Metspalu recognizes the need to educate Estonians about genetics, but he believes that obtaining informed consent will not be a problem. "In a small pilot study, questioning 111 people resulted in a 90% acceptance rate, and I expect something similar for the general population," he says. **–LONE FRANK**

Lone Frank is a writer in Copenhagen, Denmark.

INFECTIOUS DISEASES

Malarial Genome Comes Into View

In 1986, Thomas Wellems set out on a seemingly narrow quest. He wanted to find the gene that enabled the malarial parasite *Plasmodium falciparum* to become resistant to chloroquine, the drug that had been a mainstay therapy for decades. But along the way, Wellems, a malaria expert at the National Institute of Allergy and Infectious Diseases (NIAID) in Bethesda, Maryland, accomplished what may be a more far-reaching feat. As reported on page 1351, he and his colleagues from NIAID and from the National Center for Biotechnology Information pinpointed a series of genetic landmarks across the entire 14-chromosome genome of this deadly parasite. It is one of two new maps of the parasite unveiled this month; the second, published in the November issue of *Nature Genetics*, shows a different type of landmark.

Richard Hyman of the Stanford DNA Sequencing and Technology Center in Palo Alto, California, says that the new maps will be "really useful" for researchers working to sequence the parasite's genome, because the landmarks will enable them to align short stretches of sequenced DNA in the correct order along *P. falciparum*'s chromosomes. Producing that sequence is a top target, Hyman notes. There's no preventive vaccine for malaria, which kills about 2 million people a year, and in the past 2 decades the organism has become resistant to other key antimalarial drugs in addition to chloroquine. The completed sequence may reveal potential targets for antimalaria vaccines or drugs.

A sequenced genome seemed an impossible dream when Wellems first started his project. "At the time, we didn't even know how many chromosomes there were," he recalls. He and his colleagues planned to home in on the location of the chloroquine-resistance gene by identifying genetic landmarks in the genome and seeing which of them were inherited along with the drug resistance. The team did this by tracking down microsatellites, short, easily identifiable bits of repetitive DNA that could serve as these landmarks.

For that effort, they also spent more than 5 years developing new resistant and sensitive parasites and then cross-breeding them. Only then could they trace the inheritance of the markers and the drug-resistance trait in the offspring of the hybrids to glean clues to the gene's location.

The map naturally emerged from this effort, as the group determined the patterns of microsatellites in the offspring of the crosses. Markers that are close to one another on a chromosome are more likely to be inherited together than those far apart, and so the team could establish the relative orders of the markers—901 in all—along the chromosomes and the approximate distances between them.

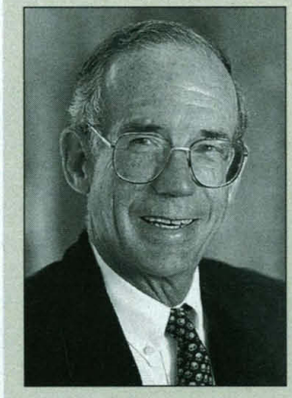
The second map, produced by David Schwartz of the University of Wisconsin, Madison, and his colleagues, pins down the physical locations of its markers. These researchers used a technique called optical mapping, which Schwartz devised while at New York University (NYU) in New York City. It uses electrostatic forces to hold pieces of fluorescently labeled *P. falciparum* DNA stretched out on glass. Then, for this

Getting the picture. Computer software merges fluorescence microscopy images to reveal cuts in long stretches of the malarial parasite's DNA.

CREDIT: (TOP) SCHWARTZ *ET AL.*

PUBLISHING

Kennedy Named Editor-in-Chief of *Science*



Donald Kennedy, president emeritus of Stanford University and a former commissioner of the Food and Drug Administration (FDA), has been appointed the next Editor-in-Chief of *Science*. A neuroscientist by training, Kennedy is currently Bing Professor of Environmental Science at Stanford.

Kennedy's appointment was announced on 9 November by the board of directors of the American Association for the Advancement of Science, which publishes *Science*. Board chair M.R.C. Greenwood, chancellor of the University of California, Santa Cruz, said in a statement: "He brings to this task a broad understanding of current science issues, a wealth of experience in government and university, and incomparable insight." He will take over the editorship on 1 June 2000 from Floyd Bloom, who announced last year that he would not seek a second 5-year term when his current appointment expires in May 2000. Kennedy will retain his Stanford faculty position through the 2000–01 academic year.

Kennedy, 68, received A.B. and Ph.D. degrees from Harvard and joined the Stanford faculty in 1960. His research focused on invertebrate neurobiology, in particular on how organisms generate and control patterned motor output. He served as FDA commissioner from 1977 to 1979, returned to Stanford as provost, and was appointed president in 1980, a position he held for 12 years.

His current research and teaching focuses on environmental policy. He co-chairs an interdisciplinary center at Stanford that explores the development of policies on issues such as land-use changes, shifts in agricultural practices, and global climate change.

map, the researchers treated the DNA sequentially with two enzymes, each of which cuts it at different, specific sites, leaving the DNA fragments lined up in the right order.

After each enzyme treatment, the researchers measured the fragments. They put DNA pieces of known lengths on the slide for reference and used fluorescence microscopy to digitally image the DNA fragments. Finally, a sophisticated computer program developed by NYU's Bud Mishra and Thomas Anantharaman compiled the map showing the cut sites. "It's a brilliant [approach],"says Wellems.

The payoff will come as an international team completes the actual sequence of the parasite's genome, and later, as new genes are found with the help of the genetic map. In genome sequencing, researchers first generate lots of tiny, overlapping bits of DNA, then they assemble them in the right order along the chromosomes to get the full genome sequence. Now, they can use the locations of the cuts and of the microsatellite markers to figure out where newly sequenced DNA belongs along the *P. falciparum* genome. "They provide a scaffolding of sequence that we can use as a reference," says Leda Cummings, a molecular biologist who is sequencing the parasite's DNA at The Institute for Genomic Research in Rockville, Maryland.

