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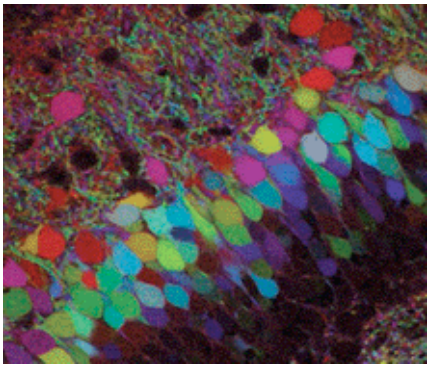
NEWS

BREAKTHROUGH OF THE YEAR:
Areas to Watch



Gray matter no more. Colorful labeling methods should help researchers map out neural circuits.

CREDIT: LIVET *ET AL.*, *NATURE* 450, 7166 (2007)

A smashing start? Next summer, physicists will start up the Large Hadron Collider (LHC) at the European particle physics lab, CERN, outside Geneva, Switzerland. Researchers hope this highest-energy collider will reveal plenty of new particles and puzzles, but the immediate question is how fast will it come on? The ultracomplex machine runs at a frigid 1.9 kelvin, and if for some reason researchers have to warm part of it up, it will take months to cool it again. Still, CERN has a record of bringing new machines on line smoothly. Call it a major success if the LHC produces even a little data next year.

See Web links on the LHC

Micromanagers. Research on small RNA molecules that control gene expression continues at a rapid clip, and microRNAs are surging to the front of the pack. Roughly 800 papers on the tiny molecules were published in 2007, tying them to a slew of cancers, heart ailments, a healthy immune system, stem cell differentiation, and more. But it's still early days. In 2008, researchers will start using microRNAs to unveil disease mechanisms and will make inroads into solving fundamental puzzles about how they function.

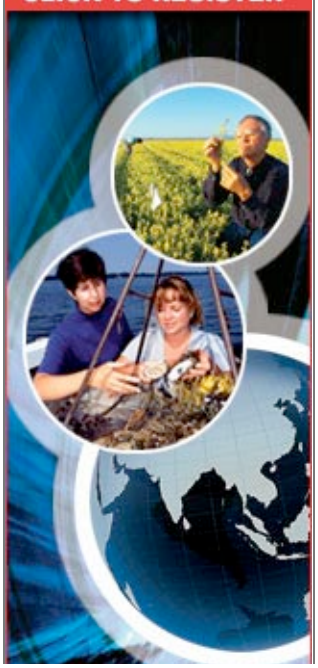
See Web links on miRNA

Cell to order. It's hard to separate the hype from the hard science, but synthetic biologists say humanmade microbes are in reach. By this time next year, one group hopes to put a synthesized genome into DNA-less bacteria; another is incrementally replacing natural DNA with synthetic DNA. The point is to make biofuels--perhaps even microbe-derived gasoline--or pharmaceuticals.

See Web links on synthetic biology

Paleogenomics. Expect a very rough draft of the Neandertal genome by the end of 2008 and more comparisons between the genes of Neandertals and *Homo sapiens* that will continue to flesh out those fossil bones, filling out many features of this extinct human. Thanks to cheaper, faster technologies, there will be more genomes, from more extinct species, rolling out of the sequencing pipelines.

See Web links on paleogenomics



Multiferroics. Relatives of ceramic oxide superconductors, the compounds called multiferroics form a group in which single materials display multiple electronic, magnetic, and structural behaviors. Physicists recently used electric fields to manipulate magnetic domains in a multiferroic. Now, they are racing to better control this switching and shape the materials into novel computer chip devices. Success could pave the way for chips that combine the logic functions normally handled by semiconductors with the memory functions now carried out by magnetic materials.

See Web links on multiferroics

Megamicrobes. Featured in both the U.S. National Institutes of Health and the European Union plans for 2008, the human microbiome will go under the microscope this year in many labs around the world. Expect the genomes of 200 of the bacteria that call humans home to be sequenced, as well as the first steps toward extensive surveys of gut, skin, mouth, and reproductive- tract microbial communities. Meanwhile, researchers are mapping the distribution of microbes in other environments, including icebergs and hot ash.

See Web links on the microbiome

New light on neural circuits. Exciting new methods are poised to start revealing how circuits of neurons process information and mediate behavior. Recently, neuroscientists mapped neural connections in mice by genetically tagging neurons with nearly 100 fluorescent hues. Others have been using lasers to control the electrical activity of individual neurons in the brains of rodents, thanks to light-sensitive ion channels introduced by genetic engineering. Meanwhile, a magnetic resonance method called diffusion tensor imaging is providing new detail about connections between regions of the human brain. These techniques should yield important insights into how neural circuits work--and how they break down in brain disorders.

See Web links on neural circuits

The editors suggest the following Related Resources on *Science* sites:

In *Science* Magazine

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BREAKTHROUGH OF THE YEAR: Human Genetic Variation
Elizabeth Pennisi (21 December 2007)
Science **318** (5858), 1842. [DOI: 10.1126/science.318.5858.1842]
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