

at the University of South Carolina, told the Senate Commerce Committee hearing that at least 10% of NNI funding is needed for developing methods to detect and characterize nanomaterials in the environment, standardize testing methodologies to assess the toxicity and biological uptake of nanomaterials, and assess human and ecological exposures from releases of nanomaterials.

### Highly reactive materials

Nanoparticles are worrisome because their size allows easy passage into and out of individual cells. Many nanomaterials are designed to be highly reactive, but their potential interactions with biological material are mostly unknown. Normally inert gold, for example, becomes highly reactive at the nanoscale, noted Kristen Kulinowski, executive director at the Center for Biological and Environmental Nanotechnology at Rice University. CBEN is one of six NSF-funded academic centers focusing exclusively on nanotechnology EHS research issues. NSF provides the largest share of EHS funding; the administration has requested \$30.6 million for FY 2009. The EPA is in store for a nearly 50% increase, to \$14.3 million, while NIST, which received less than \$1 million this year for EHS, is slated to receive \$12.8 million.

Briefing congressional staffers in April, Kulinowski said Congress should reconsider whether decisions on regulatory actions and risk assessments should continue to be based solely on the chemical compositions of nanomaterials, without regard to their size or structure. Most nanomaterials are subject to the Toxic Substances Control Act, which lists 75 000 regulated chemical substances. Charles Auer, director of the EPA's Office of Pollution Prevention and Toxics, told the staffers that most of the 35 new nanomaterials submitted to the EPA through "premanufacture notices" since 2005 have not displayed properties or behaviors that differ from their non-nano forms. Ten US chemical and materials manufacturers to date have committed under a stewardship program to voluntarily submit information to the EPA on nanomaterials they develop.

Computational models that can predict how nanoparticles will interact with organisms top a list of EHS research needs unveiled on 1 May by the International Council on Nanotechnology, a stakeholder group housed at Rice. The NSF-funded ICON study estimated that those models will require 10 years or more of R&D.

PEN, ICON, and others have warned that EHS issues need to be resolved if nanotechnology is to thrive and avoid a repeat of the public backlash that accompanied commercial introduction of genetically modified foods during the 1990s. With new ap-

plications appearing at the rate of three to four per week, Rejeski cautioned, "If government and industry do not work to build public confidence in nanotechnology, consumers may reach for the 'no-nano' label in the future."

David Kramer

## Ehrenfest letters surface

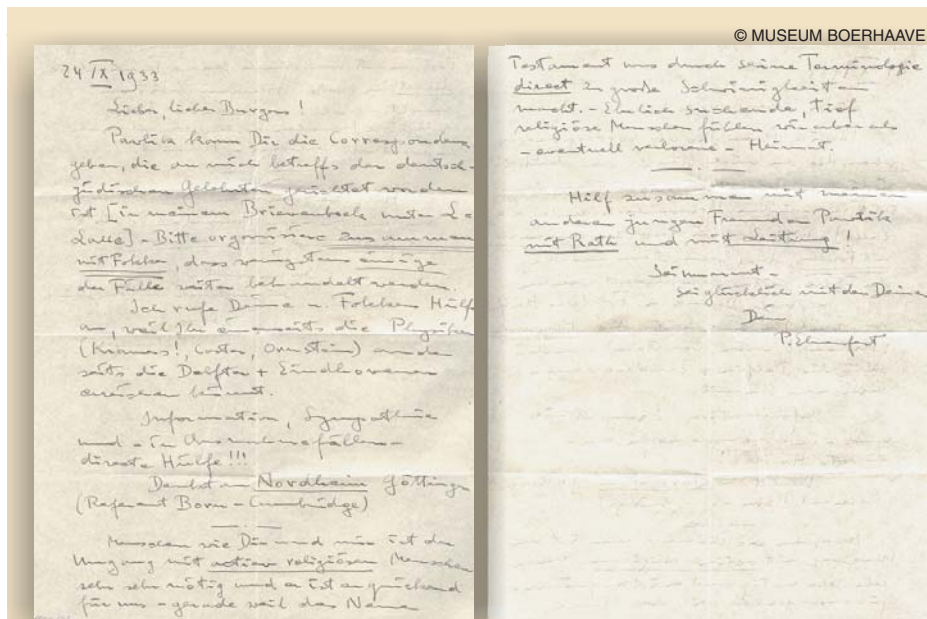
"And so it is that most likely in the coming school year, to finally free up my position in Leiden, the only way out left to me is to kill myself."

The Austrian-born theoretical physicist Paul Ehrenfest wrote that to some of his former PhD students on 15 August 1932, about a year before his suicide at age 53. In the letter, he tells them that "each of you has been, during some stretch of your life, something like my own child" and "I have you much more to thank than you realize. Your affection, your consistent wish to give me confidence in myself made it possible until just recently for me to maintain my enthusiasm. Forgive me that it is now over."

That letter is one of four given in 1992 to the Museum Boerhaave in Leiden, the Netherlands, by the descendants of Ehrenfest's first student, Johannes Burgers, who is perhaps best known for the eponymous equation for nonlinear diffusion. The letters went unnoticed until the museum's new director, Dirk van Delft, happened on them recently. "The most important one

is the last one in the set," says van Delft. "Very probably it was Ehrenfest's last letter. It was written on the 24th of September 1933. The next day he committed suicide."

