



**REPORT CARD:** In the National Research Council's ranking of 5,000 U.S. doctoral programs, pharmacology-toxicology and physiology at DMS were among the top 10 such programs nationally and molecular and cellular biology was in the top 20.

For a **WEB EXTRA** with links to articles about McCollum's appointment and accomplishments as dean at DMS, see [dartmed.dartmouth.edu/w10/we05](http://dartmed.dartmouth.edu/w10/we05).

## Heartfelt remembrances of a modest Texan

Imagine a born-and-bred Texan without a hint of a swagger. A dean who eschewed the perks of the office while presiding over a period of enormous growth. A researcher so modest that many people didn't know about his significant scientific accomplishments. That's a start on conjuring up what made Dr. Robert McCollum tick.

**Dean:** The dean of Dartmouth Medical School from 1982 to 1990, McCollum died of heart failure on September 13 at his home in Etna, N.H. He was 85.

His obituary in the *New York Times* hailed his contributions to helping to isolate the polio virus in the early 1950s, distinguish serum hepatitis from infectious hepatitis, and identify the cause of infectious mononucleosis.



DMS Dean Emeritus Robert McCollum.

And his tenure as DMS's dean, after 12 years as chair of epidemiology and public health at Yale, was one of notable productivity: research income rose 377%; eight new endowed chairs were funded; and the agreement was forged to move DHMC to Lebanon, N.H.

But it was McCollum's personal qualities that were at the fore at an October 16 celebration of his life. Born in Waco, Texas, he graduated from Baylor, then earned an M.D. at Johns Hopkins and a doctorate in public health at the London School of Hygiene and Tropical Medicine. He is survived by his wife, Audrey; son, Douglas; and daughter, Cynthia, all of whom spoke at the October 16 event. They shared amusing anecdotes, including the fact that McCollum had a stash of much-wrinkled wrapping paper that he reused for years, so committed was he to the environment.

**Rung:** A number of colleagues and friends also spoke. "I remember when I was the lowest rung on the academic ladder—a brand new assistant professor," said Dr. David Nierenberg, now senior associate dean for medical education. "There was this . . . dean who would come up to me in the hall, know my face, know my name, and ask me in detail how things were going. . . . It just amazed me that a dean who had so much to worry about was actually concerned about a brand new rookie."

**O'Donnell also extolled McCollum's "infectious smile" and "integrity."**

Nierenberg also commented on McCollum's "wonderful, laconic, usually dry, sometimes ironic sense of humor."

Jane Hebb, who worked with McCollum in the bioepidemiology section after he stepped down as dean, offered an example: "He would always send us postcards of . . . creepy-looking insects" when he traveled, she said. So one year "a coworker made him a birthday cake and baked a big, black gummy rat in the cake to get even. How he laughed when he cut into the cake and found the rat."

**Listen:** Dr. Joseph O'Donnell, who has been involved with student affairs ever since McCollum tapped him for that duty, said, "What I remember most about Bob was his ability to listen, to hear diverse opinions—and to mold them into a whole. . . . Decisions were joint, with lots of input, honesty, and trust."

"I marvelled at Bob's humility, his complete disregard for the trappings of power," O'Donnell went on. "My enduring memory of him was ensconced in his little, unpretentious office with . . . piles of paper all around, writing thousands of hand-written notes to celebrate the achievements of others. . . . Bob reveled in the success of others."

O'Donnell also extolled McCollum's "infectious smile, . . . integrity, and genuineness," attributing to those qualities his "success at fund-raising . . . [donors] just loved him," he said.

Lots of people did, it's clear.  
DANA COOK GROSSMAN

## THEN & NOW

A reminder of the pace of change, and of timeless truths, from the 1980 DMS admissions brochure:

"A medical school's reputation is ultimately established by . . . [its graduates'] competence and compassion. . . . Dartmouth Medical School alumni are among the nation's most respected physicians and scientists, and their contributions to the . . . profession belie their small numbers. [DMS] now has 1,565 living alumni."



**4,505**

DMS alumni today, some of whom hold multiple degrees

**75%**

Percent who hold an M.D.

