

BREAKDOWN OF THE YEAR: FINANCIAL MELTDOWN

THE SALES SLUMP THAT BECAME A CREDIT crunch and then a global financial crisis this fall will leave a big smudge in the economics record for 2008. Panic hit the stock market in October, engulfed investment companies, and even threatened to pull down the giant General Motors Co. The full scope of the breakdown isn't clear yet.

Luckily, scientific research did not take a direct hit, but scientists are feeling the consequences like everyone else, and research

budgets could get caught in the fallout next year. In the United States, the drop in stock values deflated private endowments—some by 15% to 25% over a few months. Retirement accounts withered. Meanwhile, programs funded by endowments began to cut back (*Science*, 7 November, p. 841). The Smithsonian Institution acknowledged in its first public board meeting in November that its endowment was down 21% over a 4-month period and that it would need to tighten its \$1 billion budget. Like many, it has delayed announcing hard cuts.

Companies that need capital to advance new technologies will be pinched, and some will go under. New energy projects seem likely to be delayed. In the biomedical area, a recent report by the Biotechnology Industry Organization in Washington, D.C., noted that 38% of its smaller public companies are on track to burn through their cash reserves in a year.

State-funded hospitals and universities are cutting employees and putting off new facilities as state revenues decline. The California state university system, responding to the governor's budget, has threatened to cut student enrollment by 10,000, or 2.1%, next year. Private schools are being affected, too. President Drew Faust announced a 22% drop in Harvard's endowment, along with potential delays in the new Allston campus and research area. The Massachusetts Institute of Technology plans to reduce spending by 10% to 15%, said MIT President Susan Hockfield. Federal spending on research has not changed, but President-elect Barack Obama and Congress have not yet tackled

the 2009 budget.

In this murky landscape, there is at least one fixed point: the official starting date of the crisis. According to Federal Reserve Board Chairman Ben Bernanke, the cascade began in August 2007 with a general price collapse in U.S. real estate. Houses went unsold; owners walked away from mortgages; companies holding the mortgages began to default on obligations; a huge firm that insured against such defaults, AIG, ran out of funds and was saved by the government. Five high-flying U.S. investment banks with mortgage-related investments quit the investment field—four to become ordinary commercial banks and one to disappear (Lehman Brothers). Governments in North America, Europe, and Asia are now pumping hundreds of billions of dollars into private companies in an attempt to restore the economy's pulse.

What caused the crash? Bernanke and other Fed economists describe it as the natural end of an "asset bubble," an irrational run-up in values. Whether it's labeled as optimism or greed, the appetite for growth got out of hand, and the financial models that underpinned some investment strategies broke down. Some say the remedy is to increase controls on finance and enable more scrutiny of private funds. One school of economists argues that the solution is to create models that steer investors away from bad risks by relying less on "rational" economic principles and more on observed human behavior (*Science*, 12 December, p. 1624). The debates are just warming up and will occupy analysts of the 2008 crash for years to come.

—ELIOT MARSHALL



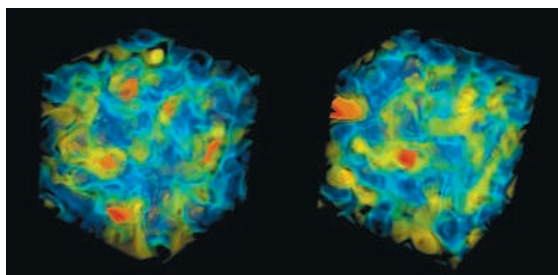
Proton's Mass 'Predicted'

STARTING FROM A THEORETICAL DESCRIPTION OF ITS INNARDS, physicists precisely calculated the mass of the proton and other particles made of quarks and gluons. The numbers aren't new; experimenters have been able to weigh the proton for nearly a century. But the new results show that physicists can at last make accurate calculations of the ultracomplex strong force that binds quarks.

In simplest terms, the proton comprises three quarks with gluons zipping between them to convey the strong force. Thanks to the uncertainties of quantum mechanics, however, myriad gluons and quark-antiquark pairs flit into and out of existence within a

proton in a frenzy that's nearly impossible to analyze but that produces 95% of the particle's mass.

To simplify matters, theorists from France, Germany, and Hungary took an approach known as "lattice quantum chromodynamics."



They modeled continuous space and time as a four-dimensional array of points—the lattice—and confined the quarks to the points and the gluons to the links between them. Using supercomputers, they reckoned the masses of