

SCIENCE & MATH 2009

The College of

North Dakota State University, Fargo

**'ICE PEOPLE'
PREMIERES P.3**



What your CONTRIBUTIONS do

The NDSU College of Science and Mathematics depends on alumni contributions to provide a wide variety of services that benefit students. Each of these services acts as a puzzle piece that, when assembled, paints a picture of a college constantly striving to provide the best education to its students. While scholarships are by far the biggest benefit of alumni contributions, here are some other services your funds help provide.



The costs alumni cover

- \$50 – provides a biological sciences student with an Outstanding Student award
- \$100 – covers a coffee house rental for a community Science Café
- \$250 – helps with expenses for a student to present research at a conference
- \$500 – pays expenses for Darwin Days, an across-campus celebration of Darwin's science
- \$1,000 – brings a faculty member's mentor to campus to ease his or her transition from student to professor
- \$5,000 – adds to department endowment for supporting students, faculty and staff
- \$10,000 – endows a scholarship to provide \$400 a year to attract new students
- \$50,000 – remodels a laboratory in the coatings and polymeric materials department
- \$100,000 – endows a graduate student stipend to attract the best students
- \$500,000 – endows a professorship in the college, increasing the chances of keeping an award-winning faculty member
- \$1,000,000 – provides a building addition to support undergraduate science labs

Donations to the College of Science and Mathematics are administered by the NDSU Development Foundation.

Startup funds:

Erin Gillam, assistant professor of biological sciences, needed startup funds to continue her research on bats. She doesn't have a lab yet, but is gathering equipment.

Using microphones and a speaker capable of recording and projecting ultrasonic frequencies, she can observe bat calls and how they react to recordings of other bats. She is



Erin Gillam

researching bats' ability to maneuver in changing environments.

"If the Navy had sonar systems that are even half as sophisticated as bat echolocation, it would be above and beyond anything they have now," she said.

Similarly, Katie Reindl, an assistant professor of biological sciences, received a start up package to purchase new equipment and laboratory supplies, support undergraduate research assistants and support part of her work in the summer. "I am able to spend the funds on a variety of different things as opposed to just equipment or just supplies," she said. "This flexibility allows me to make the best use of the money."

Start-up funding to attract new faculty like Gillam and Reindl comes, in part, from alumni contributions.

Guest lectures:

The College of Science and Mathematics brings in top scientists from all over the country as well as sends out its own top professors for guest lectures. Whether bringing in or sending out, guest lectures require alumni funding for support.



James Coykendall spoke on the Rubik's Cube during a Science Café in February.

This year, the college started the Science Café series (see page 5) to take the value and fascination of science to the local community. One of the most important events that funds sponsor, according to college dean Kevin McCaul, is the Science and

Mathematics Community Lecture Series. Now in its third year, this series brings in top researchers from across the spectrum of science and math to give a community talk at the Fargo Theatre. The first, Lonnie Thompson, covered climate change. The second, Brigit Stuchberry, spoke about songbirds and migration. This year's speaker was Daniel Gilbert (more on page 5).

"These are internationally known speakers who have an uncanny ability to take their science to the community in a way the community appreciates," McCaul said.

They also spend time in classrooms so students get a close-up look at an internationally known scientist.

Each department also works to bring in their own guest speakers. Psychology runs a colloquium series on Friday afternoons, and mathematics conducts a workshop each year for young girls called Sonia Kovalevsky Day, which includes national speakers.

"We couldn't run all these series without alumni contributions," McCaul said.

Student travel:

Jeremy Brown, a Ph.D. student in computer science, traveled to Washington, D.C., in December 2007, to participate in the Institute of Electrical and Electronics Engineers Global Communications Conference. He presented a paper on wireless sensor networks—small computers with wireless capabilities.

This particular conference is the flagship of conferences for students like Brown, who will depend on such resume builders and networking to find employment in the future.



Jeremy Brown

"Anybody who's anybody in this field presents at this conference," he said.

The \$2,500 cost of attending this conference was partially offset by funding provided by alumni.

Attending conferences is a crucial part of graduate student education as well as an important opportunity for undergraduates. Getting to conferences around the country would be an undue burden for many students. Alumni contributions work to bridge that gap between NDSU and other parts of the country. Undergraduate students are able to meet potential graduate-school advisers at these conferences as well as see other scientists presenting their work. For example, the average cost of attending a geosciences conference is \$900. Alumni contributions can help cover \$300 of that.

