



NEWS FROM THE UNIVERSITY OF CHICAGO PHYSICAL SCIENCES DIVISION

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Fixing the Leaky Pipeline: Walter Massey, Champion for Diversity

As résumés go, Walter Massey's is more than impressive. President emeritus of Morehouse College, former president of the American Association for the Advancement of Science, former director of Argonne National Laboratory, and, since April 2009, chairman of the board at Bank of America—to name just a few. He's no stranger to the University of Chicago, either; from 1983 to 1991, he served as vice president for research. Now Massey, physicist-turned-administrator, is bringing his expertise back to Chicago. He's advising the Physical Sciences Division on a variety of strategic initiatives, in particular on how to tackle one of the most stubborn challenges in the field today: diversity.

Minorities are underrepresented in the physical sciences in the United States; in 2002 the National Science Foundation found that fewer

than 7 percent of all physical scientists in America were black or Hispanic. Chicago is no exception to this trend—if anything, says Massey, “we are behind many universities.” The causes are elusive, but he thinks a large part of the problem is that bright young minority students don't consider the sciences as a career to begin with.

“There are a number of factors, starting with the quality of education that a significant number of minorities receive in the elementary and high schools,” he says. Adding to this “is the lack of role models and the lack of visible signs to youngsters that these are interesting, exciting fields, and fields in which they are likely to succeed.” He also suspects the problem has been compounded by the weakened job outlook for young scientists. And although Massey does see progress overall, noting that the growth in doc-

torates awarded to black students in the sciences is faster than the growth in the white community, “the numbers are small.”

Massey has been studying strategies that Chicago could adopt to counter this underrepresentation. “One is to build relationships with institutions that produce minority graduates,” historically black universities (such as Morehouse, his own alma mater) and Hispanic-serving schools. Establishing a “pipeline” with such schools should lead to more students being recommended to Chicago.

Massey describes his work on diversity issues as only one of his advisory tasks. The other is assisting faculty with large research proposals. He understands the ins and outs of the grant process better than most; you can add former director of the National Science Foundation to his résumé

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Note from Dean Fefferman



On Confidence

Scientific progress moves forward regardless of the economy, and I can say without hesitation that the Physical Sciences Division is moving forward as well. I will be honest with you, though: we do not live in a separate universe, unaffected by the economy. As I have described in this space before, our response to the economic downturn has been to slow our pursuit of our priorities while not changing them. Our planning for new space is progressing, and we continue to hire new faculty, though not in the same numbers that we would if the economic climate were different. But Chicago is better off than many of our peer institutions,

above. Thus far, he has been helping astronomy and astrophysics chair Rocky Kolb on issues with Chicago's participation in the construction of the next generation of telescopes. He also advised Dean Fefferman during the proposal for the creation of a new Mathematical Sciences Research Institute, for which Chicago is a finalist.

Lately, though, his attention has been divided. "I was just really getting involved with meeting the faculty and learning about where I might be most helpful," he says, "when I took on the position of chairman at Bank of America." He had served on the board of directors of the bank and its predecessor, BankAmerica, since 1993. Massey, with his long experience in administration in the

so the short answer to the question "How are you coping?" is, we're coping well.

It is a mistake to think that a tightened budget will necessarily prevent advances in science. For example, although the Great Depression was a crisis far worse than the one we find ourselves in now, it was also the era when Chandrasekhar investigated the life cycle of stars, Fermi developed his theory of beta decay, and Urey demonstrated the existence of heavy water.

As you can read about in this issue, our faculty and their students continue to advance science in myriad ways. In fact, right now there is research going on in the PSD that, if it does not earn a Nobel Prize, is certainly of that caliber. I think we have made good investments in talent over the years, though we are not content to rest on our laurels: we have made some excellent new hires in the past year, and you will learn more about them in upcoming issues of *Inquiry*.

This university has weathered much worse economic storms than the current one in the past century, and yet in that time Chicago has changed the course of science again and again. My message to you is to be confident. Great things are happening even as you read this.