**10%**

Percent who hold a Ph.D. or M.S. in the sciences

**16%**

Percent who hold an M.P.H. or health-policy degree

For a **WEB EXTRA** with a slideshow featuring more photos of the meeting of the bone marrow donor and recipient, see [dartmed.dartmouth.edu/w10/we03](http://dartmed.dartmouth.edu/w10/we03).

**BRIGHT IDEAS:** Healthspottr.com (“we believe in the future of health care” is its mantra) recently named the top 100 health-care innovators in the United States. Three are from DMS: Drs. Jack Wennberg (#7), John Wasson (#14), and Elliott Fisher (#18).



## FARM-ACOLOGY INITIATIVE

Say “migrant farmworker” and most people think of picking lettuce in California, not milking cows in New England. But many area dairy farms can’t hire enough labor locally and so use migrant workers. Exact numbers are hard to come by, but there may be over 2,000 in Vermont and New Hampshire.

Something else that’s hard to come by, for the workers themselves, is health care. But thanks to two Dartmouth medical students, Karl Dietrich and Holly Schroeder, that’s changing.



With funding from an Albert Schweitzer Fellowship, they’re reaching out to workers on dairy farms throughout the Upper Valley. They’ve met with about 40 so far and expect to reach many more. They’re conducting health screenings and making sure workers are aware of the resources at Little Rivers Health Care, a Bradford, Vt.-based federally qualified health center.

“Most of the migrant workers we’ve met don’t know that 10 minutes away there is a federally qualified health center that will see them for free,” Dietrich and Schroeder explained in an e-mail. And, they added, the workers “are reluctant to do anything that takes them away from making the money they need to send home.” So they’re now tackling those problems, as well as creating a DMS interest group to sustain the effort. K.R.

## SIGNATURE OF THE TIMES

When Dr. Ira Byock asks a patient to sign an advance directive, sometimes the patient’s eyes will widen in surprise. “I’m not dying,” he often hears. But *everyone* should have an advance directive, Byock believes, not just those who are close to death. He has one, as do his wife and two adult daughters.



An advance directive is simply a document that takes effect if people are unable to make decisions about their own care as a result of injury or illness. It can state their individual preferences regarding the kinds of treatments they would want, such as whether they’d want CPR if they were terminally ill. Or the document can simply designate someone else to make those decisions.

Byock’s persistence is part of an effort to get every DHMC patient who undergoes a procedure requiring informed consent, as well as every employee, to sign an advance directive. The effort puts DHMC in the vanguard of a national trend. “Asking about an advance directive isn’t a hidden message that somebody is ill,” Byock says. “It’s a clear message that, at DHMC, we think this is part of giving the best care possible.” A.E.

## Men share marrow—and a love of baseball

Gerry Best and Kevin Ireland have been “blood brothers” for two years. But until a few months ago, they’d never met.

In fact, most bone marrow donors don’t meet the patient who benefits from their gift. But on a sunny Saturday in October, the two men and their

**Their meeting was shown during the game’s national broadcast.**

families met—at Fenway Park in Boston, just before a Red Sox-Yankees game. Best, who lives in Claremont, N.H., is a Sox fan, and Ireland, of Norwalk, Conn., roots for the Yankees.

The stage for the meeting was set in 2008, when doctors at Dartmouth’s Norris Cotton Cancer Center gave Best some of Ireland’s bone marrow; Best’s leukemia has been in remission ever since.

**Seats:** Their shared love of baseball emerged in the course of a phone-in radio interview after Best’s recovery. So with help from the Red Sox, the men and their families were treated to a pregame tour of Fenway and seats behind home plate. The meeting was even filmed by Fox Sports and shown during the game’s national broadcast. A poignant coincidence was noted by announcer Tim McCarver: it was Mike Lowell Day at Fenway, and the retiring Sox third-baseman is also a cancer survivor.

Over 137,000 people in the U.S. will be diag-

nosed with blood cancers in 2010—9% of all new cancer cases. Norris Cotton’s nationally recognized Bone Marrow Transplant Program offers all types of marrow and blood stem cell transplants on both an inpatient and outpatient basis.

Ireland says that meeting Best helped him fully grasp his donation’s impact. “There’s no feeling like it,” he says.

