A visitor to Nadrian Seeman’s office in the department of chemistry could be forgiven for wondering whether this is the same Ned Seeman who pioneered the precise manipulation of matter at the tiniest scales. The room has few bare surfaces—including the ceiling, from which geometric models dangle. Stacks of books and papers are piled high, pieces of plastic toys block a window, postcards and printouts and rope knots cover the walls. The chalkboard, with equations and sketches of DNA, is a discovery zone of its own.

A disorderly office, however, is apparently an unreliable indicator of a disorderly mind. Amidst this chaos, Seeman, who has been on the faculty at NYU since 1988, works within a new realm of chemistry that he created, called nanotechnology, or the control of matter on the scale of billionths of a meter. It seems an impossibly delicate task, like building a ship in a microscopic bottle. But a wave of researchers is exploring an ingenious shortcut—essentially a way to get trillions of tiny ships in a test tube to assemble themselves—by using the programmable matter of DNA.

Seeman recently built an entire assembly line using this technology, inspiring The Christian Science Monitor to call him the “Henry Ford” of nanotech. Earlier this year, he shared the biannual million-dollar Kavli Prize for nanotechnology—the field’s version of the Nobel. “For a long time, there were no other labs working on his ideas,” says William Shih, a chemist at Harvard University who also studies DNA nanotech. “Now it’s a rapidly expanding field.”

Though the ultimate utility of nanotech is unclear, scientists believe it could revolutionize computers. Imagine an iPod Nano that’s actually nano.

Though the ultimate utility of nanotech is still unclear, many scientists, including Seeman, believe it could revolutionize building materials, medicines, and even computers. Imagine an iPod Nano that’s actually nano. “Our goal is to further in a realistic fashion the kinds of things that people have been talking about with nanotechnology for many years, most of which has been bullshit,” says Seeman, who has longish hair, a bushy beard, and no objection to colorful language.

Seeman, who earned his PhD from the University of Pittsburgh in 1970, invented DNA nanotechnology 30 years ago when he was working as a crystallographer at the State University of New York at Albany. He loved the puzzle of trying to figure out the shapes of tiny molecules. Researchers in his lab would shoot X-rays at crystals and decipher what the component molecules looked like by how the structure scattered the radiation. But forming those crystals “is the dumbest experiment known to modern science,” Seeman says, because it’s difficult to control. You fill a container with many copies of the molecule you’re trying to crystallize, concentrate it, and hope they all line up in a repeating pattern. “If you get a glop of crap, you
have no idea what you did wrong,” he explains.

One day at the local pub, Seeman was thinking about DNA junctions—created when strands of different DNA double helixes are unzipped and stuck together to form branched intersections—when an image by M.C. Escher popped into his head. The illustration, titled “Depth,” depicts fish swimming in a regular pattern with other fish lined up above, below, in front, and behind. He realized that if he combined the right strands of nucleotides, their sticky ends would meet up and they would automatically conform to a repeating three-dimensional grid of six-arm junctions, just like Escher’s fish.

“When I had that epiphany in the bar, I had been doing a lot of things that to me were really neat, but it wasn’t me,” Seeman recalls. “Crystallography was fun, and I was good at it, but something clicked in me that said, ‘This is what I’ve got to spend the rest of my life doing.’” Controlling matter on a fine scale using DNA had the analytical components of crystallography, but he saw considerably more potential for creativity.

Since this epiphany, Seeman’s work has spawned several branches of research now being conducted in more than 50 labs around the world—many of them populated by former students of his. One branch is the construction of intricate self-assembling shapes. In 1991, he and a collaborator built a cube that consists of six loops of DNA. Later he and another collaborator built a truncated octahedron, or eight-sided figure. Other researchers have made a smiley face and a map of the Western Hemisphere, a thousand of which could fit across the diameter of a human hair. There’s no immediate use for any of these shapes, but they were proof of a concept—any design could become a reality.

Seeman also helped give birth to the fields of DNA computing and
DNA nanomachines. In the latter, manipulating the DNA strands allows scientists to control their movement like little machines. Years ago he built the first nanoscale inchworm walker. Others have made tweezers. “He invented a somewhat crazy field,” and for years was “a lone voice in the wilderness,” says Caltech researcher Paul Rothemund, who created the smiley faces and maps.