With warm regards,

Robert A. Fefferman
Dean

government, academic, and corporate worlds, was seen as a trusted but independent hand for a bank that was hit badly by the financial crisis of late 2008. The ongoing economic crisis has kept him away from Chicago since taking his new position in April, but he plans to be around campus more "after things settle down" in his new position.

Despite the calls on his time (he also serves on the board of McDonald's), Massey remains committed to his work for the PSD and to the challenge of increasing diversity. "It's something I've been working on all of my professional career," he says. "I think the University of Chicago is such an important institution that I would like to see it be a leader in this area." ■



The Unpredictable World between Science and Engineering

"Any given day," says Milan Mrksich, "there's a surprise waiting for me when I come into the lab. And that's the fun part of being a scientist: seeing a scientific result for the first time, before anyone else has." Mrksich's idea of fun, however, is serious business. He leads a lab that investigates one of the most fruitful areas of research in chemistry today—the interface between living and nonliving materials.

As a student at the University of Illinois and in his later graduate studies at Caltech, Mrksich was fascinated by the idea that a chemist could build molecules "atoms at a time." This aspect of organic chemistry coexists at a "triple point" with biology and materials science. For example, to study how a cell adheres to a surface, a researcher needs to understand not only the biological composition of the cell but also the material properties of the surface, as well as chemical techniques to make observations and measurements. Says Mrksich, "I would categorize this approach as a hybrid between science and engineering."

The common thread that runs through Mrksich's research is the interface between a material and a biological environment. This research falls into two broad areas. The first is creating sensors, such as those used for discovering drugs for pharmaceutical use. The key to treating many diseases is finding a molecule that can interact with a particular enzyme in the body. The traditional way to identify these molecules is the shotgun approach: a test (or "assay") with the enzyme in question is run hundreds of thousands of times, each in the presence of a different molecule—and the activity of the enzyme is visualized with a fluorescent or radioisotope tag.

"It can take many weeks and a substantial amount of money to develop a good assay for high-throughput screening," says Mrksich. Even then, the labels themselves frequently produce false positives, wasting time and effort.

To get around these limitations, Mrksich and his group developed a label-free assay. It uses a single glass slide containing 1,500 dots, each with a surface chemistry conducive to attaching molecules modified by the enzyme. A solution with the enzyme is added to each dot; after the reac-

"And that's the fun part of being a scientist: seeing a scientific result for the first time, before anyone else has." —*Milan Mrksich*



Milan Mrksich checks on the progress of experiments in his lab.

tion between the enzyme and test molecule occurs, the plate is placed in a mass spectrometer, which reads all 1,500 dots in less than an hour. (The innovative use of mass spectrometry, a patented method called SAMDI, is also a direct product of the Mrksich lab.) The time needed to discover possible drugs is reduced dramatically.

The other branch of Mrksich's work concerns a related theme: instead of attaching biological materials to a nonbiological surface, the challenge lies in learning to integrate and connect nonbiological materials with biological surfaces. The exteriors of most cells are studded with receptors—proteins that attach themselves to other proteins, binding the cells to a matrix. Different kinds of cells have different receptors so that, for example, a kidney cell doesn't adhere to a muscle. ("It's like a ZIP code for organs," explains Mrksich.) But how cells adhere to each other, and how diseases cause some cells to let go (such as cancer, which is spread when cancerous cells leave their origin and circulate throughout the body) is still far from understood to biologists. Mrksich has focused on determining the role of proteins in cell adhesion. The importance of this obscure-sounding field is great: understanding the proteins that let cells adhere to each other is the first step in designing drugs that

can control cell adhesion, including preventing the migration of cancer cells, controlling blistering in skin disorders, and facilitating the healing of wounds with less scarring.

