THEN & NOW

A reminder of the pace of change, and of timeless truths, from the 1944-45 DMS course bulletin:

The course in Immunology and Epidemiology covered "the topics of immunization, vaccines, antisera, tuberculosis and venereal disease diagnosis and control, water supply protection and purification, sewage disposal, milk supply, dairy inspection, pasteurization, food handling, restaurant and swimming pool sanitation, occupational diseases, general epidemiology, and the relation of the physician in general practice to preventive medicine and public health."

$450

Annual tuition in 1944-45, compared to $34,498 in 2005-06

23

First-year students in 1944, compared to 82 in 2005

Separating the real from the realistic

If you've ever seen a tabloid at the supermarket and been astonished by an image of an unlikely celebrity couple, you've probably been fooled by a phony photograph.

People have been falsifying photographs for decades with dodgy darkroom techniques. But nowadays, most photos are digital, and computers make it even easier to manipulate them in ways that are undetectable to the human eye. When an image is faked for a tabloid, the consequences are rarely more serious than embarrassment. It's much more significant, however, when a scientific image is called into question.

Doctored: But Dartmouth computer scientist Hany Farid has developed algorithms—mathematical equations—that enable computer programs to spot doctored images.

Farid plays forger and tampers with images, then develops algorithms to quantify the changes. In an altered image, he explains, "some underlying mathematical and statistical properties" have been disturbed and are not consistent with the pixel patterns in an original image.

An associate professor of computer science, Farid was recently named a Guggenheim Fellow and has received funding from the FBI for his work in digital forensics.

Bogus images are more likely to be found in tabloids and advertisements, but they've turned up in scientific journals, too. Hwang Woo-Suk, a South Korean stem-cell researcher, made headlines last November when it was discovered that two of his papers in *Science* had contained fabricated data and doctored images. Until then, Hwang had been considered a pioneer in studying stem cells—unspecialized cells that are able to differentiate into any cell in the body and that hold promise for curing diseases such as Alzheimer's and Parkinson's.

Science has since begun applying an image-screening test to submitted materials, and other journals are doing the same. The *Journal of Cell Biology*, which has been using a test it developed in 2002, has found that "25 percent of all accepted manuscripts have had one or more illustrations that were manipulated in ways that violate the journal's guidelines" according to the *New York Times*.

Blatant: However, points out Farid, scientists are more likely to use digital manipulation to "clean up" images than to commit blatant fraud.

Today, many medical images are taken digitally as well—such as MRIs, CAT scans, and x-rays. But Dr. Peter Spiegel, chair of DHMC's Department of Diagnostic Radiology, says there are many layers of protection in place at most medical centers. At DHMC, he explains, each radiologist is given an individual, confidential access code to the image database. And every image is archived in triplicate—both on-site and off-site locally, as well as in a remote location elsewhere in the country. "I suppose it's theoretically possible to hack into the system, but I don't see that as a risk," says Spiegel. "I don't know of any instance where it's ever happened or come to light that somebody manipulated an image."

JOSEPH MEHLING

Dartmouth computer scientist Hany Farid is a national leader in the development of ways to detect whether a digital image has been tampered with.

Farid—who frequently testifies in cases involving suspected tampering of digital images, but usually not scientific ones—says one way to guard against fraud is to insert an imperceptible watermark in an image. "If you manipulate the image, you disturb that 'signature,'" he explains, leaving a trail of tampering for forensic analysts to find.

In addition, Farid's team is continuing to develop new algorithms. "There is no single algorithm for detecting forgery," he says. "There are a lot of different ways to create forgeries, and you need at least as many different ways to detect them." And canny mathematicians like Farid on the case.

LAURA EVANCICH

A GOOD TELLING OF A GOOD STORY: Vermont Public Radio reporter Susan Keese won an Edward R. Murrow Award for a report in 2005 on the memorial service that Dartmouth medical students hold for their anatomy-class cadavers.

Gifts totaling $7 million will go to palliative care

The last months, weeks, and minutes of one's life do not have to be filled with loneliness, fear, and pain: this is the promise of palliative care. But fulfilling that promise takes coordination, time, and resources: this is the challenge of palliative care.