“He gave me my life,” Best responds. But some things haven’t changed. “I guess I’ve got Yankee blood in me now,” Best says, “but I’m still for the Red Sox.”

STEVEN P. BJERKLIE

CARLEEN GODFREY



“Blood brothers” (and baseball rivals) Gerry Best, left, and Kevin Ireland met at Fenway.



**IT'S A BIRD, IT'S A PLANE:** No, it's med student Mike Piccioli. The intellectual prowess he flexes in class is matched by his physical prowess. Piccioli pulled a 24-ton fire engine 75 feet in 29 seconds to become New Hampshire's Strongest Man.

For a **WEB EXTRA** with links to more photos of the new art installation, see [dartmed.dartmouth.edu/w10/we06](http://dartmed.dartmouth.edu/w10/we06).



## Kids plus paint equals exuberance

The grounds of Dartmouth-Hitchcock Medical Center got a little brighter this fall—and not just during the peak of autumn foliage season. A colorful new art installation, part of a project called Inside & Out, was placed in a grassy area near the East Patient Tower.

**Needs:** Suzannah Luft, a second-year medical student and a Schweitzer Fellow at DMS, conceived of the project while teaching children's art classes this past summer at the AVA Gallery in Lebanon, N.H.

"One of the empowering things about art is you can work with other people to make something really special," says Luft. She decided to help her students create colorful life-sized self-portraits to bring some cheer to an unadorned corner of the hospital grounds. Her eight students ranged in age from 7 to 13, and

all have some special need, such as autism, developmental delays, or a chronic disease.

**Pose:** Luft had each of the kids strike a pose—waving or doing a handstand—while she traced the pose onto cardboard. Then Jeffery Sass, a metal sculptor affiliated with the AVA Gallery, transferred the silhouettes to aluminum, which he cut and polished. Next, "the kids went wild with acrylic paint," Luft says.

Every step the students took was a learning experience. "I really believe that art is essential for your soul," says Luft. Even mixing paint—discovering that red plus blue makes purple—was an opportunity for language interaction, she says.

Once the silhouettes were complete, it was time to install them in a permanent location. Luft knew just the place. Volunteering at DHMC last year, she

had noticed that several inpatient rooms in the East Patient Tower looked out on a weather-stained concrete wall. "It was so dismal," she says.

No longer. Patients in those rooms now look out at a crowd of colorful silhouettes. To top it off, Luft says, "the hospital painted that wall light blue so it looks like they're dancing against the sky."

The project is the first art piece created for Inside & Out, a collaborative public art project.

In 2008, the New England Foundation for the Arts awarded DHMC and the AVA Gallery a \$10,000 grant to develop a comprehensive, collaborative art plan for the DHMC campus. "We wanted to identify places and projects where we could collaborate with the community," explains Elisabeth Gordon, coordinator of the DHMC Arts Program. "This was the first of those projects."

Gordon is now trying to secure funding to add more artworks to Inside & Out. In the meantime, she's thrilled that the first installation has been such a hit. "I've gotten a lot of good feedback from patients and staff," she says.

**Gaze:** Luft, too, is delighted to have made a difference, both for her special-needs art students and for the patients who can now gaze at the result from their hospital room windows. "I really believe that art is essential for your soul and your spirit and your mental health," she says.

KIRSTEN WEIR

## THEN & NOW

A reminder of the pace of change, and of timeless truths, from the 1970 MHMH-DHMC annual review:

"In the spring of 1953, we moved into a shiny new, modern, gem-of-a-place with the latest equipment and the delight of air-conditioning. Imagine being gowned, rubber-gloved, masked, and having your hair covered throughout a six-hour operation on a hot, humid August day, and you can truly appreciate what a tremendous advance . . . came about with air-conditioned operating rooms!"



12

Operating rooms in 1970

1991

Year the Lebanon DHMC opened, with 16 ORs and an eco-friendly AC system

31

Operating rooms today



MARK WASHBURN

These boldly colored metal figures—newly installed on the DHMC grounds, within view of a number of inpatient rooms—were the work of a group of art students with special needs, led by a second-year medical student. There are eight figures in all.