At any one time, the Mrksich group has about 25 people: a dozen graduate students, ten postdoctoral researchers, and a few technical and administrative staff. With a group the size of his, Mrksich says, there's a critical experiment being run almost every day. "As you pursue projects, you find that your understanding of the question changes as you go." And, in the end, that's the best part of his job: "It's quite unpredictable." ■



Rob Kass and the "Bayesian Revolution"

As a graduate student, Rob Kass, PhD'80, was presented a problem by a postdoc in molecular biology. The postdoc had been studying whether two traits of different strains of bacteria were related. His data indicated that, in most cases, they were,

according to a standard statistical chi-squared test. But in one instance, the chi-squared value suggested that the traits were not connected in a statistically significant way. The postdoc wanted to use his data to show that the two traits were independent, but standard statistics allowed him no way to do so. Kass went away to work on the problem, tinkering with the chi-squared test. "At some point, I realized I was rather clumsily re-inventing Bayesian hypothesis testing," he says. "This set me on a path that I would follow for more than 15 years."

Kass had also wandered into a great intellectual battle within statistics. "A rather acrimonious feud had developed between Bayesians, who were a small minority, and the non-Bayesians, often called frequentists," he explains.

Bayes's theorem is simple in concept, stating that if you know the probability of B given A , you can get the reverse—the probability of A given B , as long as you also know the initial probability of A . For example, take a screening test for cancer. Any screening test will have some rate of error; Bayes's theorem allows doctors to determine the chance a patient actually has cancer when a test comes back positive. In this example, A is having cancer and B is the screening test being positive; the initial probability of A is determined from the background prevalence of the cancer in the population.

This simple application of Bayes's theorem has never been controversial. But what if the probability being sought was that of a scientific hypothesis being true? "Instead of A and B , we have hypothesis and data," explains Kass. "If we know the probability of a particular data outcome according to some hypothesis, we can reverse things and compute the probability the hypothesis is true, given the data, as long as we have an initial probability for the hypothesis." The problem that the frequentists saw with this application of Bayes's theorem was that there is no compelling way to determine the initial probability that the hypothesis is true. Bayesians responded by showing that, in many circumstances involving large amounts of data, the initial probabilities become unimportant and both frequentist and Bayesian methods would yield similar results.

Chicago's statistics department, like most statistics departments, did not espouse Bayesianism, but Kass found himself "on the bandwagon," as he puts it. He took a faculty position at Carnegie Mellon University in 1981 because it had one of the few Bayesian statistics departments. He start-

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ed his career working in theoretical statistics and became interested in neuroscience in the 1990s.

At that time, Kass realized that the way data were treated in neuroscience research was lacking in statistical rigor. A neural network, he explains, is basically a big electrical circuit, albeit one that is not particularly well understood. "Because neurons fire somewhat erratic sequences of electrical pulses, called spike trains, in response to stimuli or to produce an action, understanding spike-train patterns is an inherently statistical problem." His research to decode the meaning of these spike trains has led to an unexpected real-world application: neural prostheses, in which sensors decode spike trains and use them to control robotic devices.

Kass says he was a theorist when he was a young faculty member at Carnegie Mellon but now feels that neuroscience lets him study real-world applications and cases as well. "My experience in neuroscience has given me a renewed appreciation for the two sides of statistics—theoretical and applied." In 2008 he joined Carnegie Mellon's machine-learning department, a field increasingly interconnected with statistics.

Meanwhile, in the nearly three decades since Kass received his PhD, statistics has become involved in matters less theoretical and more practical, and the clash between Bayesians and frequentists has faded to near-irrelevance. Now, he says, statisticians tend to solve problems using whatever method they can. "We are all much more eclectic and spend our energy advancing techniques instead of arguing about their foundations." ■



GEOPHYSICAL SCIENCES

Geologist Goes to Ends of the Earth to Make Sense of Planet

In an oversize office full of maps—some historical, some topographical, some with three-dimensional relief, and some marked in Chinese—Professor David Rowley describes his area of expertise. "I am a geologist, and I mean that in the broadest sense. I'm interested in things geological, and I don't tend to be easily pigeonholed."

One of his interests, plate tectonics, has led him to paleogeography—how the Earth looked millions (or even billions) of years ago. Rowley now heads the Paleogeographic Atlas Project, which was started at the University of Chicago by Alfred Ziegler. Although creating maps of a



David Rowley examining maps in his office

Triassic-period Earth is an impressive feat in and of itself, the maps aren't the end goal. "It's service work," he says, because geology, evolutionary biology, climatology, and other sciences depend on knowing the distribution of continents and oceans in different geological eras. "It's the fundamental basis upon which all of the geological questions are posed."