More and more people are listening to the “lone voice.” In May, Seeman’s team reported in the journal Nature that they’d built an entire assembly line out of DNA. A microscopic walker could pivot and move past three other machines, each holding a different cargo of nanoparticles. The scientists could direct whether each machine would reach over and deposit its cargo onto the “chassis” as it marched past. “A new chemistry, I believe, will come out of this in terms of control,” Seeman says. Creating molecules is currently a messy multistage process that involves adding and removing protective groups of atoms at various stages to avoid volatile interactions among unfinished molecules. But with something like Seeman’s assembly line, researchers will eventually be able to manufacture drugs and who knows what else more easily and cleanly. It’s Detroit in a test tube.

Despite these leaps forward, it was only last fall, after nearly three decades, that Seeman finally constructed the DNA version of Escher’s “Depth”—a project he thought he could accomplish in five years. The path was more difficult than he’d expected. “On the way, we took what we thought of as baby steps,” he says, noting they continued breaking down the process to see why it didn’t work. This led them to discover: “Some of them were, in fact, giant steps.”

It was just about quitting time on Saturday, March 25, 1911, when the first tongues of flame licked across the eighth floor of what is now NYU’s Brown Building, but was then home of the Triangle Shirtwaist Company. The fire jumped to the ninth then to the 10th, and top, floor. Along the way, scores of finished blouses, freshly cut patterns, and ubiquitous scrap boxes, fueled by rows of well-oiled sewing machines, lit up like greased tinder. Next door, in today’s Silver Building, NYU professor Frank Sommer and his law class heard shrieking and sirens. They scrambled to the roof, where students George DeWitt, Charles Kramer, Frederick Newman, and Elias Kanter lifted dozens of workers to safety. Within half an hour, the fire had mostly burned itself out; the modern building was, ironically, considered fireproof. Yet some 146 people were dead—most of them mere girls and recent Jewish and Italian immigrants. Trapped in unbearable heat, many had leapt from the windows, to the point that the first reporter on the scene wrote that the gutters ran “red with blood.”

Only the year before, these same women, on strike with the International Ladies Garment Workers Union, had demanded safer working conditions. Looking over the carnage, the reporter prophesied. “These dead bodies were the answer” to their unheeded call. Indeed, the tragedy shocked New York City and the nation into action, delivering many of the fire and building codes that protect us today, as well as routine drills, better inspections, and more humane labor laws. “A certain amount of air per worker, windows, clean bathrooms—all those things we take for granted were legislated as a result of the fire,” notes historian Richard Greenwald (GSAS ’95, ’98), dean of the Caspersen School of Graduate Studies at Drew University and author of The Triangle Fire, the Protocols of Peace, and Industrial Democracy in Progressive Era New York (Temple University Press). As the fire’s centennial approaches, many groups on and off campus are reconsidering this history with an array of activities—performance art, museum shows, courses, and no less than three TV documentaries—all culminating on the anniversary with the annual reading of the victims’ names at the Brown Building.

The modern building was considered fireproof. Yet some 146 people died—most of them mere girls.

In the days after the fire, spontaneous memorials sprang up around the city, as newspapers opined about who was at fault and union activists called for more stringent codes and enforcement. The groundswell of public concern led to a mammoth relief effort for survivors and families of victims, and a solemn funeral parade for the seven women who remained unidentified. Despite rain, it drew some 400,000 participants and observers. It also put pressure on the political elite to respond and triggered a period of reform that would extend through the New Deal in the 1930s. In fact, Frances Perkins, FDR’s labor secretary, witnessed the fire from the street, while future U.S. Senator Robert F. Wagner presided over state investigations in the aftermath. Both championed new regulations.

Reform is just one focus of a spring show at NYU’s Grey Art Gallery on how the tragedy has been commemorated over the past century. The exhibit is the labor of an ongoing interdisciplinary course for graduate students in the Archives and Public History and the Museum Studies programs, and will incorporate painting, sculpture, historical documents, and photos. Though students are still creating the exhibits, one highlight will be several sculptures by Evelyn Beatrice Longman, a protégée of American sculptor Daniel Chester French, who was quietly commissioned by the city’s elite to
carve a memorial for the unidentified remains. The city purposely installed Longman’s marble relief of a garment worker at the Evergreens Cemetery in Brooklyn, far from the grieving immigrant masses of downtown Manhattan.