**EXTRA! EXTRA!: On November 8, Dartmouth rated what may be the 2010 version of a banner headline: a Google home-page link. The browser's tribute to the x-ray linked to a Wikipedia entry citing Dartmouth as the site, in 1896, of the first medical x-ray in the U.S.**

## Mirza knew in his bones that DH was a good fit

**D**r. Sohail Mirza's recruitment to Dartmouth-Hitchcock began with a three-word e-mail: "Can we talk?" That was all Dr. James Weinstein, then chair of orthopaedics, wrote. Weinstein knew about Mirza's research in spine surgery outcomes and liked his approach to medicine. He'd also been a scientific reviewer for several of Mirza's National Institutes of Health grants. And, as editor of the journal *Spine*, Weinstein had published several of Mirza's papers.

Likewise, Mirza knew a lot about Weinstein. The leader of the \$15-million Spine Patient Outcomes Research Trial, the nation's largest study of back pain, "Weinstein is the leading figure in changing orthopaedics," says Mirza. So when he got that brief e-mail, his first thought was "What trouble did I get into?"

**Spine:** Mirza soon learned that Weinstein was looking for someone to replace himself when he stepped down as chair to make more time for his role as director of the Dartmouth Institute for Health Policy and Clinical Practice. But Mirza, who specializes in cancer of the spine, was happy at the University of Washington, where he had trained and been on the faculty for 19 years. He had little desire to uproot his practice, his research, and his family for a position in rural New Hampshire.

That changed when he visited Dartmouth and attended the orthopaedics department's weekly meeting. "The entire faculty in orthopaedics and all of the

residents were in the room," recalls Mirza, and they were "talking about clinical cases and asking big questions. What is the right treatment here? Does the patient know all the choices? I hadn't seen that [before]."

**Lots:** He found the emphasis on delivering the right care, not just on increasing clinical production, "very refreshing." Lots of institutions talk about patient-centered care, says Mirza, "but the way it was actually lived out in this institution was inspiring for me." So he joined the department in 2008 and became its chair in 2010.

Mirza wants to build on the foundation Weinstein left and do no less than "change the world of orthopaedics for the better," he says. That means measuring outcomes for every procedure, making sure all patients are informed about their

choices, and developing systems that incorporate those practices efficiently and routinely.

"Nobody has been able to do that," says Mirza. "The general assumption is that you can't do all these things and still run a busy practice that is successful as a business. . . . Our challenge is to show how it can be done."

Mirza is also working with neurology, radiation oncology, and palliative care to build an interdisciplinary spine cancer program—a service lacking in the region, he says, and thus "a huge opportunity." Another "huge opportunity" he sees is working under the leadership of Weinstein, who is now also co-president of DH; Dr. Wiley Souba, the new dean of DMS; and Dr. Jim Yong Kim, the president of Dartmouth College.

"I wouldn't have considered [moving] to any other place," says Mirza. "Only Dartmouth."

JENNIFER DURGIN

**The emphasis on delivering the right care was "very refreshing."**



**Sohail Mirza, intent here in the OR, is also intent on his new role as chair of ortho.**

## Union between Uruguay and the Upper Valley passes 10-year mark

**M**edicine no longer recognizes national boundaries," says Dr. David Roberts, a DHMC neurosurgeon. "We are all part of the same global effort." Perhaps no one at Dartmouth-Hitchcock embraced that philosophy more enthusiastically than the late Dr. Peter Williamson, a longtime professor of neurology. He traveled the world helping to treat patients and train clinicians.

**Field:** On a visit in 2000 to Montevideo, Uruguay, Williamson found a group of surgeons poised but not equipped to improve their diagnosis and treatment of epilepsy—a field in which Williamson was an international leader. Uruguay had excellent residency programs in neurology and neurosurgery but needed more sophisticated instrumentation and training in the latest techniques.

Mark Natola, DHMC's manager of neurodiagnostics, was a member of the first team to visit Uruguay, in 2001. His challenge? To make American equipment compatible with foreign electrical circuits and computer networks. On that trip, the team brought monitoring instruments and taught Uruguayan clinicians the fundamentals of developing an epilepsy program; they also identified six patients who could benefit from surgery.