The Geo-Alumni Endowment is the funding vehicle of the geosciences department. Only interest from the fund is used from year to year. While most of it is used for scholarships, alumni funds also help get geosciences students into the field for course work. Almost all geosciences students benefit from the funds. This spring, they participated in field courses in Colorado and Utah. They have traveled to Death Valley, Calif.; Ontario, Canada; and northern Minnesota. They also were able to take advantage of internships by working with a geologist for a day on a drill rig in western North Dakota.

For Bernhardt Saini-Eidukat, the benefit of alumni funds is to give students the ability "to see the science in real life as opposed to a picture on a PowerPoint or a sample in a box in a lab. You really can't understand the three-dimensional aspect of the Earth and its structures without physically being there."

A quick look at how departments use alumni contributions:

Biological Sciences: This past year the department gave out more than \$12,000 in awards, both undergraduate and graduate. Some awards are monetary; others are a combination of research funds and a stipend.

Chemistry and Molecular Biology: scholarships and awards for undergraduate students; award for one graduate student; travel support; interviewing expenses to recruit faculty

Computer Science: student scholarships; student travel to professional conferences

Coatings and Polymeric Materials: newsletter costs; Industrial Advisory Board meetings; student recruitment; new student orientation; visiting scholars and guest lecturers; research collaboration meetings; faculty startup

Geosciences: scholarships; travel to conferences; field visits to different parts of the country; student internship support

Mathematics: Contributions not for a specific scholarship fund help support the Pythagoras Award scholarships and Rao Exam awards and scholarships.

Statistics: student scholarships; faculty development through workshops and conferences

Physics: Alumni contributions are distributed to a number of student scholarships.

Psychology: The department handed out 17 awards during the past academic year, including scholarships, research fellowships and graduate student conference travel.

PRESIDENT'S MESSAGE



NDSU is an institution of choice for students, and the College of Science and Mathematics is an important player as we move forward.

NDSU's official fall enrollment stood at 13,229 undergraduate, graduate and professional students, which was a record for the ninth year in a row. A truly exciting development was the unprecedented 23 percent increase of first-year students.

Advancement is coming on many fronts across our university. We are working to diversify our faculty, staff and student body. I believe our students will not be fully prepared for a diverse, global work world if they are not part of an inclusive university environment. So, we are creating an Equity and Diversity Center and the President's Council on Global Outreach. By building partnerships around the world, we can further expand our research, enhance our educational offerings and help the economy of our great state.

In my State of the University Address, I outlined a number of goals, including:

- NDSU will further raise the caliber of its research enterprise.
- NDSU will be among the top 15 computer centers in the world.
- NDSU will continue to be one of the leading agricultural research programs in the world.
- NDSU will make advancements in the arts, humanities, health sciences, material science and science, and engineering and mathematics educational programs.
- NDSU will become one of the top 100 universities in the number of National Merit Scholars enrolled.

NDSU is an institution that continues to advance and succeed. Our stature is growing, our programs are being recognized across the nation and the best is yet to come.

- Joseph A. Chapman

DEAN'S MESSAGE



We are working on a new strategic plan for the college, including the development of new mission, values and vision statements. Although we have just initiated this process, it is already clear to me that our leadership team highly values service and that service to the community in particular will be part of our strategic planning.

Our faculty members are already involved in such service, of course.

Many of us, for example, followed Don Schwert's flood page this spring (www.ndsu.nodak.edu/fargoflood). And we began a new service of monthly events this year to take science to the community: the Science Cafés (described in this issue).

What you will not see here are multiple pictures of our wonderful students, staff and faculty members who committed to community service in preparing for (and, for the most part) surviving the flood. But I had to include at least one: I promise you that at least some of the hard-working volunteers in the picture to the right are proudly representing our college and North Dakota State University.

Please let us know any ways in which we can serve you!

- Kevin D. McCaul



Faculty, staff and students of NDSU joined the larger community at the Fargodome to fill sandbags during the spring flood.

COLLEGE NEWS



Adam Lewis, Anne Aghion and Allan Ashworth were on hand at the Fargo premiere of the documentary film that covered the faculty members' research in Antarctica.

"Ice People" shines at Fargo Theatre premiere

Well-wrapped audience members stepped gingerly on slippery paths among Emperor penguins sculpted from snow to attend the premiere of "Ice People" at the Fargo Theatre in early March. The life-sized penguins were a special treat for the premiere, created by three landscape architecture students who do competitive snow sculpting. "Ice People" seeks to capture the experience of living and working in Antarctica's extreme environment. The film focuses on staff and students from NDSU's geosciences department, as they camp in the mountains during an Antarctic summer and collect samples from ancient glacial deposits in their search for fossils.

