

## Unlocking the Human Genome

*Affymetrix-Molecular Dynamics Joint Venture Boosts Molecular Analysis*



MegaBACE 1000 DNA Sequencer (Image courtesy of GE Healthcare).

**The Challenge**—The early 1990s found molecular biologists eager to pursue genetic research but hampered by cumbersome tools.

To address this problem, the biotechnology company Affymetrix formed a joint venture with Molecular Dynamics, a medical instrument company, to develop a handheld device with a microchip that could extract DNA from a blood sample, then amplify and analyze it. They applied to ATP in 1994 and won an award to develop the methodology and processes.

**The Outcome**—Affymetrix upgraded their GeneChip<sup>1</sup> system by increasing its capacity to handle dense arrays and scaling up the photolithographic process. It also improved the software for working with increasingly copious readouts of data from the chip.

The company marketed a GeneChip system, which added software to the chip, along with instruments to process the probe arrays. Affymetrix continued to improve the chip's capabilities throughout the ATP project. Molecular Dynamics built the MegaBACE<sup>2</sup> 1000, a new kind of sequencer which replaced a gel

used in electrophoresis with capillaries. The process, capillary array electrophoresis (CAE), speeded up sequencing a hundredfold and inspired other companies to introduce sequencers using the new process. MegaBACE was used in mapping about 30 percent of the human genome, and CAE made it possible to complete the mapping of the human genome at least three years ahead of schedule.

The award helped DNA chips become a robust method of molecular analysis. As of 2006, Affymetrix had 82 percent of the DNA microarray market and had established a licensing program to stimulate the broad commercialization of genome analysis technologies. Molecular Dynamics, a small company at the project's outset, was acquired by progressively larger companies and is now a component of GE Healthcare.

An economic impact study<sup>3</sup> conducted by ATP estimates public economic benefits from the project at \$394.5 million. When adjusted for inflation, ATP's contribution was \$34.7 million. For every \$1 ATP invested, the public realized \$8.70 in benefits.

<b>Partnering Organization:</b>	Affymetrix, Inc., Santa Clara, CA and GE Healthcare (Formerly Molecular Dynamics), Piscataway, NJ
<b>Project Duration:</b>	2/1/1995 – 1/31/2000
<b>Project Cost:</b>	\$28.8M ATP cost-share; \$31.5M industry cost-share
<b>Project Brief:</b>	<a href="http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=94-05-0016">http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=94-05-0016</a>
<b>Project Status Report:</b>	<a href="http://statusreports.atp.nist.gov/reports/94-05-0016.htm">http://statusreports.atp.nist.gov/reports/94-05-0016.htm</a> Research conducted March 2006
<b>Economic Case Study:</b>	<a href="http://www.atp.nist.gov/eao/gcr06-898.pdf">http://www.atp.nist.gov/eao/gcr06-898.pdf</a>

<sup>1</sup>GeneChip is a registered trademark of Affymetrix, Inc. GeneChip was the industry's first microarray allowing for sequencing of several DNA fragments simultaneously.

<sup>2</sup>MegaBACE is a registered trademark of GE Healthcare.

<sup>3</sup>*Economic Impact of ATP's Contributions to DNA Diagnostics Technologies*. NIST. January 2007