One of the letters, dated 21 August 1918, is to Burgers's fiancée, Jeannette Roosenschoon. In it, Ehrenfest writes: "Maybe it's wrong, but you know that my wife and I are convinced that the key to a lasting marriage is common love for something other. Usually the others are the children, but for a man like Jan [Johannes] for whom intellectual work is so much a source of happiness, it is very, very good, in my view, if his wife is a true [*waschechte*] physicist." In that letter, he also mentions the birth of his son Vassily. On 21 October 1918, he tells Burgers—complete with sketches—how to label the envelopes with his dissertation in preparation for his defense. In the 1932 letter to his students he writes: "My belief in the absolute (unanalyzable) worth of the natural and mathematical sciences grows unabated! That I myself have completely lost contact to it, THAT is the



Paul Ehrenfest wrote this letter to his former student the day before committing suicide.

crux of my collapse, my 'surrender' [*Lebens-Muedigkeit*]." And he asks them to keep an eye on and mentor his older son: "From you in particular, I am not asking for any material support for the children. But I do ask you, through a loose organization of all of you, to promote especially Pawlik's healthy, strong development." (Pawlik became a cosmic-ray physicist and was later killed in an avalanche.)

In his final letter, Ehrenfest writes that Pawlik will give Burgers correspondence about Jewish German intellectuals, and he makes a request: "Please arrange, together with [Adriaan] Fokker, that at least some of the cases are handled." From the time Hitler came to power, explains Martin Klein, who wrote a biography of the first part of Ehrenfest's life, "Ehrenfest was very active in trying to rescue German Jews—in particular he used his influence to find jobs for physicists." Ehrenfest, who was Jewish, felt guilty about "occupying a principal chair in Europe and being unproductive, especially with all the Jewish physicists being dismissed from their jobs," Klein adds.

Ehrenfest wrote a letter similar to the one foreshadowing his suicide, but with a different tone, to Albert Einstein, Niels Bohr, Abram Ioffe, and other contemporaries, according to Klein, who refers to page 408 of Abraham Pais's book, *Niels Bohr's Times* (Oxford Clarendon Press, 1991). "I don't think [those letters] were sent," says Klein. "I can't imagine that if [they] had been sent, that there wouldn't have been a recorded and visible reaction from some if not all of the recipients." The group letter is the only typed one among the four newly found letters.

In autobiographical notes published posthumously last year by the J. M. Burgers Centre in the Netherlands and the University of Maryland at College Park, where Burgers was on the physics faculty, Burgers wrote,

Sometimes it looked . . . as if he [Ehrenfest] gave away everything he had found or observed, without building up a reserve, a kind of stronghold, within himself. . . . His analytical mind stirred up everything. . . . On the long run this pushed his students somewhat away from him and I have also experienced this effect. There were things which we did not like to have analyzed. It may look as if this betrays a lack of intellectual interest, but in several cases it was an instinctive protective reaction from our side.

About a 1918 meeting for physics

teachers that Ehrenfest arranged, Burgers wrote,

This meeting naturally gave him great pleasure, but what was strange to us was that he said it had given him more pleasure than the birth of his youngest child in that same year. . . . I spoke with [physicist Hendrik] Lorentz and asked him whether he could talk with Ehrenfest, and help him find a way back to feelings which looked more normal to us. . . . While we perceived that Ehrenfest's self-analysis could take dangerous forms and lead to utter despair, we could not help him.

Toni Feder

## Lockheed Martin seeds Rice center

Lockheed Martin Corp and Rice University announced in April the creation of a new center that will pursue applications of nanotechnology relevant to the advanced-technologies defense contractor. The Lockheed Martin Advanced Nanotechnology Center of Excellence at Rice University, or LANCER, will be based at the university's Richard E. Smalley Institute for Nanoscale Science and Technology and will initially be funded by the company at \$3 million over three years. "Areas we expect to explore include super-sensitive detection devices with space-based applications, fast communications systems, and greatly improved devices for energy generation and storage," says Lockheed Martin's director of advanced technology Sharon Smith.

The new center grew out of the relationships that formed between Rice researchers and Lockheed Martin engineers in a summer nanotechnology short course that the Smalley Institute has offered the company every year since 2005. "The folks in the labs are the ones who came to [their managers] and said, 'Make it easier for us to work together,'" says Smalley Institute director Wade Adams. "We have labs across Lockheed Martin," says Smith, "but one of the many benefits we see to participating in LANCER is access to some of the equipment we need for fundamental nanotechnology research."

Most of the LANCER seed money will go toward research that is of potential business value to Lockheed Martin, with little for overhead, says LANCER's inaugural director Daniel Mittleman, who hopes to attract funds

JEFF FITLOW/RICE UNIVERSITY



Daniel Mittleman will lead a Lockheed Martin-Rice University partnership to pursue nanotechnology applications in aerospace, security, and energy.

from other corporate investors and the federal government to continue the center after the third year.

Jermey N. A. Matthews

## From school board to state senate: Running for office

Ever considered running for the school board? City council? State legislature? Some 70 scientists and engineers attended a workshop last month to learn about campaigning for local office. The 10 May event was held at Georgetown University and was sponsored by 10 professional organizations, including the American Physical Society and the American Institute of Physics (AIP).

The idea, says APS associate executive officer Alan Chodos, "is to give

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A campaign flyer from one of chemist Jesse Jones's runs for the Texas House of Representatives.