As the event moved into the past, there was a span of decades when unions appeared to be almost the sole stewards of its memory. Now that’s shifting again, says Marci Reaven (GSAS ’09), director of the cultural conservation project Place Matters, who is co-teaching the NYU course with Lucy Oakley, education and program coordinator at Grey. “One could imagine that with industry moving out of the city and union membership down generally, no one would pay attention,” Reaven says. “But they are.”

This is because “there’s a sense of the pure wrongness of it,” says artist Ruth Sergel (TSoA ’08), who, since 2004, has organized a group of volunteers to haunt the neighborhoods where victims lived—primarily the East Village, Lower East Side, and Little Italy—and chalk their names, ages, and addresses onto the sidewalk before their former homes. Though the annual, if impermanent, memorial started with a low-key e-mail blast to family and friends, Sergel has drawn an increasing number of participants, and in 2008, sensing the coming centennial would need a central organizing body, she founded the Remember the Triangle Fire Coalition. “You have the labor movement, Jewish-Americans, Italian-Americans, women, immigrants—they all feel passionately invested,” she says. Some see parallels with the plight of undocumented workers who toil today in meat factories and on farms and construction sites. For others, Triangle resonates with a more recent, though starkly different workplace trauma, 9/11.

Then there are those who feel a bit of déjà vu, as if American society had returned to the Gilded Age with the recent string of regulation-related catastrophes, from the financial crisis to the BP accident in the Gulf of Mexico. “The oil spill, it’s really Triangle all over again,” says Daphne Pinkerson, producer of HBO’s Triangle documentary, which will air next spring. While fire drills and sprinkler systems were known to significantly reduce injuries in 1911, for example, government was reluctant to trample on the liberties of the private sector. Then, like now, “The business of government was really to help business,” explains Michael Hirsch, a researcher and collaborator on the film. “But that changed after the fire.” Unlike the many other documentaries that have recounted the incident with authors and historians, the HBO film will look at it through the stories of the descendants of victims and survivors. To do this, Hirsch tracked down about 25 relatives, some of whom are featured in the documentary.

For Hirsch, the search for family members is part of a larger project to create an association of descendants so that they may have a voice in how the event is remembered going forward. There is a movement afoot, for example, to build a permanent memorial on or near the site of the fire, now noted simply by two retiring plaques on the building’s facade. The most lasting monument, however, may be all the lives saved since that fateful day. “American history is filled with these kinds of tragedies,” historian Greenwald muses. “In very few do you see something positive rising out of them.”
Users Beware

EXPERTS PONDER THE FUTURE OF ONLINE PRIVACY AND CYBER SECURITY

by Kevin Fallon / CAS ’09

Facebook has been in the news a lot lately. In July, the social networking site hit 500 million users—that was the good press. The bad: A glitch in May inadvertently released many users’ private information, such as chat transcripts, to their friends. Last April, the site changed its privacy policy and suddenly users faced the dilemma of whether to share some personal information with everyone, or no one at all. Perhaps the scariest breach of trust was the discovery that data such as your name, age, and occupation was being shared with digital marketing companies, including Google’s DoubleClick and Yahoo’s Right Media. With each scandal came a media firestorm.

“Facebook, while iconic, is not alone,” warns Gabriella Coleman, assistant professor of media, culture, and communication at the Steinhardt School of Culture, Education, and Human Development. “There are banks and other institutions at play here.” And more than just personal mortification or consumer patterns are at stake. Last December, the all-powerful Google was hacked—reportedly by an entity in China—and companies and contractors that handle critical infrastructure, such as Internet service providers, electrical grids, and nuclear power plants, grew increasingly worried. The accumulating breaches led the Obama administration to announce, in the president’s Cyber Security Review last year: “Cyber threat is one of the most serious economic and national security challenges we face as a nation.”

