

Tuesday, December 22, 2009

## The Year in Biomedicine

Advances in antiaging drugs, **acoustic brain surgery**, flu vaccines--and the secret to IQ.

By Emily Singer

We may look back on 2009 as the year human genome sequencing finally became routine enough to generate useful medical information ("[A Turning Point for Personal Genomes \(http://www.technologyreview.com/biomedicine/23522/\)](http://www.technologyreview.com/biomedicine/23522/)"). The number of sequenced and published genomes shot up from two or three to approximately nine, with another 40 or so genomes sequenced but not yet published. In a few cases, scientists have already found the genetic cause of a disorder by sequencing an affected person's genome.

Scientists have also sequenced the genomes of a number of cancers, comparing that sequence to patients' normal genome to find the genetic mistakes that might have caused the cells to become cancerous and to metastasize ("[Sequencing Tumors to Target Treatment \(http://www.technologyreview.com/biomedicine/23621/\)](http://www.technologyreview.com/biomedicine/23621/)"). The results suggest that even low-grade and medium-grade tumors can be genetically heterogeneous, which could be problematic for molecularly targeted drugs. That points to a need to develop new strategies for drug development and treatment in cancer.

The year brought more good news for aging mice, and maybe humans, too, as scientists identified the first drug that can extend lifespan in mammals ("[First Drug Shown to Extend Lifespan in Mammals \(http://www.technologyreview.com/biomedicine/22974/\)](http://www.technologyreview.com/biomedicine/22974/)"). Rapamycin, an antifungal drug currently used to prevent rejection of organ transplants, was found to boost longevity 9 to 13 percent even when it was given to mice that were the mouse equivalent of 60 years old. Previously, genetic engineering and caloric restriction--a nutritionally complete but very low-calorie diet--were the only proven methods of extending lifespan in mammals ("[A Clue to Living Longer \(http://www.technologyreview.com/biomedicine/16826/\)](http://www.technologyreview.com/biomedicine/16826/)").

Because of its potent immunosuppressant effect, the drug isn't suitable for this application in humans. But researchers have already found that disrupting part of the same signaling pathway has similar life-extending benefits ("[Genetic Fountain of Youth \(http://www.technologyreview.com/biomedicine/23560/page1/\)](http://www.technologyreview.com/biomedicine/23560/page1/)"). Mice with the relevant protein disabled showed superior motor skills, stronger bones, and better insulin sensitivity when they reached mouse middle age. Female mice lived about 20 percent longer than their unaltered counterparts. But male mice, while healthy, didn't have longer lifespans. (In comparison, caloric restriction boosts longevity by about 50

percent.) Scientists now aim to develop drugs that target this pathway, which is thought to act as a kind of gauge for the amount of food available in the environment.

The emergence in April of a new pandemic flu strain, H1N1, rapidly renewed interest in new approaches to making vaccines ("[New Vaccines for Swine Flu](http://www.technologyreview.com/biomedicine/22591/page1/) (<http://www.technologyreview.com/biomedicine/22591/page1/>) "). For the first time during an active pandemic, pharmaceutical companies were able to use faster cell-based production methods to create vaccines against the virus, in addition to the traditional egg-based method. (None of these methods has yet been approved for use in the United States--the vaccine currently available was made in eggs.) In November, an advisory panel for the U.S. Food and Drug Administration declared that a novel method of producing flu vaccines in insect cells, while effective, needs more safety testing before it can be approved ("[Caterpillar Flu Vaccine Delayed](http://www.technologyreview.com/biomedicine/24031/page1/) (<http://www.technologyreview.com/biomedicine/24031/page1/>) "). The vaccine, developed by [Protein Sciences](http://www.proteinsciences.com/) (<http://www.proteinsciences.com/>), based in Meriden, CT, uses a single protein from the virus to induce immunity, rather than a dead or weakened version of the virus. Two other companies began clinical trials of flu vaccines made from virus-like particles--protein shells that look just like viruses but do not contain viral DNA ("[Delivering a Virus Imposter Quicker](http://www.technologyreview.com/biomedicine/23782/page1/) (<http://www.technologyreview.com/biomedicine/23782/page1/>) ").

→ A new approach to brain surgery, tested by a Swiss team earlier this year, allows surgeons to burn out small chunks of brain tissue without major surgery using specialized sound waves ("[Brain Surgery Using Sound Waves](http://www.technologyreview.com/biomedicine/23031/page1/) (<http://www.technologyreview.com/biomedicine/23031/page1/>) "). Neurosurgeons used a technology developed by [InSightec](http://www.insightec.com/14-en/InSightec.aspx) (<http://www.insightec.com/14-en/InSightec.aspx>), an ultrasound technology company headquartered in Israel. The method employs high-intensity focused ultrasound (HIFU) to target the brain. (HIFU is different than the ultrasound used for diagnostic purposes, such as prenatal screening, and has previously been used to remove uterine fibroids.) Beams from an array of more than 1,000 ultrasound transducers are focused through the skull onto a small piece of diseased tissue, heating it up and destroying it. In the study, nine patients with chronic debilitating pain reported immediate pain relief after the procedure. ←

Scientists also hope to co-opt the technologies developed for HIFU to modulate brain activity, using low intensity focused ultrasound to activate nerve cells ("[Targeting the Brain with Sound Waves](http://www.technologyreview.com/biomedicine/22746/page1/) (<http://www.technologyreview.com/biomedicine/22746/page1/>) "). This approach might one day provide a less invasive alternative to deep-brain stimulation. This procedure, in which surgically implanted electrodes stimulate parts of the brain, is an increasingly common treatment for Parkinson's disease and other neurological problems.

In another first for the brain, scientists discovered this year that our IQ, or general intelligence, depends in large part on our white matter--the fatty layer of insulation that coats the neural wiring of the brain ("[Brain Images Reveal the Secret to Higher IQ](http://www.technologyreview.com/biomedicine/22333/) (<http://www.technologyreview.com/biomedicine/22333/>) "). Using a type of brain

imaging called diffusion tensor imaging, researchers analyzed the neural wiring in 92 pairs of fraternal and identical twins and found a strong correlation between the integrity of the white matter and performance on a standard IQ test. In addition, the researchers found that the quality of one's white matter is largely genetically determined. They are now searching for genetic variants tied to white matter and IQ.

A feature in the November issue of the magazine further explored the secret of intelligence, revealing that our smarts may be determined by the function and efficiency of the networks within the brain, rather than the number of neurons or the size of any particular region ("[Intelligence Explained \(http://www.technologyreview.com/biomedicine/23695/\)](http://www.technologyreview.com/biomedicine/23695/)").

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## Upcoming Events

### **[2010 IEEE Conference on Innovative Technologies for an Efficient and Reliable Electricity Supply \(http://www.ieee-energy.org/\)](http://www.ieee-energy.org/)**

Waltham, Massachusetts

Sunday, September 27, 2009 - Tuesday, September 28, 2010

<http://www.ieee-energy.org/> (<http://www.ieee-energy.org/>)

### **[MIT Sloan CIO Symposium \(http://www.mitcio.com\)](http://www.mitcio.com)**

MIT Campus, Cambridge, MA

Wednesday, May 19, 2010

<http://www.mitcio.com> (<http://www.mitcio.com>)

### **[BIO International Convention \(http://convention.bio.org\)](http://convention.bio.org)**

Chicago, IL

Monday, May 03, 2010 - Sunday, May 10, 2009

<http://convention.bio.org> (<http://convention.bio.org>)