"Ice People" was produced and directed by Anne Aghion who, along with a cinematographer and sound technician, spent four months filming in Antarctica to capture the experience of living and working in an extreme environment. Much of their time involved living with and filming the NDSU geology team.

In their studies, distinguished professor Allan Ashworth focuses on the fossils and assistant professor Adam Lewis focuses on tills. Till is made of clay, sand, gravel and boulders laid down by glaciers. When the glaciers retreated, lakes and rivers deposited sediments

that contain fossils of the plants and insects that colonized the landscapes. Together the soils and fossils are a rich source of information about the Earth's history and global climate change. In their discoveries, Lewis and Ashworth are rewriting part of Antarctica's history. Among other things, they have opened up our understanding of a major climate change at 14 million years ago. For example, the leaf fossil we see uncovered in the film was only the second time a fossil leaf of a southern beech tree has been found in the interior of Antarctica.

Meanwhile, at home, the wives of the scientists keep watch over the mundane. The seasons are reversed so while it is summer in Antarctica, the chores of winter fall on their shoulders, along with paying the bills and minding the family. Hazel Ashworth is retired and the film provided some unique rewards for her: attending film premieres in San Francisco, Paris and New York. But, because of friends, family and students, she said the Fargo premiere was the most fun of all. More than 800 people attended the Fargo showing, an audience which she described as being "as sophisticated as any of them."



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Think spring – but not too early

Study reveals ecological consequences of warming up too soon



Steve Travers

Ahhh spring – snow melting, birds chirping, trees budding – for most people the sights and sounds of spring can't come soon enough.

That's not the case for Steve Travers, assistant professor of biological sciences. Along with researchers across the globe, Travers is working hard to reveal the costly ecological effects of rising temperatures. He's spreading the message – careful what you wish for.

"We're not only seeing things get warmer," Travers said, "but plants and animals are changing what they are doing in response to it."

To demonstrate this, Travers and his graduate assistant, Kelsey Dunnell, analyzed the relationship between climate variables and the flowering time of native plant species in the Northern Great Plains over the past century.

They started with two primary questions: 1) Is Fargo warming up? and 2) Are plants changing when they flower?

Travers and Dunnell used climate data collected in Fargo as part of the North Dakota Agricultural Weather Network (a collection of 67 networked weather stations across the state).

Historic flowering data wasn't as immediately available.

When Travers joined NDSU in 2007 he had heard that former professor O.A. Stevens had recorded flowering dates for several plant species in the area. Armed with this information, Travers went digging in the library archives and struck gold. He found 51 years of handwritten notes from 1910 to 1961. They detail the precise flowering dates of more than 700 plant species in the Northern Great Plains.

Travers and Dunnell were able to compare the first flowering dates of native plant species in spring 2007 and 2008 to the flowering dates of the same species in the years 1911 to 1961.

They then compared the flowering data to climate variables, such as median daily temperature, snow fall and last freeze during each year.



Left: A photograph of a cemetery in Lowell, Mass., taken on May 30, 1868. **Right:** a photograph of the same location on May 30, 2005, taken by Dr. Primack. The year 1868 was not the coldest for New England, but the tree branches were still bare at the end of May. In 2005, the leaves were out and the flowers in bloom. Compared with Thoreau's observations in the mid-19th century, blueberry bushes in Concord, Mass., are now blooming more than a week earlier.

Four main conclusions surfaced:

- Spring temperatures in the Northern Great Plains have gradually increased during the past 100 years.
- The flowering phenology of many plants native to the region is closely tied to climate, particularly temperature.
- Many local species are flowering earlier than they ever did in the past century.
- Further shifts in climate toward earlier springs in the Fargo area are predicted to result in significant changes in local flowering phenology and could have important ecological impacts.

Travers and Dunnell have hypothesized about several negative ecological impacts. Pollinators might not shift causing reproductive issues; plants may flower and then be destroyed by a freeze; and crop diseases, which traditionally couldn't make it through short growing seasons, may spread.

But to Travers, this study is all wrapped into a bigger question – will the time shifts of some events disrupt others in the ecological world? The snowballing effect to the environment could be dramatic, requiring everything from reproduction cycles to migration patterns to adjust. For plants and animals that can't adapt, extinction is imminent.