While the gravity of these cyber challenges is clear, what to do about them remains contentious and uncertain. Private companies are taking their own measures, while the federal government struggles to assuage fears with several proposals—most notably a classified National Security Agency program called Perfect Citizen, which would monitor Web activity and detect cyber assaults on companies and government agencies. Meanwhile, universities are tackling these questions from other vantages. The hope is that some of the ideas now swirling around campuses, government halls, and boardrooms will illuminate how to regulate the Web in a manner that is both legal and effective, that preserves the openness and transparency that built such a powerful tool but still protects privacy.

To get any regulation right, one needs to understand how our conception of privacy is changing. The increased reliance on new technologies has “radically disrupted” the way information flows in society, notes Helen Nissenbaum, professor of media, culture, and communication at Steinhardt and author of Privacy in Context: Technology, Policy, and the Integrity of Social Life (Stanford University Press). Privacy remains an important value, but not in the form of secrecy, or controlling and withholding information. “People say that young people don’t care about privacy anymore,” she says. “That’s nonsense. Look at their loud objections to the changes in Facebook’s privacy settings.” What people do care about, she says, is that information is shared appropriately.

Nissenbaum predicts that people will eventually stop using Face-
The class of 1980 donned their caps and gowns while Jimmy Carter was in office, the Iran hostage crisis was showing no signs of a resolution, and Blondie’s “Call Me” was rocking the airwaves in the top spot on Billboard’s Hot 100. NYU was primarily a commuter school in those days, with the vast majority of students trekking to the Village from the outer boroughs and suburbs. This year, more undergrads hail from California than New Jersey, and 25 percent of students live in dorms—compared to less than 4 percent back then. Here’s how some other stats stack up to their 1980 counterparts:

**WOMEN OUTNUMBER MEN—MORE THAN EVER**

Then: 53% of students were women
Now: 59%

**RESIDENCE HALLS HAVE MORE THAN QUADRUPELED,**
from 5 to 21

**MOST POPULAR UNDERGRADUATE MAJOR**

Then: Biology
Now: Film and Television

**A MOVIE DATE FOR TWO TO FILM FORUM**

Then: $8
Now: $24

**MOST POPULAR STUDENT GROUP**

Then and Now: Asian Cultural Union
(It’s nice to know some things don’t change.)

Sources: NYU Archives, Office of Institutional Research, Film Forum, Division of Student Affairs
When President Barack Obama delivered his first speech to Congress in 2009, he proclaimed that “every American will need to get more than a high school diploma,” affirming the consensus that a BA has become the new baseline of education. But as college degrees grow more common, a new study warns not to let someone’s résumé fool you—undergraduate students may not be learning fundamental skills, such as critical thinking and writing, the hallmarks of higher ed. “If ‘college for all’ is nothing more than just warehousing kids for four years, that’s pretty disturbing,” says Richard Arum, a professor at the Steinhardt School of Culture, Education, and Human Development.

The “soft” level of student achievement is the focus of Arum’s new book, Academically Adrift: Limited Learning on College Campuses (University of Chicago Press), co-written with Virginia assistant professor Josipa Roska, which examines the results of the Council for Aid to Education’s Collegiate Learning Assessment exam, or CLA. The test—which gauges critical thinking and writing skills—was administered to more than 2,300 students at 24 universities around the country, and the results are disconcerting: 45 percent of students exhibited no measurable improvement in these areas over their first two years of college.

The tidings grew more alarming when Arum and Roska cross-referenced the CLA results with data on participating students’ socioeconomic backgrounds and lifestyles. They found that half of those surveyed hadn’t taken a single course in which they were required to write more than 20 pages, while a third report not being assigned more than 40 pages of reading per week. While this may not instill confidence in those hiring students right out of college, there are those who glean hope from the conversation provoked by the news. “You need data to hold people accountable,” reasons Matthew Santirocco, dean of the College of Arts and Science. “That’s why Richard’s study is so important. Institutions need to embrace his results, so they can individually see where their weaknesses are and then start addressing them.”