Now, thanks to two recent gifts totaling $7 million from the Jack and Dorothy Byrne family, meeting those challenges at DHMC will be a little easier. The Byrnes, of Etna, N.H., have committed $5 million to establish an endowed chair in palliative medicine and $2 million for the ongoing work of DHMC's Palliative Care Program.

"At one time," says Dr. Ira Byock, director of palliative care, "academic medical centers and the clinicians who work within them were sheltered from the pressures of time and revenue generation that clinicians in private practice experience. But in today's world, the pressures of time and money are impinging on all of us.

"A five-minute procedure in the emergency department, for instance," says Byock, "is better compensated than hours I might spend at the bedside of a seriously ill patient with his or her family. And so philanthropy is very important in allowing us to practice and teach the state of the art in palliative care."

The multidisciplinary palliative care team at DHMC works to address the social, emotional, spiritual, and physical needs of patients who are critically ill. The Byrnes' gifts are helping the team expand both its staff and the services they offer. One new service is the No One Alone program, in which trained volunteers "sit with patients in the hospital," explains Byock, "to alleviate the sense of loneliness and boredom and sometimes anxiety that people feel during the very long hours" near the end of their lives.

Alone: Such loneliness is what first inspired Dorothy Byrne's interest in palliative medicine. About 20 years ago, her son was being treated for cancer at a hospital in New York and she noticed that some patients had neither family members nor friends at their bedside. "That was my induction into seeing a lot of people having to battle their disease alone," says Byrne. Over the years, she and her family have become more and more involved in supporting palliative care at DHMC. They decided to establish the endowed chair after meeting with Byock last summer.

"His reputation of course preceded him," says Byrne of Byock. Still, "I was impressed when I met him." Byock has been a hospice physician for more than 20 years and is a leader in the field. He was recruited to Dartmouth in 2003, and since then the Palliative Care Program has flourished. Staffed 24 hours a day, seven days a week, it logged 2,178 inpatient visits and 912 outpatient visits in 2005—increases since 2003 of 345% and 57%, respectively.

Cause: Dorothy Byrne recognizes the importance of having "someone as motivated and dynamic as Ira" leading the effort. Establishing an endowed chair "makes a powerful statement that we're devoted to the cause," she adds. She believes Byock's presence and her family's ongoing support will also enhance Dartmouth's ability "to recruit [other] talented people, [if] they know there is such a powerful thrust behind this cause."

"I had a number of opportunities [elsewhere] to practice and build a palliative care program," Byock admits. But "as I traveled and interviewed and spent time in various medical centers, I was struck by how ready and ripe Dartmouth seemed to transform health care. . . . Now, having been here for over two and a half years," he adds, "I can tell you that nothing has diminished my confidence that we can change the world, right here."

A WEB EXCLUSIVE Q&A with Byock is at **dartmed.dartmouth.edu/summer06/html/vs_gift_we.php**.

JENNIFER DURGIN

MARK WASHBURN

Byock's palliative medicine program will benefit from two recent gifts.

THEN & NOW

A reminder of the pace of change, and of timeless truths, from a 1952 booklet marking the opening of the Faulkner House addition to the old Mary Hitchcock Memorial Hospital:

Faulkner House was heralded as the "most significant single development in the history of the Hospital." In 1945, with occupancy at 95%, "all departments [had been] operating under serious handicaps of space." But Faulkner made "the facilities . . . entirely adequate for offering the best possible hospital service."

$3 million

Cost of Faulkner House, compared to $220 million for the 1999-2006 Project for Progress (PfP) expansion

113,000

Square feet of new space in Faulkner House, compared to 467,000 in PfP; for more on PfP, see **dartmed.dartmouth.edu/spring06/html/healing_place.php**

HEART-SMARTS: High school biology students from Hanover, N.H., and Hartford, Vt., got a chance in May to use a defibrillator in a cardiac simulation lab, to feel a real pig's heart, and to hear a presentation by Dr. Alan Kono, a DHMC heart-failure specialist.

THEN & NOW

A reminder of the pace of change, and of timeless truths, from a 1987 issue of this magazine:

Six years after AIDS was identified, the first mention of the disease appeared in these pages: "An education supplement in the *New York Times* . . . hailed Dartmouth's leadership in educating students about AIDS. 'Some students think they are invulnerable,' [a DMS faculty member told the *Times*]. . . . Though criticized in some quarters, . . . Dartmouth's program is at the forefront of higher education's response to AIDS, according to the executive director of the American College Health Association."

