ther rejected or didn't have enough money to fund. He plans to invite rejected researchers to post their ideas on a free electronic bulletin board. That way, he says, scientists can avoid being penalized by a peer-review system that is "inherently flawed, overly cautious, ... and unfriendly to real innovation."

Some researchers at the center of the storm say they don't see the release of their names as a threat. "Even the most successful researchers don't always get funded, but I can see why someone might feel embarrassed," says Mark Blumberg, a neuroscientist at the University of Iowa in Iowa City, who, like Vagell, is on the list but was eventually funded by the National Institute of Mental Health (NIMH). Vagell, who says he doesn't mind the attention, finds Kurzon's information-sharing plan "interesting, ... [but] I can't imagine that funders are facing a shortage of good applicants."

This is the second time that the 71-year-old Kurzon, a Harvard-trained physician who has worked in the pharmaceutical industry and as a venture capitalist, has forced NIH to cough up such a list. In 1980, he won a court order forcing the National Cancer Institute to reveal the names of its unfunded applicants after he learned that it had rejected a proposal from prominent biochemist Albert Szent-Gyorgyi. Kurzon turned the list over to a social scientist studying peer review.

Kurzon went to federal court again last year, after NIMH rejected a 1999 Freedom of Information Act request for a similar list. In July, a judge found that although neither NIH nor Kurzon had made a strong case, the law requires agencies to make records public whenever possible. So on 12 October NIH sent Kurzon a list of the 800-plus NIMH applicants who weren't funded in the spring of 1999, after informing everyone on the list and inviting them to contact Wendy Baldwin, head of the agency's extramural grants agency.

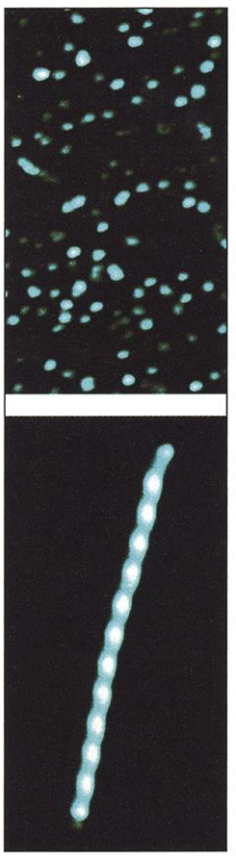
"I can't see how a list of names is ... the most effective way to advance science," says Baldwin. The agency already encourages researchers who don't get NIH funding to approach private donors, she says.

Kurzon thinks that NIH officials are missing the point. The exercise will have been worthwhile if it leads to the funding "of even one overlooked gem of an idea," he says, adding that he plans to ask every NIH institute to provide updated lists of its unfunded applicants. But scientists may cling to their anonymity a bit longer: Kurzon has yet to raise the money to mail out his invitations or set up his Web site. –DAVID MALAKOFF

PARKINSON'S DISEASE

Dopamine May Sustain Toxic Protein

The tremors, stiffness, and slurred speech that accompany Parkinson's disease are rooted in the death of neurons that churn out the chemical messenger dopamine. But precisely what kills these brain cells has long stumped researchers. Now a provocative test tube study suggests that a surprising culprit—dopamine itself—may assist in the neurodegeneration that defines the disease. Parkinson's researchers say the findings are intriguing and worthy of follow-up experiments but caution that they must be confirmed in cell cultures and laboratory animals.



Misfolding. Dopamine may keep α-synuclein in toxic protofibrils (top) by preventing it from forming fibrils (bottom).

CREDIT: CONWAY ET AL.

Neurons in parts of the brain stricken by Parkinson's disease are marked by tangled deposits called Lewy bodies. These clumps are made of the folded, or fibrillar, version of a protein called α-synuclein. Neuroscientists initially assumed that fibrillar α-synuclein—as opposed to the unfolded form common in healthy brains—is responsible for neural demise. Recently, however, researchers have pursued a version of α-synuclein that hovers between normal and fibrillar, called protofibrillar, which some consider far more toxic than fibrils.

On page 1346, Peter Lansbury of Harvard Medical School in Boston and his colleagues describe their search for compounds that either prevent or encourage protofibril accumulation. Lansbury's team used human α-synuclein produced by bacteria to screen 169 compounds. To the researchers' surprise, of the 15 compounds that inhibited the transition from protofibril to fibril—thus, presumably, making protofibrils stick around in a cell longer—14 belonged to a set of neuromodulators called catecholamines, which includes dopamine.