One bright spot in the study revealed that students at institutions with strong liberal arts programs, undergraduate research opportunities, and a competitive peer environment learn at higher rates. This may be due, in part, to the fact that faculty in these programs spend less time on their own research and more time interacting with students. NYU’s own need to address this issue has resulted in programs such as the Morse Academic Plan, which offers foundational courses in science, culture, writing, and languages, in addition to an expansion of the university’s arts and science core, and access to freshman honors seminars. Key to the success of these initiatives is constant oversight. The faculty committee governing the Morse curriculum, for example, meets every few weeks to assess the courses. “[The results] show that our instincts and our rigor are validated, but it also shows that we’ve got to continue to push in that direction,” Santirocco says.

Even those schools that have already initiated reforms may be in for an awakening in 2016, when the Organization for Economic Cooperation and Development will employ the CLA in the largest cross-national study of the higher-education system to date. Arum believes that the findings will galvanize everyone with a vested interest in learning to act. “Undergraduate education is clearly a worthwhile investment as a whole,” Arum says. “But that doesn’t mean we can’t do better to deliver a more meaningful, valuable product for students.”
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BIG WINNER, LITTLE WONDER

Last April, Paul Harding’s debut novel, *Tinkers*, published by Bellevue Literary Press, won the 2010 Pulitzer Prize for fiction. The little-known but visionary imprint, founded in 2005 in affiliation with the NYU School of Medicine, has only two full-time staffers and publishes two fiction and six nonfiction titles yearly. Fittingly, the tiny publisher focuses on the intersection of art and science, with an emphasis on medicine. Switching between past and present, *Tinkers* explores the fraught relationship of a dying New Englander with his epileptic, traveling-salesman father. The Pulitzer citation lauded the slim volume as “a powerful celebration of life.”

—Sally Lauckner

A FULLER VIEW OF IRAN

In the summer of 2009, all eyes were on Iran when a controversial presidential election tipped off widespread protest. The mass demonstrations and violent government crackdown played out in real time as protesters turned to new media, such as Twitter and text messages, to communicate with one another and the outside world. Though brief, the incident was a powerful reminder for the West to look beyond Iranian president Mahmoud Ahmadinejad and see a dynamic and diverse nation in which many are desperate for democracy.

NYU’s newly launched Iranian Studies Initiative, sponsored by the Gallatin School of Individualized Study, couldn’t have come at a more relevant moment. The brainchild of Ali Mirsepassi, professor of Middle Eastern studies and sociology at Gallatin, the program kicked off this fall with a six-part lecture series stretching over the academic year and featuring prominent scholars, including exiled Iranian author Reza Baraheni. Intended as a resource for students, scholars, and public-policy makers, organizers hope it will eventually grow to a full-scale academic program, promoting coursework and research. NYU Alumni Magazine asked Mirsepassi, author of the recent *Democracy in Modern Iran: Islam, Culture, and Political Change* (NYU Press), about the country’s cultural and political complexities.

Why study Iran?

Iran is an important center of ancient civilization and Islamic history and culture. It bridges the cultures of the Arab-Islamic world with Asian, Indian, and Chinese cultures. Since the late 19th century, Iran has been at the center of modernization in the Middle East and recently it has been at the center of attention in politics and religion due to the rise of political Islam and the struggle for democracy. We believe that interest in Iran should expand beyond those of us who study it as part of our academic profession to all sorts of interdisciplinary fields and even those who are interested in global studies.

In your book, you suggest President Obama’s election indicates a possible shift in which the West will be more accepting of other cultures. Is this shift happening?

I think there has been a change of attitude that I hope will be followed by a change of policy. The politics of reconciliation doesn’t necessarily lead to immediate results; it requires one to be patient and to be hopeful and to wait for the right moment for change to occur. My hope is that President Obama will favor global ethical reconciliation over the real politics that necessitate military or physical intervention in solving our problems.

You also debunk the idea that Iranian culture is incompatible with democracy. Why is this idea wrong? Iranians have struggled for democracy and rule of law since the second part of the 19th century, and as a result, in 1906, there was what we now call the Constitutional Revolution, which resulted in the formation of a parliamentary government. It is not culture but a mixture of domestic politics and international imperatives that made Iran victim to dictatorships. Whenever Iranians have had the chance, they have always wanted democracy. I finished the book in May 2009 and in it I predicted that very soon there will be a large, social movement for democracy in Iran. During that summer, millions of Iranians in Tehran came out and demonstrated in demand for democracy and their rights. So to ask: “Is Iranian culture or Islam compatible with democracy?” is in itself a problematic question.