4,000+

Number of occurrences today on Dartmouth websites of the term "AIDS"; for more about AIDS, see page 36 in this issue

Initiatives show that the devil is in the details

Sometimes the best way to improve health care is not by prescribing fancy drugs or buying expensive equipment, but simply by paying attention to details. That seems to be the bottom line of two successful infection-reduction efforts at DHMC and of another that's under way.

In 2003, Melissa Bennett, nurse leader of DHMC's hematology-oncology special care unit (HSCU), set out to reduce infections among bone-marrow transplant (BMT) patients. She and her colleagues had noticed that a lot of BMT patients had to have their central lines removed because of infections. A central line is a catheter placed in a large vein, usually in the chest, instead of in a peripheral artery, such as in the arm.

"For this patient population," says Bennett, "it is a huge [problem] not to have a central line because we give them high-dose chemotherapy through it, blood products, antibiotics, all sorts of things, along with the actual stem-cell reinfusion."

Lines: Bennett found that 60% of BMT patients had to have their lines taken out. This translated into 17 bloodstream infections for every 1,000 catheter-days. Though they could find no national benchmarks for central-line infections in BMT patients, Bennett and her colleagues in the HSCU and interventional radiology—where the lines are inserted—agreed that they could do better.

Over the next two years, with the support of a quality improvement grant through DHMC, Bennett and fellow nurses Judy Ptak and Debra Hastings examined every aspect of central-line implantation and maintenance. They found that often patients weren't getting the right kind of line because of miscommunication between the unit and interventional radiology. So they created a standard ordering system with common language.

They felt that dressing and maintenance procedures could be improved, too, so they designed a new protocol and trained staff in it. They also added an antimicrobial dressing that costs a mere $7.

These interventions were neither high-tech nor expensive, but they were extremely effective. "The goal," explains Bennett, "was to get our catheter-related bloodstream infection rate less than 10" per 1,000 catheter-days. In fact, there has been just one in a year and a half.

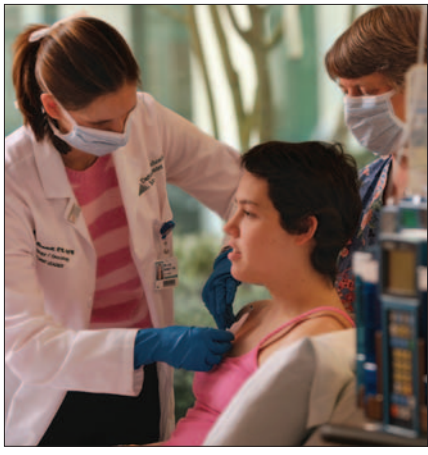
Word of the HSCU improvement project spread quickly throughout DHMC and inspired other units to take similar action. While Bennett's project was gaining momentum, physicians and nurses in the intensive care nursery (ICN) began working to reduce catheter-related bloodstream infections in their unit. They focused on such basics as regular and thorough hand-washing among staff and patients' families, encouraging breast feeding (which strengthens babies' immune systems), reducing the number of intravenous connections on a central line, and, whenever possible, shortening the length of time a line remains in.

The ICN gauged success by the number of consecutive days without a single infection in babies weighing less than three pounds or born more than 10 weeks early.

Run: "Previously, the average [run] had been around 10 to 15 days," says Dr. William Edwards, ICN section chief. "When we started the project, after the first few months, we began to see runs that were up in the 30 to 40 days. Then between May and mid-December [2005], we had a run of over 200 consecutive days without an infection in this group of babies." The ICN's goal was to halve the infection rate for this group, but they far exceeded the goal, reducing the rate from 40% to 6% (for more on ICN quality improvements, see the feature starting on page 28).

Another bloodstream infection reduction initiative is now

MARK WASHBURN



Melissa Bennett, left, applies an antimicrobial dressing to transplant patient Erica Miller. Simple steps like this have dramatically cut central line infections.