The results appeared paradoxical; after all, Parkinson's disease is caused by a crippling loss of dopamine. How could dopamine be worsening the disease? "The whole thing led in a very unexpected direc-

ScienceScope

The fall of RISE In May 2000, an advisory committee to the National Science Foundation (NSF) proposed a big spending boost in mathematics and the physical sciences, citing their role in national security and economic development. Committee members hoped that the 20-page manifesto—the Reinvestment Initiative in Science and Engineering (RISE)—would inspire a doubling of the NSF budget, a goal of NSF director Rita Colwell.

But the campaign never took off. Last week the committee vented its anger at NSF's top management for failing to trumpet its message while a recent Defense Department commission led by former U.S. Senators Gary Hart and Warren Rudman attracted national attention by making many of the same points. "NSF had an opportunity to be at the forefront on the role of science in national security and economic development, and it dropped the ball," said chemist Ronald Brisbois of Macalaster College in St. Paul, Minnesota. "RISE could have been on everybody's lips [after 11 September] instead of Hart-Rudman."

NSF staffer Robert Eisenstein says he understands their frustration. But he also told the committee that Colwell *et al.* "are very supportive" of the RISE plan.

Arsenic Déjà Vu Ending one of the biggest scientific controversies of the young Bush Administration, the Environmental Protection Agency (EPA) last week issued a new standard for arsenic in drinking water. It chose exactly the same level of 10 parts per billion (ppb) set by the Clinton Administration.

In March, EPA administrator Christine Whitman suspended that standard and asked for more scientific review, noting that cleanup costs could be high. Her move provoked an uproar among environmentalists and some members of Congress and inspired countless jibes about the president's disregard for the public's health. But if more review was meant to block the standard, it backfired: A National Academy of Sciences panel found that the cancer risks of arsenic were greater than previously thought, suggesting that even 10 ppb might not be protective enough (*Science*, 21 September, p. 2189). The panel's chair, retired pathologist Robert Goyer, declined to comment on EPA's decision. But he said that it's in line with a World Health Organization guideline followed by many countries.

tion," says Lansbury.

A clue came when postdoc Kelly Conway found that adding antioxidants to the test tube mix reversed the inhibitory effect of dopamine and sped back up the transformation of α-synuclein from protofibrils to fibrils. The dopamine that sends neural messages, which people with Parkinson's disease lack, is stored in synaptic vesicles and protected from oxidation. But dopamine is formed in the cytoplasm, and while there it's easily oxidized. Because the oxidized form of dopamine has been implicated in cell death in earlier studies, and because of his team's new work with antioxidants, Lansbury speculates that the balance between dopamine and its oxidized form goes awry in Parkinson's patients. Perhaps, he says, dopamine is not promptly moved to the vesicles and languishes instead in the cytoplasm, where it's oxidized and sustains protofibrils.

Others researchers are intrigued: "It's a new way of thinking about the basis for Parkinson's disease ... one that ought to be pursued," says Jeffery Kelly, a chemist at the Scripps Research Institute in La Jolla, California. Virginia Lee, a neurobiologist at the University of Pennsylvania in Philadelphia, says the work complements mounting evidence that protofibrils are harmful and that oxidative stress helps stabilize them.

Because all three forces—α-synuclein, dopamine, and oxidative stress—are present in some form in normal brains, it remains unclear which is more to blame in Parkinson's. Lansbury's group suspects that a buildup of α-synuclein is the first domino that topples the rest, eventually combining with oxidized dopamine to form protofibrils. Although the theory of excess α-synuclein has not been broadly tested, transgenic mice with excess protein are more likely to develop Parkinson's symptoms.

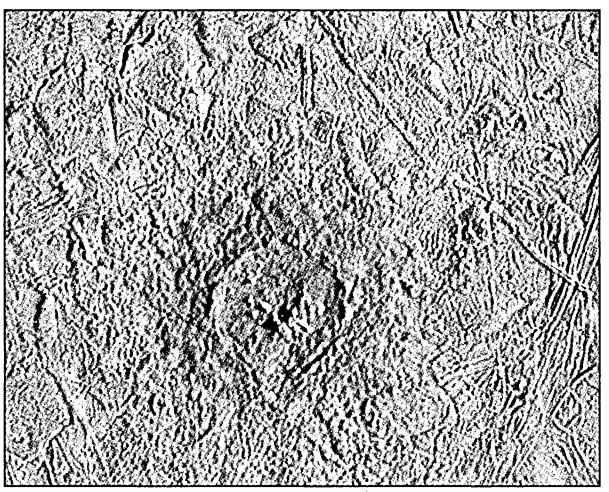
Despite the limitations of studying protofibrils in a test tube, scientists are gingerly discussing the study's implications for treating Parkinson's. Many patients currently take a drug called L-dopa, which passes through the blood-brain barrier and there converts to dopamine. If the Lansbury team is correct, say neurobiologists such as Teresa Hastings of the University of Pittsburgh, giving cells more L-dopa could be counterproductive: Some neurotransmitter may get oxidized, sustaining protofibrils and allowing them to kill cells. Studies thus far have not deemed L-dopa treatment harmful, and it often eases symptoms. Still, researchers have long wondered about L-dopa's long-term effect on brain cells. A clinical trial funded by the National Institutes of Health and based at Columbia University is examining whether L-dopa affects the progression of Parkinson's disease; results are expected in about a year. **–JENNIFER COUZIN**

