WHAT'S IN A TERAGRID?

- 13.6 teraflops (trillions of calculations per second) of computing power
- More than 450 terabytes (trillions of bytes) of data storage
- A 40-gigabit (40 billion bits per second) fiber-optic network
- Four main nodes: San Diego, Urbana-Champaign, Caltech, and Argonne National Lab

The TeraGrid will build on an existing 40-billion-bits-per-second fiber-optic network, the so-called Internet-2 created by Qwest, one of three key industrial partners in the facility. It will rely on clustered Linux servers from IBM powered by thousands of Itanium-family processors from Intel. Each of the four institutions will contribute elements to the TeraGrid; by April 2003, it is expected to deliver 13.6 teraflops of computing power and more than 450 terabytes of storage.

NSF officials are hoping that this fall Congress will give the agency enough money to connect the Pittsburgh center to the grid in a few years' time. That will be followed, says Borchers, by a "deepening" of the network to connect a steadily rising number of regional and local sites. That's the path NSF followed to help create its previous research backbone that became the Internet.

–JEFFREY MERVIS

PLANT SCIENCE

How Seedlings See the Light

Seedlings start to turn green the instant they pop out of the earth and receive sunlight. Exactly how light touches off the chain of events that converts a ghostly pale seedling into a green, photosynthesizing plant has long been a mystery. Now, a team of scientists has filled in one of the major gaps in understanding this photomorphogenesis, as it's called, by uncovering a surprisingly simple three-step pathway involving blue light.

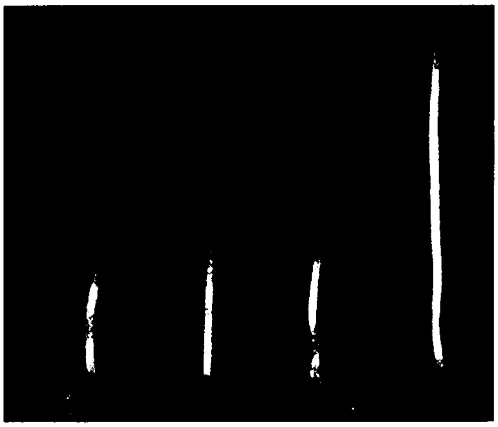
Plant scientists have known for roughly a decade that a plant protein called COP1 is a master regulator of photomorphogenesis. When seedlings germinate in the dark, COP1, which was discovered by Xing-Wang Deng's team at Yale University, keeps the genes that bring about the process in the "off" state by fostering the degradation of transcription factors needed for the genes' activity, including one well-characterized factor known as HY5. Then, when seedlings encounter light, COP1 levels in the nucleus fall, allowing the transcription factor levels to rise and switch on the photomorphogenesis genes.

Since COP1 was discovered, a number of laboratories have tried to identify what they assumed was a cascade of proteins connecting it to the photoreceptors that detect the light. But they could find no such proteins. Now Deng and colleagues have explained why this search has been futile. In a report published online this week by *Science* (www.sciencexpress.org), they show that in the plant *Arabidopsis thaliana*, blue photoreceptors known as cryptochromes interact with COP1 directly. Thus, they suggest that the light signal may be transmitted to COP1 without the intercession of other proteins.

Plant physiologist Roger Hangarter of Indiana University, Bloomington, says the study is "profound, because people have been struggling for a long time to see how the photoreceptor gets information into the nucleus." But plant geneticist Albrecht von Arnim of the University of Tennessee, Knoxville, cautions that the researchers have yet to show that a change in light conditions actually changes the interaction between cryptochromes and COP1.

The Deng team's current work was inspired by results published last year by Anthony Cashmore at the University of Pennsylvania in Philadelphia and his colleagues. They created *Arabidopsis* mutants in which cryptochrome structure was altered and that, consequently, experience photomorphogenesis even when reared in darkness. The observation that a change in cryptochrome shape blocks inhibition of the light response by COP1 suggested to Deng and his colleagues that there might be a direct interaction between COP1 and the cryptochromes.