Travers plans to continue gathering flowering data and hopes to get more people involved.

"One of things we are trying to do is to get amateur botanists or anyone who likes to go and just look at things outside, keep their eyes open and let us know through our Web site (www.ndsu.edu/ndsu/phenology) when things are flowering. The more people who are looking at it the better data we get."

Despite the negative trends he is uncovering, Travers says optimistic. "There are certainly a lot of aspects about it that can make you get really depressed. But there are also glimmers of hope that things can change," Travers said. "There's a value to showing people the real data."



Student Kelsey Dunnell stands next to passive warming cone for experiments on warming effects.

STEM Education doctoral program launched

In January, the Science, Technology, Engineering and Mathematics (STEM) Education doctoral program was launched through the School of Graduate and Interdisciplinary Studies. This interdisciplinary program is one of the first discipline-based educational research programs in the United States.

"There has been a significant amount of interest for this sort of degree program," said Erika Offerdahl, one of three faculty hired for the STEM education program. "There are very few programs that train people to do educational research in their discipline. That is why NDSU is so special. It is really visionary."

The purpose of the program is to prepare future college faculty who can successfully teach in their discipline and conduct research focused on teaching and learning at the collegiate level. Mila Kryjevskaja, another faculty member hired for the STEM education doctoral program, says that nationally there is a higher demand for faculty who will conduct educational research. "These faculty tend to work in isolation within their department, but here at NDSU there is a collaborative interdisciplinary team dedicated to student learning and discipline-based research in education," she said.

Possible research projects of students in the STEM education doctoral program might involve studying large-lecture learning environments, technological tools used for formative assessment, development of the understanding of the nature of science, gender issues in learning or characterizing barriers to knowledge integration in science and math.

The founding faculty members have joint appointments in the Colleges of Science and Mathematics (80 percent) and Human Development and Education (20 percent). The expectation is that future STEM education faculty also will be scientists with primary appointments in STEM departments.

The faculty and program work in collaboration with existing educational research programs in the STEM disciplines, the College Teaching Certificate Program and STEM educational research projects already established at NDSU.

"There are very few programs that train people to do educational research in their discipline. That is why NDSU is so special. It is really visionary."

– Erika Offerdahl

Interdisciplinary faculty established three required courses to coincide with students' diverse educational backgrounds. They ensure a strong understanding in education, research and expertise within a student's discipline. Discipline-based courses will complement the students' research interests as they conduct research for their dissertation to complete the program.

Organizers are in the process of hiring one more faculty member for the STEM Education doctoral program. The first student began in Spring 2009 with several more beginning in Fall 2009.

Biological sciences professor author of most-cited article



Craig Stockwell

Charles Darwin, commonly known as the father of evolutionary biology, said evolution would only be observed over long periods of time. He also acknowledged that evolution could occur due to artificial selection. According to Craig Stockwell, associate professor of biological sciences, this means that Darwin recognized that evolution could happen rapidly. "What Darwin probably didn't anticipate was the degree to which humans could become novel and important selective agents for wild populations," he said.

Stockwell, an evolutionary conservation biologist, has studied the response of wild fish populations to novel selection pressures. He applies scientific principles of evolutionary biology and ecology to his research subject to discover how evolution contributes to species persistence and endangerment. In February 2003, Stockwell was lead author on a journal article, titled "Contemporary Evolution Meets Conservation Biology," that was published in *Trends in Ecology and Evolution*. In June 2008,

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Biological Sciences

Students gain experience in Yellowstone research

This October, students in environmental science will have an opportunity to be involved in a four-day field experience at Yellowstone National Park investigating reintroduction of the gray wolf. All students in the class of more than 300 can submit questions for the participating team to investigate. Eleven of those students will accompany assistant professor Gerald Ketterling to the park. They will talk with researchers, observe wolves, make observations on how the park has changed, and talk with ranchers to get a complete picture of the complex issue. Students will give a multi-media presentation to the class when they return. This project is the result of a professional development grant to Ketterling to seek ways to engage students in real world issues and research while enrolled in a large lecture class.

