institute were elected to the American Society for Clinical Investigation and the Association of American Physicians (May).
- Broad received an $18 million CARe grant from the National Heart, Lung, and Blood Institute (May).
- Broad postdoctoral fellow Pardis Sabeti received a grant from the Burroughs Wellcome Fund for $500,000 over five years and a 2006 Trailblazer award from Science Spectrum magazine (June).

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More information about the Broad Institute can be found at http://broad.mit.edu/.