

# Genome Technology

## Scientists Demonstrate NMR on a Chip

[April 2008]

By Ciara Curtin

A sensitive nuclear magnetic resonance setup could easily take up a room — just think of the analogous magnetic resonance imaging machines in hospitals. Not only does it take up that much space, but it requires an expensive magnet and, often, cryogenics. Recently, however, researchers in Berkeley and Boulder teamed up to miniaturize this bulky process and take the magnet out of the equation by bringing together microfluidics, atomic magnetometry, and optics.

"This technology allows us to marry all the analytical potential of the NMR and MRI technology with all the advantages of the microfluidics chip: its portability, its automation, its small amount of material that you use," says Dmitry Budker, a physicist at the University of California, Berkeley.

In general, an NMR signal is obtained from a sample in a stable magnetic field that has a second, oscillating magnetic field applied to it. The protons in the sample spin and create a magnetic moment that occurs at different frequencies and is detected and recorded as an NMR spectrum. "The real trick is to work without a magnet and put the detector on the chip using a laser," says Alexander Pines, a chemist at Berkeley.

To be able to work an NMR without a magnet, certain technological stars had to align. For years, Pines' lab has been working on alternative strategies for NMR and MRI, particularly in remote NMR detection (where the detection and encoding of the NMR signal is separated), while Budker has worked on atomic magnetometers. Together, the labs made an MRI in which signals are detected by a laser-based atomic magnetometer, rather than a magnet. Then,

**Welcome Guest**

**[Printer-Friendly Version](#)**  
**[Genome Technology Online](#)**  
**[RSS Feed](#)**

### In This Week's Issue



[Signature Genomic Labs Debuts Program To Help Patients Negotiate With Payors](#)

[Protagen Says Study Shows Its Protein Chips Shed Light on Monoclonal Antibody Effects](#)

[Expression Analysis Says Chips, Next-Gen Sequencers 'Perfect Fit' in New GWAS Service](#)

[NSF Microarray Grants Awarded Jan. 1 — April 8, 2008](#)

[Autogenomics, Genomics USA, NuGen Technologies, Affymetrix, IBM, Febit](#)

[Navigenics, Children's Hospital of Philadelphia, Autism Genetic Resource Exchange, Asuragen, Codon Devices](#)

[Agilent Technologies, CombiMatrix Molecular Diagnostics](#)

researchers led by John Kitching at the National Institute of Standards and Technology were able to make really tiny magnetometers (they also make atomic clocks the size of a grain of rice).

Matthew Pando, John Jaskowiak, Philippe Rousseau, Bruno Tocque, Douglas Amorese

Te three groups of Budker, Pines, and Kitching collaborated to combine these advances to develop a small NMR-on-a-chip that uses a diode laser and microfabricated atomic magnetometer, all set onto a microfluidic chip. "Everything is microfabricated, including the detector of the NMR, onto the chip," says Pines.

"What we have illustrated is basically the first microchip combining these features. It's sort of a first step in that direction," Budker says.

**New GEX Resource Guide**

Learn about the typical needs researchers have. And how we address them.

**Annual Cancer Issue Download**

Download the April PDF when you request a free subscription to Genome Technology.

**Annual Cancer Issue Download**

Download the April PDF when you request a free subscription to Genome Technology.