Rowley doesn't confine his work to theory; he conducts fieldwork in Tibet, working to better understand the origins of the world's highest plateau. He's interested in what he describes as the paleoaltimetry of Tibet: how did the Tibetan plateau, where two major continental plates collide, get to be so unusually high? Normally, he says, the question in geology is how deep inside the planet did rocks form, not how high above sea level.

Rowley has been able to tease out an answer to the Tibetan puzzle by using the work of Chicago chemist Harold Urey on oxygen isotope ratios. Through a process called orographic precipitation, when moist air interacts with mountains, the air is compelled to rise and water condenses out of the air, becoming precipitation. But the higher the altitude where the precipitation falls, the lower the ratio of oxygen-18 to oxygen-16 in the water. "All we need to do, then, is measure the oxygen-18 that's fallen up there, and I can tell you what a reasonable estimate of the surface elevation was on which that precipitation fell." His fieldwork consists of trying to find pristine rocks in Tibet to analyze for their isotopic content,

which, together with their age, allows him to determine the height as a function of time.

He began his research in Tibet in 1996, but the Chinese government is becoming warier of allowing foreigners there, even those with a purely scholarly purpose. For the past two years, Rowley's been denied permission to conduct fieldwork in Tibet, but this year Chinese authorities changed their mind. "It turns out that a lot of very interesting parts of the world are also ones that are politically challenging," he laments. Other places he would like to conduct research but can't include Pakistan, Afghanistan, and Myanmar.

The range of his research is also reflected in the work of his students. Their research has "compelled them to develop expertise in a wide range of disciplines and employ that expertise to address questions typically beyond the scope of most dissertations. Thus, they are not readily pigeonholed into the traditional subdisciplinary fields that most academic institutions recruit within." As a result, a significant number of his students have ended up not in academia but in industry. "They get identified as people who can approach lots of different kinds of problems and not hesitate to dive into new areas."

But Rowley sees a common thread connecting the topics on which he has spent his career. "It's really looking at the evolution of the surface, the entire surface, of the Earth as a function of time," he says. The entirety of the planet's surface seems a fittingly large subject for a "geologist in the broadest sense." ■



PHYSICS

Faculty Q&A with Eric Isaacs

Eric Isaacs was named director of Argonne National Laboratory in May 2009. He has had a joint appointment as professor of physics in the University of Chicago's James Franck Institute since 2003. Before being named director of Argonne, he was the deputy laboratory director for science programs at Argonne and director of the Center for Nanoscale Materials.

Argonne is noted for its research into alternative energy. What are the lab's top priorities in that field for the near future?

One major area of research is storage. We have one of the strongest programs in the country, if not the world, in lithium-based batteries. A lot of the work we do in batteries is focused on hybrid electric and all-electric vehicles, but we also are looking to another very important area, grid storage. As we add more and more variable energy sources like solar and wind onto the grid, we have to manage the grid by developing capacity storage techniques for the future.

We do a lot of work in alternative energy sources, such as alternative fuels with low carbon footprints. We're thinking about next-generation engines, what we call omnivorous engines, which can consume any kind of fuel. You could use ethanol or gasoline equally as well as diesel.

We also do a lot of basic work in chemistry and catalysis, like fuel reforming, which means taking materials such as methane gas or coal and converting them to liquids. It takes a lot of energy to do that today, so we're looking for ways that use less energy. Illinois is a big coal producer, and this gives us new ways to use existing fuel sources—at least in the short term.

In your opinion, to what extent do the nation's energy challenges require major scientific advances, and to what extent can they be solved with existing technologies?

The primary existing energy technologies are based on fossil fuels, and we know where that leads. It's very hard to talk about energy without talking about climate and our carbon footprint. But renewable energy technologies, like solar and wind, are not highly de-

veloped. The technologies needed for wind power, for example, aren't rocket science, but there's a lot of work that still needs to get done to make it viable in terms of cost.