Another DHMC team, including Roberts, Williamson, and Natola, returned in 2002. Working with Uruguayan neurosur-

For a **WEB EXTRA** with a link to a video of Francis Collins's talk at DHMC, see [dartmed.dartmouth.edu/w10/we08](http://dartmed.dartmouth.edu/w10/we08).

**GIVE ME FIVE:** Dr. Francis Collins, the director of the National Institutes of Health, gave the inaugural C. Everett Koop Lecture at DHMC in November. He called Koop an "icon" and listed five areas of biomedical research he thinks are ripe with opportunity.



## Chair provides inspiration for lung research

In July, Dartmouth physiologist Bruce Stanton, Ph.D., received an honor that recognized his past accomplishments and that will also facilitate future advances. He was appointed to the Andrew C. Vail Memorial Professorship, which was established in 1973 by Mary McGaw in memory of her grandson.

**Model:** Stanton arrived at DMS in 1984 from Yale, where he earned his Ph.D. His scientific contributions over the past 25 years include helping to develop a much better understanding of cystic fibrosis (CF), a genetic disease that affects about 30,000 Americans. The disease causes a build-up of mucus in the lungs, leading to chronic infections and premature death. In recent years, Stanton has collaborated with other DMS researchers to develop a new model of the human lung in which to study the bacteria that infect people who have CF. The

team has found that the combination of an antibiotic and a drug that binds to iron is effective in eradicating bacteria in the model. Stanton is now working with the pharmaceutical industry to conduct clinical trials using this combination, and he is optimistic that it could eventually lead to improved treatments for CF patients.

Also the director of Dartmouth's Lung Biology Center, a National Institutes of Health-funded Center of Biomedical Research Excellence, Stanton has helped bring together researchers from a number of fields to study chronic lung diseases—such as CF and lung cancer—which affect about 25 million Americans. A dedicated educator as well, Stanton has taught classes for medical students, mentored future scientists in his lab, and written physiology textbooks.

**Team:** He appreciates the honor but says his work is possible only with help from many others. "Although I am the recipient of the chair, the chair was awarded based on research by a very talented team of collaborators in my laboratory and in the laboratories of many colleagues at Dartmouth," he says. "So the recognition is for all of us."

And, he adds, the chair provides not only practical support in the form of funding, but intangible support in the form of inspiration and invigoration.

AMOS ESTY



ION GILBERT FOX

**Pulmonary physiologist Bruce Stanton has been named to an endowed chair.**

## F A C T S & F I G U R E S

### Teachable moment

6,000

Approximate number of hospitals in the United States

400

Approximate number of them that are major teaching hospitals

6%

Percentage of U.S. hospitals that are major teaching hospitals



But that 6% share (which includes DHMC) provides much of the nation's specialized and charity care, including:

62%

of the nation's pediatric ICUs

(DHMC opened a dedicated pediatric ICU in 1999)

61%

of the nation's Level I regional trauma centers

(DHMC is one of only 30 institutions with Level I Pediatric designation)

50%

of surgical transplant services

(DHMC opened a solid organ transplant service in 1992)

40%

of the nation's neonatal ICUs

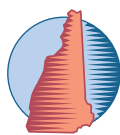
(DHMC opened a neonatal ICU in 1972)

41%

of charity care

(Dartmouth-Hitchcock extended \$22.3 million in financial assistance to 17,898 patients in fiscal year 2009)

SOURCES: AMERICAN HOSPITAL ASSOCIATION, ASSOCIATION OF AMERICAN MEDICAL COLLEGES, AMERICAN COLLEGE OF SURGEONS, DARTMOUTH-HITCHCOCK MEDICAL CENTER



**TAKEN FOR GRANITE: DMS and the University of New Hampshire are the lead institutions on a \$15.5-million federal grant to bring research opportunities to students and faculty members at eight undergraduate schools throughout the Granite State.**

## A \$4-million “ah-ha moment” in the OR

New bureaucratic procedures are never popular, especially among surgeons, who have a reputation for autonomy. Yet a process for bringing new products into DHMC’s operating rooms (ORs) has gained the support of surgeons and holds the promise of saving \$4 million a year for Dartmouth-Hitchcock. The process was devised in part by a team of students from Dartmouth’s Tuck School of Business, including two students in the M.D.-M.B.A. program.