Jennifer Couzin is a writer in San Francisco.

ASTROBIOLOGY

Putting a Lid on Life on Europa

No earthling would choose to live on Jupiter's satellite Europa. But its deep ocean of liquid water beneath −170°C ice has made the satellite the second most enticing body in the solar system for astrobiologists after Mars. Now that the idea of an ocean is generally accepted, the debate has shifted to how far below the icy surface it lies. If it's too far, even the most tenacious ocean life could be cut off from its best energy source—the sun—and heavily shielded from the prying eyes of astrobiologists. But this issue of *Science* contains discouraging news. New information about how comets punch into Europa's surface suggests that the ice is more than 3 to 4 kilometers thick, not an optimistic 1 kilometer. That poses a greater obstacle for life in Europa's ocean as well as for astrobiologists.



Thickness gauge. Impact craters on Europa having central peaks, as does Pwyll (diameter 26 kilometers), suggest that the ice is more than 3 to 4 kilometers thick.

Researchers have debated the issue through thick and thin. For the past decade or two, most assumed that at least the upper 20 to 30 kilometers of the 100 kilometers or so of water overlying Europa's rocky core was frozen solid. Calculations suggested that heating of the ice by the tidal pushing and pulling of Jupiter might allow such a thick layer of ice while keeping the ocean from freezing from top to bottom.

Some analyses of images returned by the Galileo spacecraft orbiting Jupiter tended to support the thick-ice hypothesis, too. Analyzing images from the mid-1990s, planetary geologist Robert Pappalardo of the University of Colorado, Boulder, and colleagues at Brown University in Providence, Rhode Island, saw "pits, domes, and spots" on the surface that tended to be about 10 kilometers in size and spaced about 20 kilometers apart. The most likely cause of such features, they argue, is deep ice warmed and thus softened by the ocean and set churning slowly toward the surface, like so many puffy clouds on a sunny day. Such convection requires ice at least 20 kilometers thick, the lower part of which would be soft to prevent fracturing from the surface to the ocean. Anything living in the ocean would then need 100,000 years to reach the sustaining sunlight or to receive energy-laden chemicals slowly moving down from the surface, where they are produced by Jupiter's intense enveloping radiation.

But planetary scientist Richard Greenberg and his group at the University of Arizona in Tucson have an alternative model that's more hospitable to possible life. Looking at more recent Galileo images, they see a whole range of sizes and spacings of features corresponding to pits, domes, and spots; to them, that looks like spotty melting of ice right through to the surface rather than the effects of thick, convecting ice. The ice can melt through, they say, because it is only "a few kilometers" thick, at most. San Andreas–like fractures visible in Galileo images also support the existence of liquid water not far below the surface, says Greenberg: "In our model, the ocean communicates with the surface very easily," with ocean water—and any indigenous life—rising through some cracks and being squeezed onto the surface and back into the ocean in the course of every Europan day (3.5 Earth days).

No one is yet ready to say that the Europan ocean can't readily communicate with the surface, but the "ultrathin" ice layer 1 to 2 kilometers thick that is the most optimistic interpretation of "a few kilometers" doesn't square with a new analysis based on Europan impact craters. In this issue (p. 1326), planetary scientists Elizabeth Turtle and Elisabetta Pierazzo, also of the University of Arizona but not part of the Greenberg group, studied the central peaks that form as material flows into the hole formed on the impact of a comet or asteroid. Europan ice, they reasoned, would not have formed central-peak craters if an object had totally vaporized or largely melted through the ice. Computer simulations of large impacts into varying thicknesses of ice suggested that the ice needed to be more than 3 to 4 kilometers thick to form central-peak craters on Europa. "That rules out the

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