I think the ultimate solution is solar energy, though it may not be ready for 50 or even 100 years. There are two ways to use solar power: one is to convert solar to electricity, and one is to convert solar to fuels. What plants do every day is take sunlight and convert it to carbohydrates to survive. We can't do that—we can, but we can't do it as an efficient conversion with a low carbon footprint. The amount of research needed to understand how proteins in a plant convert sunlight to fuel, and then to scale it to human needs, is huge. We kind of know how it works, but we can't reproduce it ourselves. That's the kind of thing that might very well win a Nobel Prize.

How does Argonne balance basic research versus applied research in allocating time and resources?

You hit it on the head—balance is the key. At Argonne, it's probably 60 or 70 percent basic research, and the rest is applied research and engineering. A government lab like Argonne is going to focus a little harder on basic research because industry has largely given that up. I used to be at Bell Labs, which was the quintessential place to do condensed-matter physics research; chemistry too. But big industry doesn't do its own research anymore; they don't have the resources.

One of the beauties of a place like Argonne is that we do basic research, but we also have

that link between basic and applied, and even to manufacturing. As director, I will always support basic research. But if you're on the trail of a really important technology, say a new kind of battery, we'll have the means to support that technology and bring it to fruition.

How does the close relationship between Argonne and the University of Chicago benefit both institutions?

Argonne and Chicago are very complementary in many ways. We have overlap in areas like materials science, physics, and chemistry. But where we can really benefit each other is where we have less overlap and more complementarity.

At the University, for example, there's no engineering at all; at Argonne, there is. We don't have a medical school; the University does. But it turns out a lot of the stuff we innovate can be utilized for things like biomedical engineering, or areas like surgery. We work in robotics because we have an interest in placing crystals in a beamline remotely, but that technology can also be used for surgery. We work closely through a joint institute here, the Computation Institute. And we collaborate with the economics department to calculate the impact of green technology and model what a cap-and-trade policy will do to the economy. It's really terrific. It's something special.



Eric Isaacs, far left.

"I don't tend to be easily pigeonholed." —David Rowley



Ross Williamson inside Amundsen-Scott South Pole Station

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ASTRONOMY & ASTROPHYSICS

Astronomy at the Bottom of the World

“One of the great benefits of studying astrophysics is that most of the world’s premier observatories are in fantastic, remote places,” says Ross Williamson, a postdoctoral researcher in astronomy and astrophysics. “None, however, are as remote as the South Pole.” Williamson is working on the South Pole Telescope (SPT), located at Amundsen-Scott South Pole Station in Antarctica. Working in the frozen south is challenging any time of year, but he has volunteered for one of the most physically and emotionally demanding jobs in astronomy today: spending the long Antarctic winter (February through October) at the pole.

The SPT, which is operated by a Chicago-led consortium of eight universities and institutions, is a radio telescope designed to examine the heavens for minute variations in the cosmic microwave background (CMB). By studying the CMB, a kind of echo of the big bang, astrophysicists aim to constrain the limits of the elusive dark energy—“something we know little about but which makes up more than 75 percent of the energy in the universe,” explains Williamson. Because microwave radiation from space tends to get absorbed by water vapor in Earth’s atmosphere, the best sites for observatories tend to be very dry or at high elevations. At an elevation of 2.8 km, and getting less than

2.5 mm of precipitation a year, the South Pole makes an ideal spot for a radio telescope.

Of course, it’s not an ideal place for scientists to live. As a “winter-over,” Williamson is responsible for making sure the telescope is operational and taking data as often as possible. One of his tasks is greasing the bearings and gears of the SPT every other week. “This involves standing outside for an hour or so trying to apply grease, which turns solid after about ten minutes in the cold, to the telescope,” he says. “Some days it can be beautiful, when the air is calm and the sky is clear. Other times, the 30-knot winds drop the wind-chill temperature to -150° F and below, which is not too pleasant. All part of the job, though.”