**Afford:** “I know a lot of us are very independent sorts and resent people telling us what to do,” says Dr. John Nutting, an orthopaedic surgeon at DHMC. But, he explains, hospitals can no longer afford the luxury of surgeons saying, “Get it in here because I want it.”

Under the new protocol, surgeons must complete a product request and cost analysis form any time they wish to begin using a new product in the OR that is not already on the hospital’s formulary—such as a specific tool, piece of equipment, device, or implant. A committee reviews the request, meets with the surgeon, and either approves the new product request or denies it. The protocol was built based on recommendations from the Tuck team, led by Kenton Allen, a DMS ’11. The committee meets bimonthly, but surgeons can also get quick, one-time approval for a product in emergency situations.

So far the committee hasn’t had to say “no” to any requests,

says Dr. Giridhar Venkatramen, an otolaryngologist who serves on the committee and advised the Tuck team on the project. Venkatramen, who himself has an M.B.A., has also worked as a business consultant. Surgeons often have what he calls “this ‘ah-ha’ moment” once they do the cost analysis. “Just going through the process educates the surgeons about the cost of what they are doing,” he says.

It’s important to get surgeons thinking about costs because every year, more and more new and expensive products are developed and marketed to surgeons. These products can represent a disproportionate share of total OR costs. For example, in 2009 at DHMC, implants that made up only 14% of total usage accounted for 26% of implant costs in Nutting’s specialty, shoulder surgery. (Implants can be as simple as a screw or as complicated as an artificial joint.)

**Devices:** Having so many different and often duplicative products in the operating rooms is not only expensive but also inefficient. Nutting and a fellow shoulder surgeon, Dr. John Bell, identified this problem several years ago when they realized that they each used different

equipment and devices to perform the same procedures.

“I’m an old guy,” says Nutting, “so I had been using certain equipment for a lot of years.” Bell, who had just completed his training, used different equipment. So the two decided to observe one another in the OR and learn how to use the equipment and devices that the other preferred. They then settled on one standard inventory that would meet both their needs.

They also had the DH purchasing department solicit bids from vendors to become the primary supplier for the shoulder surgery service. Over the next two years, from 2007 to 2009, those efforts shaved 23% off the total cost of implants for shoulder surgery alone.

Allen and his team studied

what Nutting and Bell had done and used that information as the basis for designing the new protocol. They also used the 23% savings to calculate the total potential savings—\$4.6 million per year—if DHMC implements the changes Nutting and Bell made across all surgical specialties. That would be “a real success,” says Allen.

**Process:** The Tuck students’ biggest contribution, says Nutting, was in defining and refining the process that he and Bell had devised. “I had the sense that things were better, but it hadn’t been quantified,” he explains. “There is a better process in place now.”

The new process may be “cumbersome,” he admits, and surgeons may “gripe and moan . . . but the reality is, in the long run, we’re going to be better off.”

JENNIFER DURGIN

**“Just going through the process educates the surgeons” about costs.**

JUNIPER TRAILS



**M.D.-M.B.A. student Kenton Allen, right, confers outside the OR with surgeon John Nutting.**

**DIE-CAST:** *The Dartmouth Atlas* reported that between 2003 and 2007, nearly a third of patients with advanced cancer died in hospitals and ICUs. The rate of hospital deaths ranged from 47% in Manhattan to 7% in Mason City, Iowa.



**New on the bookshelf:  
Recent releases by  
DMS faculty authors**

*The Human Brain: Prenatal Development and Structure.* By **Miguel Marín-Padilla**, M.D., professor of pathology emeritus. Springer, 2010.

*Positive Spirituality in Health Care: Nine Practical Approaches to Pursuing Wholeness for Clinicians, Patients, and Health Care Organizations.* By **Frederic Craigie**, Ph.D., associate professor of community and family medicine. Mill City Press, 2010.

*Handbook for Rural Health Care Ethics: A Practical Guide for Professionals.* Edited by **William Nelson**, M.D., associate professor of psychiatry. University Press of New England, 2010.

*Tracking Medicine: A Researcher's Quest to Understand Health Care.* By **John Wennberg**, M.D., professor of community and family medicine. Oxford University Press, 2010.