Indeed, with the help of these and other maps, the sequencers expect to finish the malarial genome by the end of 2001. Wellems predicts that with this sequence and the many other experimental resources that are becoming available (see p. 1251), the parasite's secrets "are going to unroll very rapidly." As for the chloroquine-resistance gene that sparked the map work? It's been found, says Wellems, and its identity will soon be published.

–ELIZABETH PENNISI

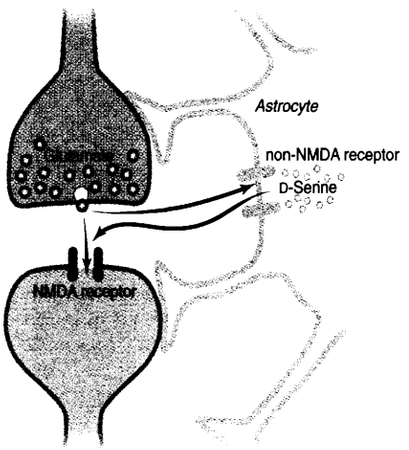
NEUROBIOLOGY

Key Brain Receptor Gets An Unusual Regulator

A team of researchers at The Johns Hopkins University School of Medicine has unearthed a strange new regulator of nerve cells—a looking-glass molecule not previously known to be made by higher mammals. In the 9 November *Proceedings of the National Academy of Sciences*, neuroscientist Solomon Snyder and his colleagues report that they have cloned a brain enzyme that makes the amino acid D-serine, rounding out their case that this unusual molecule plays a central role in learning and memory.

Snyder's team had previously implicated the amino acid as an activator of the so-called NMDA receptor—a molecule with pivotal roles in learning, brain growth, and brain cell death. But as Snyder himself concedes, the idea that D-serine acts on the NMDA receptor was so radical that people "paid no attention" to it. For one, the NMDA receptor was supposed to be activated by the neurotransmitter glutamate in partnership with another amino acid, glycine. For another, D-serine would be an extraordinary glutamate partner indeed as "D," or right-handed, forms of amino acids were not supposed to be made by mammals.

But cloning the enzyme that makes D-serine proves that the amino acid is made in the brain. Snyder's team went on to trace the enzyme to the same cell type, astrocytes, and the same brain areas where D-serine is found. And to nail their case, they showed that destroying D-serine in the brain greatly reduces NMDA receptor activity. "It's a significant advance," says neuroscientist Joseph Coyle of Harvard Medical School in Boston. "They've now characterized at a molecular level a key new participant in NMDA receptor function."



Cross-talk. Under glutamate's influence, astrocytes release D-serine into the synapse between two neurons (left).

Medicine should also benefit, as the newly cloned enzyme, called serine racemase, provides a novel target for drugs to treat a range of neurological conditions in which NMDA receptors play a role. Drugs that block or quiet the enzyme, for example, might be used to quell anxiety and epilepsy and prevent damage from strokes, which can be caused by excessive activity at NMDA receptors. On the other hand, stimulating serine racemase might improve schizophrenia symptoms, which are partly caused by depressed NMDA receptor function.

Snyder became intrigued with D-serine in the early 1990s, after stumbling across an obscure paper by scientists at the National Institute of Neuroscience in Tokyo, who had detected the amino acid in rat

CREDIT: REDRAWN FROM SCHELL *ET AL., PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES* **92**, 3948 (1995)

ScienceScope

Biomed Headhunting As government contracts go, it's small—but possibly very important for the future of biomedical research. The Department of Health and Human Services (HHS) is paying the National Academy of Sciences $25,000 to help find a successor to National Institutes of Health director Harold Varmus, who plans to depart at year's end. Academy president Bruce Alberts, with the assistance of Institute of Medicine president Kenneth Shine, has promised to deliver a list of "six to 12" suitable candidates to HHS secretary Donna Shalala later this month. She will forward the recommendations to President Clinton, who gets the final say.

Slam Dunk A high-stakes donor wants to help the next generation pump up Israeli science. U.S. industrialist William Davidson last week made the largest individual gift ever to the Weizmann Institute of Science in Rehovot: $20 million intended to enliven classroom science.

The Weizmann, a $180-million-a-year operation, already is the largest producer of science teaching tools for Israel's secondary schools. But the new Davidson Institute of Science Education aims to add new curricula and programs such as Perach, in which 25,000 undergrads tutor disadvantaged students in exchange for scholarships. The gift is an "investment in the future," says Davidson, CEO of Michigan's Guardian Industries and a partner in the Detroit Pistons basketball franchise.

Weizmann officials have their work cut out for them. According to Rami Rahimimoff, a former Hebrew University–Hadassah Medical School dean, studies show outstanding Israeli students shunning science and "looking to get rich quick" in other fields.

Case Dismissed Suing a professor for stealing one's ideas may become more difficult in New York state, thanks to a recent court decision. Judge Emily Jane Goodman of the state Supreme Court for New York City last month dismissed a suit brought by Sheng-Ming Ma, a former Columbia University Ph.D. candidate in mathematics, who claimed his thesis adviser misappropriated his work (*Science*, 23 April, p. 562). After summarizing the complex issues at stake—including the question of whether a new math proof was valid—Judge Goodman concluded: "This court cannot fathom how I or a jury could decide which theorem is correct." The decision may put a chill on such cases in New York, including a suit by nutritionist Antonia Demas claiming that her adviser at Cornell University took her ideas.