The extreme cold is just one of the difficulties Williamson and his fellow residents at the pole face. For six months of the long Antarctic winter, from March through September, the sun is continuously below the horizon. Limited water supplies dictate that winter-overs are limited to a two-minute shower twice a week. And during the winter, no planes fly between Amundsen-Scott and the supply bases on the Antarctic coast, so they see only the same 43 other people for eight months.

Despite the hardships, Williamson always wanted to work in Antarctica. “The SPT project was the perfect opportunity to work on fascinating sciences and live at the bottom of the planet. That’s why I volunteered,” he says. “Besides, every now and then we get a beautiful aurora, or the sky is crystal clear and filled with stars, and that always makes living down here worthwhile.” And when he returns to civilization, surely even February in Hyde Park won’t seem so bad. ■

e^x MATHEMATICS

Fellowship Continues Life Work of Champion of Math Education

Izaak Wirszup, PhD’55, the late mathematician who was associated with the University for almost 60 years, was a forceful advocate for better mathematics education in America. He helped create the University of Chicago School Mathematics Project and the University of Chicago Polk Brothers Foundation Program for the Improvement of CPS Mathematics Teaching, both of which continue their work today. Now a new undergraduate fellowship named for him will help ensure an ongoing department-wide commitment to improving mathematics education.

Born in 1915 in Vilnius, Lithuania, Wirszup lost his wife and infant son in the Holocaust. After the war, he lived in Paris for a time, where he married his second wife, Pera, whom he had known from childhood. In 1949 Wirszup’s old professor from the University of Wilno (Vilnius), Antoni Zygmund, wrote to him, encouraging him to come to Chicago. The Wirszups knew Chicago only as “la cité des gangsters,” but Zygmund had also sent along a list of University announcements. On the list along with Zygmund was the name of Enrico Fermi. Wirszup said, “If it’s good enough for Fermi, it’s certainly good enough for me.”

Wirszup lived the rest of his life in Chicago, where Pera still resides. He became well-loved as an instructor of mathematics, and Pera taught conversational Russian. The couple was widely known for their tenure as resident masters in the Woodward Court dormitory from 1971 to 1985.

Wirszup was concerned about the laxness of American methods of math education compared to the Soviet system as far back as the 1950s. His concern came to a head in 1979, when he wrote a report to the National Science Foundation detailing the deficiencies of the American system. Heeding the report’s call to action, the Carter administration launched a reevaluation of the adequacy of American schools. In 1983 Wirszup helped to establish the University of Chicago School Mathematics Project, now the nation’s largest university-based curriculum project for kindergarten through 12th-grade math.

In 1999 he started a new project funded by the Polk Brothers Foundation, the University of

Chicago Polk Brothers Foundation Program for the Improvement of CPS Mathematics Teaching. Through the program, elementary schoolteachers learned to improve their mathematics lessons using a creative, modern approach to instruction. Today, more than a hundred of Chicago Public Schools teachers come to campus every year for the program to improve their math-education skills.

“What [Izaak] felt was that, because he was the only one of the 60 people in his family left alive, he had to do something with his life,” says Pera. “He wanted to do something for his adopted country. He felt there was some reason he remained alive: that he had to help in education.”

Wirszup worked on the Polk Brothers–supported program until his death in 2008. Looking for a way to memorialize his life, friends, colleagues, and former students of the Wirszups hit upon a fellowship to support the program for which Izaak had cared so much. Their contributions created the Izaak Wirszup Fellowship, awarded annually by the University to a student who is committed to improving mathematics education.

The first recipient was named this past spring: third-year Jerry Lo, who had made weekly visits last year to Chicago Public Schools to work with the students of teachers in the program. “I wish that mathematics could be a challenging, yet satisfying subject for them, and the experience that they gain from learning math could be a stepping-stone for all other topics,” said Lo, echoing Wirszup’s own belief in the importance of math education.