A battery of tests performed by the team repeatedly caught the two sets of proteins in flagrante delicto: For example, antibodies against COP1 fished one of the two common classes of cryptochromes out of *Ara-*



From darkness into light. A newly discovered signaling pathway tells plants whether to grow tall in search of sunlight (far right) or to develop leaves (left).

CREDITS: (TOP TO BOTTOM) SOURCE: NATIONAL SCIENCE FOUNDATION; H. WANG ET AL.

ScienceScope

Cloning Around Just days after the U.S. House of Representatives voted to ban all forms of nuclear transfer in human cells (*Science*, 10 August, p. 1025), a panel of the National Academy of Sciences heard a case for allowing research on the technique to go forward. The workshop turned into a media circus, however, as dozens of reporters showed up to hear scientists who say they want to use cloning to create a human baby.

Although many panel members expressed grave doubts about the safety of reproductive cloning, most seemed in favor of allowing human nuclear transfer research to continue. Panel chair Irving Weissman, a cell biologist at Stanford University, said that nuclear transfer experiments with human cells could lead to better understanding of certain genetic diseases, insights into early human development, and potential therapies.

Panel member Robert Jaffe said he hoped the panel could draw a distinction between nuclear transfer research and reproductive cloning "clear enough for senators to understand."

Science Exemption Science and technology gets special treatment in new budget guidelines proposed by Japanese Prime Minister Junichiro Koizumi. Last week Koizumi announced that he plans to cut spending by 10% next year, the first overall reduction since 1999, in hopes of ending a prolonged economic slump. But science was spared: The guidelines recommend a 5% boost in funding for research, to \$9.5 billion.

Stem Cell Suit In a preview of the tangled legal claims sure to arise over rights to embryonic stem (ES) cells (see p. 1242), the University of Wisconsin, Madison, has sued to block a California company from gaining additional rights to cells it controls.

The Wisconsin Alumni Research Foundation (WARF), a nonprofit corporation associated with the university, holds the patent on derivation and use of primate ES cells, including human cells. But Geron Corp. of Menlo Park, California, funded efforts by Wisconsin researcher James Thomson to derive the human ES cell lines and received commercial rights to six types of cells derived from ES cells.

The original agreement included an option to negotiate for rights to other kinds of cells, but "after good-faith negotiations we've decided not to provide additional cell types," says WARF spokesperson Andy Cohn. Geron says they hope to meet with WARF to resolve the dispute.

sponse to inside jokes and kooky names for genome annotation algorithms such as FANTOM (for functional annotation of mouse). Indeed, the comparative study's implications depend on one's point of view. "It's a question of whether you want Havarti or Swiss cheese. The public assembly doesn't have that many holes, but the holes it does have are much bigger," says Jim Kent of the University of California, Santa Cruz, author of the computer program used for the initial assembly of the HGP genome sequence. Kent advises scientists considering a subscription to Celera's database to take a utilitarian approach. First they should examine the region of interest in the public database, he says: "If it's in good shape, then praise the lord they've just saved themselves $20,000." –**BEN SHOUSE**

Ben Shouse is an intern in the Cambridge, U.K., office.

EVOLUTIONARY BIOLOGY

Queens, Not Workers, Rule the Ant Nest

Queen fire ants not only populate their colonies, but they can also influence its sex ratio by limiting the number of female eggs they produce. This finding, reported on page 1308 by evolutionary biologist Laurent Keller of the University of Lausanne, Switzerland, and his colleagues, is contrary to expectation. Most entomologists thought that the workers, the queen's female daughters who actually raise the colony's young, determine the ratio of males to females, as they have the ability to kill or starve unwanted eggs.

Sexual conflict. The smaller workers (*inset*, left three ants) can influence the sex ratio as they tend eggs and developing young *(above)*, but the queen (fourth ant) can still bias the colony to favor males (fifth ant).

