PROSPECTS

New year, new science

Nature *looks at key findings and events that could emerge from the research world in 2011.*

THE EEMIAN REVEALED

The North Greenland Eemian Ice Drilling (NEEM) project reached bedrock in July 2010, at a depth of more than 2,500 metres. The fruits of that effort should soon be seen, now that researchers are analysing gas and particles trapped inside the ice core to reveal details of the climate of the Eemian interglacial period (130,000–115,000 years ago), when the average global temperature was about 5 °C warmer than today.

GWAS PROVE THEIR WORTH

Genome-wide association studies (GWAS) have uncovered plenty of links between diseases and particular regions of the genome, but frustratingly haven't revealed much about the biochemistry behind these associations. In 2011, expect to see real mechanistic insights explaining how genes, and non-coding regions, affect the medical conditions they have been linked with. Metabolism, obesity and diabetes are among the hottest targets.

STEM CELLS: READY FOR STUDY

Researchers have learned how to reprogram people's cells into induced pluripotent stem (iPS) cells, and on from that into other cell types: skin cells can be turned into nerve cells, for example. Patient-derived iPS cells will increasingly be used as models for studying medical conditions — particularly those, such as psychiatric disorders, for which there are no good animal models, and little understanding of what is happening inside cells. They will also be used to screen potential drugs, and to probe why existing drugs help some patients but not others.

GENOME-SEQUENCING EXPLOSION

This year should surely see the price of human-genome sequencing dropping to US$1,000 per genome. As next-generation sequencing machines reach the market, the number of fully sequenced human genomes will skyrocket.

THAT DAMNED ELUSIVE HIGGS

Although it is unlikely that the Higgs boson will be spotted this year by the Large Hadron Collider near Geneva, Switzerland, there's a good chance the collider will turn up something, such as evidence for supersymmetry — the theory that every known fundamental particle has an undiscovered, superheavy partner. Meanwhile, Fermilab's Tevatron in Batavia, Illinois, is pushing for an extension beyond its September 2011 shutdown, and still hopes to hit the Higgs jackpot.

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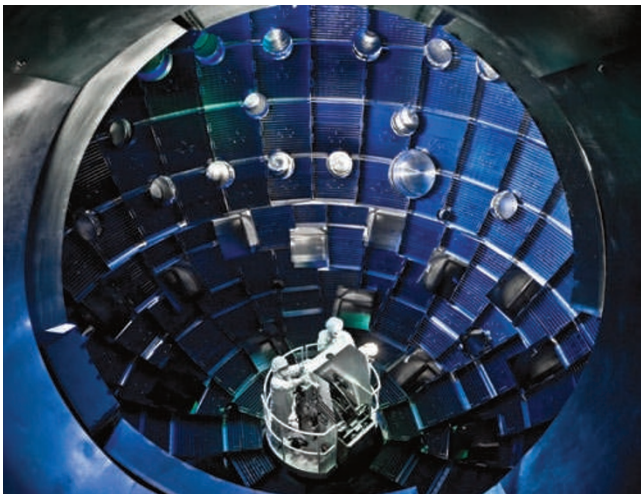
How good were *Nature*'s predictions for 2010? See:
go.nature.com/8e4y1m

DARK MATTER'S MOMENT OF TRUTH

A number of underground experiments, such as XENON100 at Italy's Gran Sasso National Laboratory near L'Aquila, and the Cryogenic Dark Matter Search (CDMSII) in northern Minnesota's Soudan Mine, are hunting for dark matter particles and expect to release results in 2011.

HEPATITIS C TREATMENT

Eagerly anticipated drug approvals in 2011 include a decision by the US Food and Drug Administration on telaprevir, which could provide relief for the 3% of the world's population infected with the hepatitis C virus. The drug was developed by Vertex Pharmaceuticals in Cambridge, Massachusetts.



LLNL

Will the National Ignition Facility ignite 2011?

ANOTHER EARTH

Planet-hunters anticipate that NASA's Kepler telescope will reveal an Earth-like planet orbiting a Sun-like star. It has already spotted hundreds of planets outside the Solar System, although full data have not yet been released.

SYNTHETIC BIOLOGY: THINK MULTICELLULAR

No longer will scientists have to cram complicated synthetic biology into a single cell. Last year, researchers engineered an entire colony of bacteria to periodically fluoresce in unison, and we can expect many more papers exploring the behaviour of collections of cells. The goal is to exploit this teamwork to give bacteria useful functions such as producing medicinal drugs.

LAST OF THE SHUTTLES

The final flight of NASA's space-shuttle fleet is scheduled for April, when it will deliver the Alpha Magnetic Spectrometer (AMS) to the International Space Station to search for antimatter and dark matter. However, the US Congress may authorize another shuttle outing in November. If the second test launch of Dragon, the craft developed by commercial spaceflight firm SpaceX in Hawthorne, California, proves successful, the launch of a private spacecraft with crew or cargo is not out of the question.

SOLAR-SYSTEM EXPLORERS

In March, NASA's Messenger mission is due to become the first craft ever to orbit Mercury, and the agency's Dawn probe will orbit one of the biggest members of the asteroid belt, Vesta, in August. Other planned space launches include Juno, which will orbit Jupiter's poles; the GRAIL mission, twin spacecraft due to measure the Moon's gravitational field; and the Mars Science Laboratory, a car-sized rover that will explore the red planet.

SUPERLASER FLIRTS WITH FUSION

California's National Ignition Facility (**pictured**), the world's most powerful laser, is inching its way to triggering ignition, when fusion reactions in a target of hydrogen isotopes should produce more energy than the laser delivers. Experts give even odds that the laser, at the Lawrence Livermore National Laboratory, will succeed this year.

PROBING HOME

The European Space Agency's satellite GOCE, which is designed to measure Earth's gravity field in unprecedented detail, will publish results next year that will be used to help monitor sea level rise. Meanwhile, NASA's Aquarius satellite will launch to measure ocean salinity, and Glory will monitor solar irradiance and aerosols. ■

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