"I think time will do the job," says Bologna expert Regine Bolter, a computer science professor at the University of Applied Sciences in Dornbirn, Austria. "The more students with new degrees that go into the workforce, the more accepted these new degrees will get."

Haug also predicts that the "core" countries, by which he means European Union members and candidates plus Norway, Switzerland, and Iceland, "will move faster and won't try to drag along everyone." So far, he says, the Bologna Process has been like "an aircraft without a pilot" and "there have been a huge number of very positive reforms and an equally impressive number of misconceived ones. I hope the second decade of the process will be better controlled." **Toni Feder**

Physicists invited to apply their insights to cancer

Can physicists help get cancer research out of a rut? That's what the National Cancer Institute is betting on with the roughly $150 million it's spending over five years on a network of 12 centers, each a multi-institutional, multidisciplinary collaboration led by a physical scientist. "We're taking cancer, turning it on its side, giving it to a new group of people, and seeing what happens when we combine what we already know with what they come up with," says Larry Nagahara, NCI program director for the Physical Sciences–Oncology Centers (PS–OCs). The centers got started last fall.

Cancer research hasn't seen a major paradigm shift in 30 or 40 years, according to William Grady, who studies signal deregulation and epigenetic modifications in gastrointestinal cancer at the Fred Hutchison Cancer Research Center in Seattle. "Most advances involve revisions and refinements. We do not have medical treatments that can cure [most cancers] despite decades of effort."

The idea behind the PS–OCs is to bring cancer research fresh perspectives, such as relating disease to the physical properties of cells. "What's new is thinking not only in terms of the chemical concentrations of signaling proteins, but also in terms of their spatial organization within the cell," says physicist Jan Liphardt, principal investigator of the PS–OC led by the University of California, Berkeley. Another example, he says, is that tumors are firmer than surrounding tissue. "What has not been known is whether this stiffening is a bystander, or if mechanical changes are intimately involved in cancer progression." To find out, researchers in Liphardt's PS–OC injected mouse breasts with cells engineered to crosslink collagen and then added cancer cells. They found that cancer grew faster in breasts that had been preconditioned to be stiff.

Robust methods for early cancer detection may be developed from tomographic imaging of single cells. These images show the nuclear surface (left) and a slice from the reconstructed isotropic three-dimensional image (right); DNA density increases from green to red. The images are formed with computed tomography, but whereas clinical CTs use an x-ray source and detector, here the source was white light and the detector a microscope equipped with a CCD camera. (Courtesy of Vivek Nandakumar, Laimonas Kelbauskas, Roger Johnson, Deirdre Meldrum, Center for Ecogenomics, Biodesign Institute, Tempe, AZ.)

One project at the MIT-based PS–OC involves "measuring the instantaneous growth rate of single cells at known points in the cell cycle," says Scott Manalis, whose team developed a resonator that can weigh single cells to femtogram resolution. "We can measure mass, density, and charge. There are many interesting clinical questions we can ask with this," he says, "such as, Can these physical properties of cells tell you how patients will respond to therapeutics?"

"The thing about cancer," says physicist Paul Davies, who heads up the PS–OC based at Arizona State University, "is that you are never going to solve the problem by details. You cannot micromanage. It always outmaneuvers you." The cell, Davies says, is so "stupendously complex we will never figure out on the level of individual interactions what to do. But we may not need to. If physical features turn out to trigger cancer, we don't need to know all the gory details."

The PS–OCs are not "another exercise in asking physicists to give oncologists another beam weapon," says Davies. "Physics has been used in cancer treatment—x rays, proton bombardment. What [NCI is] after here are insights from physicists to be brought to bear on cancer."

Says Princeton University physicist Robert Austin, "I am not convinced cancer is a disease. It's an inevitable part of evolution. We will never get rid of it. We need to learn to live with it. That is a different approach." Researchers have a "miserable track record of looking at cancer the wrong way," he adds. The collaborations he is involved with through the PS–OC he heads are a "shotgun marriage," he says. "It's stressful, but it's time to make the leap. Maybe we can make an impact on cancer fundamentals. To do that, I will have to dance with these other people."