CREDITS: (LEFT TO RIGHT) DAVID T. ROBERTS/NATURE'S IMAGES/PHOTO RESEARCHERS; L. PASSERA *ET AL.*; CDC

But, says Lotta Sundström, an evolutionary biologist at the University of Helsinki, Finland, "this is really the first experimental test of who determines [sex] ratios." The results are "compelling," adds Jon Seger, an evolutionary biologist at the University of Utah in Salt Lake City.

The idea that the female workers should shape the relative proportions of females and males in *Solenopsis invicta* ant colonies dates back to work done 25 years ago by Harvard's Robert Trivers and Hope Hare. They predicted that worker females would favor females over males for evolutionary reasons: Insect males develop from unfertilized eggs and carry just one copy of every chromosome, while the females arise from fertilized eggs and have two copies, one from each parent.

This so-called haploid-diploid system of sex determination skews the relatedness of the offspring such that sisters have more genes in common and, therefore, are more closely related to one another than to their brothers. Thus, while queens benefit equally by producing sons or daughters, worker females should prefer to raise sisters so they can pass on more of their genes. Trivers and Hare's subsequent analysis of sex ratios—using the relative dry weights of males and females in preserved ant, bee, wasp, and termite colonies in museum collections—supported an apparent bias in favor of females among these social insects. In contrast, solitary species tended to have the usual one-to-one proportion of females to males.

To reflect the degree of genetic relatedness between the two sexes, ant colonies should have three females to every male. And although several studies bore out this prediction, "there have been these nagging inconsistencies," notes Kenneth Ross, an entomologist at the University of Georgia, Athens. Some ant colonies had more males than predicted, and fire ants sometimes even had colonies with many more males than females. Keller and his colleagues decided to try to find out why.

In 1999, they collected 24 fire ant colonies, each of which had a queen. The researchers reared those colonies in the lab for at least a week, then counted the number of males and females among 100 individuals selected from each colony. Eleven turned out to have mostly males, and 13 consisted almost entirely of females. The researchers then switched queens from male-dominated colonies with queens from female-dominated ones.

ScienceScope

Genome Buzz An international attack on the genome of the mosquito that carries the malaria parasite (*Science*, 9 March, p. 1873) got a big financial boost last week—and a new partner.

The U.S. National Institute of Allergy and Infectious Diseases awarded $9 million to Celera Genomics Group of Rockville, Maryland, to swat the sequence of *Anopheles gambiae*, the primary malaria vector in sub-Saharan Africa. Researchers hope the sequence will reveal molecular targets for drugs and other antimalaria strategies.

The company expects to have the mosquito's 260 million DNA base pairs sequenced by spring 2002, giving researchers access to the genomes of all three players in the disease: humans, the mosquito vector, and the *Plasmodium* malaria parasite itself.

Climate Upheaval Despite spending 40 years in the United States, prominent climate modeler Syukura Manabe thought he knew what to expect when he decided to return to his native Japan in 1997 and join the Frontier Research System for Global Change, whose centerpiece is a massively parallel supercomputer called the Earth Simulator. But the climate for cooperative research proved so unreceptive that the former head of the U.S. government's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey, is headed back across the Pacific to his adopted home.

"To use such a huge machine, you need a lot of scientists working together. But that type of collaboration is very hard to accomplish in Japan, especially by an outsider," says Manabe, who earned his Ph.D. at the prestigious University of Tokyo before coming to the United States in 1958.

Manabe, who turns 70 next month, says that he's spent a "very productive" 4 years in the Frontier program, which is funded by both the marine science and space agencies. "But it's time to slow down," he says, "and hand over the job to a younger scientist who can communicate better with everybody involved." He expects that person to be someone who's spent his career in Japan.

Contributors: Gretchen Vogel, Charles Whipple, Michael Balter, Jeffrey Mervis