Izaak Wirszup once said that he did the things he did because he had “a moral legacy and a constant responsibility.” In the programs he established, the countless educations he influenced, and in the fellowship that will continue his work, his responsibilities have become his legacy. ■



Izaak Wirszup

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COMPUTER SCIENCE

Q&A with Aren Jansen

Aren Jansen is a graduate student in the Department of Computer Science who is studying the problem of computer recognition of human speech. He received his BA in physics from Cornell University in 2001, an SM in physics from the University of Chicago in 2003, and another SM in computer science from Chicago in 2005.

Why did you decide to switch from physics to computer science?

I used to be in experimental high-energy physics. In high-energy physics you have both very exciting, productive times when experiments are being built or coming online and times where it’s mainly data analysis and not as fun. When I entered grad school, I joined a group whose experiment was mostly in data-analysis mode, so I thought it might be more exciting to pursue one of my other interests.

I also had a very strong interest in neuroscience, so I wondered if there was a practical degree where I could do some work in that field. Looking into the Committee on Computational Neuroscience, I found a couple of computer scientists there, including Partha Niyogi, who’s now my adviser. That led me to where I am now—trying to build a machine to do something the brain can do very well, which is speech recognition.

Why study speech recognition?

First and foremost, it’s an interesting technological problem. It has a plethora of useful applications, from ordinary computer interaction to helping people with disabilities. It’s also a very interesting problem in that it interfaces with a lot of otherwise distinct fields, like linguistics, computer science, mathematics, physics, and neuroscience. You can come at it from many different backgrounds and find a lot to keep you interested over time.

Besides the commercial applications of better speech recognition, how does your research advance computer science?

I’m interested in the underlying science of the problem. My view is that it’s very beneficial in approaching the problem to take inspira-



Aren Jansen

tion from different scientific traditions to refine your system design. Alternatively, you can use the system as a means to test various theories from those scientific traditions, like linguistics and artificial intelligence. That’s definitely where I’ve been coming from.

What’s the biggest challenge to solving the problem of speech recognition?

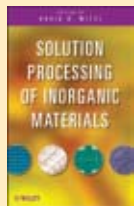
Depending on whom you talk to, some people will say the problem is solved; I happen to believe that it’s very far from solved. The main challenge left is achieving the robustness in the system that humans are capable of. You can put a human in all sorts of different environments and conditions, and they can still understand speech very easily. The ability of current systems to ignore noise and channel distortions and the like is far below that of humans.

I would claim that one of the biggest problems in the field is that there isn’t enough interplay between people who are trying to directly understand the architecture and the function of the brain and people who are trying to implement computer systems that perform tasks the brain does so well, like understanding speech. I think that making connections between those different fields will eventually expand the state of the art, not only in speech recognition but also for computer vision and all the fields related to artificial intelligence.

Faculty Bookshelf



Dan Hooper, assistant professor of astronomy and astrophysics, has published *Nature's Blueprint: Supersymmetry and the Search for a Unified Theory of Matter and Force* (HarperCollins). Written to be comprehensible to the nonspecialist, Hooper's book explains the origins and predictions of the theory of supersymmetry, including the new class of "superparticles" that it theorizes will be discovered by the Large Hadron Collider.



Dmitri Talapin, assistant professor of chemistry, has contributed a chapter to *Solution Processing of Inorganic Materials* (Wiley and Sons), edited by David B. Mitzi. Professor Talapin's chapter is titled "Engineered Nanomaterials as Soluble Precursors for Inorganic Films."

Looking for upcoming lectures and other events from the Physical Sciences Division?

Go to <http://event.uchicago.edu> for the University's new master calendar of events.

Faculty Additions

Mihai Anitescu, professor of statistics
(joint appointment with Argonne National Laboratory)

Paul Fischer, professor of statistics
(joint appointment with Argonne National Laboratory)

Kazuya Kato, professor of mathematics

Karen Livescu, assistant professor of computer science
(joint appointment with Toyota Technological Institute at Chicago)

Yury Makarychev, assistant professor of computer science
(joint appointment with Toyota Technological Institute at Chicago)

Gregory Shakhnarovich, assistant professor of computer science
(joint appointment with Toyota Technological Institute at Chicago)

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