The PS–OCs are special, Liphardt says, "because of how rare it is to have funding to do something really new, and just try things." The locations, principal investigators, and other information relating to the 12 centers can be found online at http://physics.cancer.gov.

Toni Feder

PCAST urges more coordination of nanotech R&D

The federal government should sharpen the focus of its nanotechnology environmental, health, and safety R&D program to address the specific questions that industry and regulatory agencies have as nanotechnologies are commercialized. That opinion is from a report released on 25 March from the President's Council of Advisors on Science and Technology. PCAST also recommends strengthening the interagency coordinating mechanism for the National Nanotechnology Initiative (NNI) by recruiting two new individuals, one to coordinate the EHS R&D efforts that are dispersed throughout the government and the other to oversee the development of standards, which are critical for many aspects of EHS and also for commercialization and testing of products.

The report finds that the 10-year-old NNI "has had a catalytic and substantial impact on the field of nanotechnology," said Maxine Savitz, cochair of the PCAST working group that performed the assessment. The US, she told reporters, continues to lead the world in nanotechnology by various metrics, including numbers of publications, citations, and patents, and the variety of products commercialized. But competition from other nations has risen "dramatically," she said, with the nanotechnology R&D programs in Europe and Asia growing much faster than those in the US. And in the past few years, China has overtaken the US in the number of nanotechnology-related patent filings, Savitz added. Already in 2005 PCAST had warned that the US was in danger of losing its lead in nanotechnology R&D (see PHYSICS TODAY, August 2005, page 28). For fiscal year 2010, 11 federal agencies have been allocated $1.8 billion for nanotechnology R&D, in addition to the $494 million in stimulus money from the American Recovery and Reinvestment Act.

President Obama has requested $1.8 billion for the NNI in his FY 2011 budget proposal, which for the first time proposes new line-item funding for the Food and Drug Administration and the Consumer Product Safety Commission to assess the health and safety of products that incorporate nanotechnology. The PCAST report also recommends that the manufacturing R&D component of the NNI be doubled to 6% of the total effort over five years, while stressing that those new resources not be taken from the NNI's basic research program.

The NNI EHS budget has grown from $35 million in 2005 to the $117 million proposed by Obama for FY 2011. Clayton Teague, director of the interagency National Nanotechnology Coordination Office, said the $250 million that the US has devoted to nanotech EHS R&D from 2005 through 2009 probably exceeds that of the rest of the world during that period.

But the PCAST working group said that the EHS research activities could be better linked to identify the plausible risks associated with the products of nanotechnology and to address the knowledge gaps and decision-making needs within government and industry. Ed Penhoet, the group's other cochair, said that further increasing funding for EHS R&D without improving that linkage "is not necessarily a wise thing to do." Penhoet said EHS R&D needs to be structured "in such a way that it answers the questions that are necessary for decision making by government and by industry." Teague said that an individual will be named soon to assume the EHS coordinating job.

The PCAST report also recommends an unspecified increase in federal support for "signature initiatives" that would apply nanotechnology to specific grand challenges, such as novel materials that can capture solar energy more efficiently. **David Kramer** ■

web watch

To suggest topics or sites for Web Watch, please visit http://www.physicstoday.org/suggestwebwatch.html. Compiled and edited by Charles Day

http://www.youtube.com/thenobelprize

The Nobel Foundation has recently launched a YouTube channel called **Ask a Nobel Laureate**. Viewers can upload videos of themselves posing a question to a Nobel laureate. After a few weeks, the laureate—currently Albert Fert, who shared the 2007 physics prize—can be viewed answering the questions.

http://www.langorigami.com/science/4osme/abstracts/077%20You2.pdf

Expandable Tubes with Negative Poisson's Ratio and Their Application in Medicine is a short description of a novel idea: folding a flat piece of material into a tube in such a way that the tube will fatten when stretched. Zhong You and Kaori Kuribayashi's summary not only explains how such tubes could be used as medical stents, it also shows how to make the tubes out of a sheet of paper.

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