*Hunger: The Biology and Politics of Starvation.* By **John Butterly**, M.D., associate professor of medicine; and **Jack Shepherd**, Ph.D., professor of environmental studies at Dartmouth College. University Press of New England, 2010.

To have a book considered for inclusion in "New on the Bookshelf," send its particulars to [DartMed@Dartmouth.edu](mailto:DartMed@Dartmouth.edu).

**Nanotechnology: Wee, wee work, all done at home**

This past fall, the National Cancer Institute named Dartmouth a Center of Cancer Nanotechnology Excellence (CCNE)—one of only nine such centers in the nation. Along with the prestigious title came a \$12.8-million grant to fund the center for five years.

Cancer nanotechnology is a promising approach in which a magnetic field is used to heat minuscule nanoparticles that then destroy tumors. To move this concept from lab to clinic, the Dartmouth CCNE is drawing on experts from the Thayer School of Engineering, the Norris Cotton Cancer Center, and Dartmouth Medical School.

In fact, Dartmouth's grant application "had a really interesting and unique mix of clinicians, cancer biologists, and engineers," explains Jack Hoopes, D.V.M., Ph.D., who headed a nanotechnology working group for the past few years. "I think our advantage was that all of the investigators came from Dartmouth." That's unusual for big grants like the CCNEs, he says.

**Cell:** "We had materials scientists who understand particles who had never known much about a cell," Hoopes adds. "We had biologists who understood cancer cells and clinicians who saw the big picture of what would fit into patients. We could really do the whole thing at Dartmouth."

For now, the Dartmouth CCNE is focusing on breast

and ovarian cancers in particular. To that end, the researchers are undertaking to design new and better nanoparticles; to better understand how the nanoparticles bind to tumors and behave in the body; and, ultimately, to eliminate breast and ovarian tumors.

**Patent:** The first step is to design appropriate nanoparticles, says Ian Baker, Ph.D., director of the CCNE. His team is leading a project to do just that. They already have a patent pending, he says, for one new nanoparticle design.

The next challenge is to get the nanoparticles into the tumors. In cases where a tumor lies close to the surface—such as esophageal cancer, for instance—nanoparticles could be injected directly into the tumor. But for deep-seated cancers, delivering the particles will require a backdoor approach. Dartmouth CCNE researchers are designing

antibody tags to attach to the surface of the nanoparticles. Once tagged, Baker says, "The nanoparticles can be injected into the bloodstream and picked up by receptors on the surface of the tumors."

Once the nanoparticles are concentrated in the cancerous tissue, a magnetic field is applied. The field heats the minute particles, destroying or weakening the tumor. This hyperthermia technique is likely to be used in conjunction with chemotherapy or radiation therapy, Baker

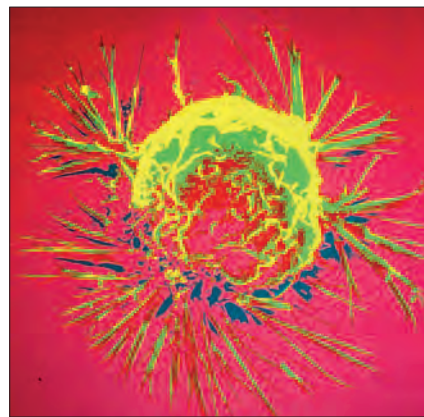
says. "The hyperthermia sensitizes a tumor to subsequent therapies," he explains.

So far, the CCNE research is all preclinical, says Keith Paulsen, Ph.D., deputy director of the center. That's by design. Under National Cancer Institute (NCI) guidelines, the CCNE grant cannot be used to fund clinical trials.

**Trials:** Nevertheless, the Dartmouth work is advancing quickly. Paulsen suspects clinical trials will start within the center's five-year lifetime, though they won't be funded directly by the NCI grant. "A lot of this is already occurring in animals and it's not a big stretch to push this into patients," he says.

Both Baker and Paulsen attribute the promising pace to the collaborative nature of the project. "The group challenges each other in a very positive way," says Paulsen. "I think it's going to be very productive."

KIRSTEN WEIR



This micrograph of a breast cancer cell is representative of the target of the nanotechnology group.