—S.L.
I have the best memories of being a student here. I’ve been building my New York City library ever since. This is the place where all my adventures began.”

— Jacob class of 2004, composer, playwright and musician
Cu raray rivers, tributaries of the mighty Amazon. That particular spot gets lots of moisture, which has kept the rain forest there lush even as surrounding regions have dried up due to climate change and have been imperiled by cultivation and development. Scientists say that, as a result of this good fortune, Yasuni is arguably the most biodiverse place on Earth.

New evidence of this was recently published in the scientific journal *PLoS ONE*, where co-author and NYU primatologist Anthony Di Fiore revealed that the species in Yasuni eclipse an array of world biodiversity records. For example, the Tiputini Biodiversity Station, located on the northern rim of Yasuni, is home to 247 types of amphibians and reptiles, 550 bird species, and more than 100 types of bats. A single hectare of forest in Yasuni is estimated to contain 100,000 different types of insects, as well as a whopping 655 species of trees—more trees than are native to the continental United States and Canada combined.

But it may not last. Di Fiore notes that oil exploration within the park and creeping development on its outskirts now threaten this refuge. The Ecuadorian government has proposed halting the oil extraction, asking the international community to compensate them for 50 percent of the projected lost revenue, which would total nearly $3 billion over the next decade. So far there have been no takers, prompting President Rafael Correa to unveil an alternative plan to conduct more “environmentally safe” drilling.

This is still not encouraging to Di Fiore, who says that man’s influence will eventually be compounded by nature’s, as climate change increases and any effect on the park’s habitat could eliminate the opportunity to document unknown species of plants and animals. “Most models that look at climate change envision a drying up of the eastern Amazon,” he says. “And if you lose the west of the Amazon to human impact, then you’ve lost everything.”

For a new college grad, “social capital” might be key to landing a job. It could also help one score free box seats to a Yankees game. But for marginalized groups, social capital—in other words, family and friends—can sometimes do more harm than good. In many cases, it’s actually “both helpful and hurtful,” explains Silver School of Social Work assistant professor Robert Hawkins, who studied how social capital has affected lower-income women in Boston and the victims of Hurricane Katrina in New Orleans.

Hawkins discovered that relationships with family and close friends were more likely to keep lower-income individuals in an economic rut. However, weaker and shorter-term relationships with teachers, service providers, or coworkers were more likely to be agents for positive change. The Boston study, titled “Fickle Families and the Kindness of Strangers,” published last spring in the *Journal of Human Behavior in the Social Environment*, revealed that families typically offer immediate emotional support for lower-income single mothers but don’t lighten their financial burden. In Hawkins’ New Orleans study, “Bonding, Bridging, and Linking,” he was able to better understand how social limitations work within a community struck by disaster. Ultimately, the interviews Hawkins conducted provided catharsis for his subjects, and possibly even some positive social capital. “For all these individuals, it was a very empowering process,” he says. “Many just were thankful they were allowed to tell their story.”
hen it comes to learning, it’s a good idea to give yourself a break. That’s what graduate student Arielle Tambini and Lila Davachi, assistant professor in the department of psychology and the Center for Neural Science, discovered in a recent study. “We found that taking breaks after absorbing a lot of information strengthens your memory of that information,” Tambini explains.

This might seem like common sense, but previous studies have only tested memory consolidation during sleep. Tambini and Davachi were interested in how memory works when you lie quietly with your eyes closed—but remain awake. Participants tested were shown pairs of images followed by a period of rest, when they could think about anything they chose. A scanner was used to gauge the activity in the hippocampus and cortical regions of the brain; it revealed that the mind works specifically to consolidate memory of those images in that time.

The findings were published in a January issue of the journal Neuron, and other NYU researchers are now testing how different kinds of activities—such as reading and math—may interfere with memory consolidation during rest. Until then, Tambini says, “We now know recess is never a harmful thing.” —E.N.