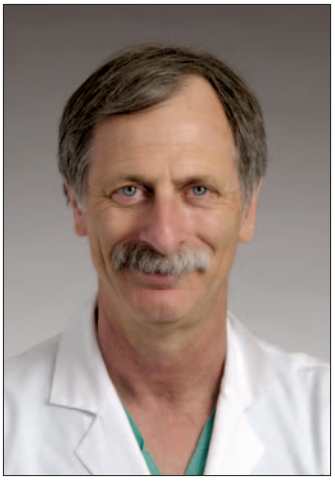
Ensuring that we're ready for the big one

Natural disasters, disease outbreaks, hazardous material spills, and terrorist attacks: they're the stuff of news shows and scary movies for most of us, but they're everyday concerns for Dr. Robert Gougelet.

All over New Hampshire, Vermont, and Maine, medical strike teams are preparing to respond to such events. These teams are part of the Northern New England Metropolitan Medical Response System (NNE MMRS), which is headed by Gougelet, an emergency preparedness expert as well as a DHMC emergency physician.

Disaster: Gougelet is a veteran of many medical relief efforts. In addition to his role with the NNE MMRS, he's also a supervisory physician for a Boston-based disaster medical assistance team that has traveled all over the world, including to New Orleans in the wake of Hurricane Katrina in 2005 and to Bam, Iran, after a devastating earthquake there in 2004.

MARK WASHBURN



Gougelet tends to individual patients in DHMC's ER and to the populace of the region as head of a preparedness team.

If, or when, a disaster ever strikes northern New England, volunteers trained by the NNE MMRS would rush to the scene to provide care for up to 48 hours, until state and federal authorities arrive. MMRS members are currently recruiting and training doctors, nurses, medics, and other personnel to staff three 115- to 130-member teams—one for each state.

In case of a mass casualty, at least 35 people would be deployed. Volunteers from the affected state would respond first, and those from the other states would be sent in as needed.

In addition, the NNE MMRS is gathering medical supplies and equipment that will be stored strategically in each state so they can be deployed quickly in an emergency. The medications will include, for example, drugs to treat 1,000 victims of a hazardous material spill or 10,000 victims of an infectious disease outbreak. The team is also identifying facilities that can be converted into care sites—such as auditoriums, conference centers, armories, and schools—in the event that hospitals are unable to handle the patient load or have to be evacuated.

Scarce: The NNE MMRS is the nation's only multi-state MMRS, as well as the only one that serves a primarily rural region, where emergency personnel can be scarce. "It's difficult in rural states, where there's not enough personnel on a day-to-day basis" in fire, health, and safety departments, Gougelet explains. The tri-state MMRS "is a way to maximize our resources efficiently."

Targets: The region presents other challenges, too. It includes not only an international border, but also a busy seacoast. Furthermore, it is near Boston and other densely populated urban areas that are potential targets for terrorist attacks.

The MMRS system, founded in 1996 by the Federal Emergency Management Agency, is now run by the Department of Homeland Security. The nation's 125 MMRSs provide resources and funding regionally to manage public health emergencies until state and federal resources can be deployed.

Although Gougelet does not expect the NNE MMRS to be fully operational until the summer, its members have already responded to at least one medical emergency—at Dartmouth-Hitchcock. Team members were recruited to help DHMC quickly contain a pertussis outbreak this spring. NNE MMRS volunteers helped vaccinate more than 4,500 employees in just a few days (for more on the pertussis outbreak, see page 11). And they stand ready to respond to future emergencies.

"I'm very pleased at the level of commitment," says Gougelet. "What most impresses me is the effort of many dozens of people to support a regional approach to this, and to put their egos and self-interests behind them."

LAURA EVANCICH

THEN & NOW

A reminder of the pace of change, and of timeless truths, from the May 1963 issue of MHMH's staff newsletter, *Hitchcock Highlights*:

The "Staff Reports" column noted that "the fast-growing incidence of a relatively obscure, serious, and occasionally fatal respiratory illness, emphysema, is strongly suspected to be the result of an increased number of habitual cigarette smokers, Dr. William Schillhammer has reported. . . . 'We do not know the exact cause of emphysema,' Dr. Schillhammer says, 'but . . . about 95% of the emphysemic patients we see are heavy smokers.'"

1

Number of DHMC pulmonary specialists in 1977-78

7

Number of DHMC pulmonary specialists in 2005-06