Assistant professor Lisa Montplaisir is principal investigator on a \$743,516 award from the National Science Foundation. The Robert Noyce Scholarship Program was created to enhance the quantity and quality of secondary science and mathematics teachers across North Dakota and adjacent states. Recruitment of talented Science, Technology, Engineering and Math (STEM) students into a quality teacher preparation program will improve student achievement in classrooms and increase the likelihood for successful matriculation of high school students into STEM programs in college. NDSU's program has two components: 1) STEM scholars receive \$12,000 awards to enroll in dual majors leading to teacher certification with commitment to teaching two years in a high needs school, and 2) STEM internships available to first and second year college students for six weeks of summer funding for a research experience. Information on the program is available at www.ndsu.edu/csme/noyce. Co-principal investigators are assistant professor Angela Hodge, associate professor Canan Bilen-Green, assistant professor Erika Offerdahl, assistant professor Gerald Ketterling, professor Donald Schwert, professor Dogan Comez, and professor William Martin.

Chemistry and Molecular Biology

Labs renovated and faculty added

Several new personnel were hired, and multiple ongoing faculty searches were completed. We welcomed two new tenure-track faculty to our department: Stuart Haring, assistant professor, specializes in the molecular biology of DNA metabolism and cell cycle regulation; and Erika Offerdahl, assistant professor, specializes in chemistry and biochemistry education. Two staff scientists also were welcomed: Raj Murthy, director of the Core Synthesis Laboratory; and Jodi Haring, director of the Core Biology Laboratory. Both laboratories are funded by our NIH-funded Center for Protease Research and provide common instrumentation and training for users at NDSU.

Renovation of our teaching facilities continues. Ladd 309, one of three general chemistry teaching laboratories, was renovated in spring and summer of 2008 and re-opened in fall 2008. This room is primarily used for Chem 122L and some Chem 121L laboratory sections. Replacement of deteriorating bench work, floors and plumbing provide an improved and modernized work area for students. An improved bench layout and relocation of the glass shop to a nearby room resulted in a substantial increase in enrollment capacity for laboratory sections held in this room. We now serve more than 1,000 students in general chemistry laboratories each fall semester, and more than 600 each spring.

Coatings and Polymeric Materials

Big awards earned at coatings conference

Many of our students and faculty attended the principal North American coatings conference, FutureCoat! 2008, in Chicago. We maintained our prior success rate by winning a significant fraction of the awards for papers and presentations. Faculty and students won the Roon Award for papers and also fared well in other categories. Our graduate students dominated the poster session awards by winning first place in the undergraduate/master/young Ph.D. section and all the awards in the senior Ph.D./post-doc level.

Professor Gordon Bierwagen served on a National Research Council committee that produced a report on the state of corrosion education. The principal recommendations were that corrosion science should be more widely taught and the government should provide resources to universities to accomplish this. Since the department already teaches corrosion science, we anticipate increased interest in our offerings.

Not only does the department operate a North Dakota Center of Excellence to promote industry and jobs in North Dakota by helping companies here, but also we seem to be regaining more general industrial collaborations, particularly with our new faculty. Assistant professor Victoria Gelling recently started a project with Toyota and another with PPG. Assistant professor Andrej Voronov anticipates successful negotiations over intellectual property with a European company and that the project will start soon.

The first college Science Café was presented in February 2008 with help of the local American Chemical Society chapter. Howard Killilea of Valspar gave a presentation on paint at a large local hardware store that was well attended. This initiative will be the subject of an article in Chemical & Engineering News, the national weekly journal of the American Chemical Society.

We were sad to learn that Lowell Wood, long-time supporter of our department, died at the age of 94. He funded a scholarship in the department and recently was very active in the our Industrial Advisory Board. We often met him at Education Night of the Northwest Society for Coatings Technology in Minneapolis, where he had been vice president for Frost Paint and Oil Corporation.

Computer Science

Large grant awarded in computer science

It has been a year of minor growth and consolidation for our department, with potential for future increases from a number of sources. It also has been a "year of assessment" as the department simultaneously underwent annual assessment, program review and accreditation self-study—the rare trifecta.

Assistant professor Anne Denton and plant science associate professor Shahryar Kianian recently have been awarded a \$3.1 million National Science Foundation grant for wheat genome research, among the largest grants won by a computer science faculty member.

Two new faculty joined us at the beginning of the academic year. Assistant professor Juan Li from the University of British Columbia specializes in distributed systems, semantic Web technologies, information retrieval and knowledge discovery. Assistant professor Wei Jin from the State University of New York, Buffalo, specializes in data mining, information retrieval, machine learning and bioinformatics.

Three graduate students were awarded North Dakota Space Grant Consortium research assistantships in September. Later that month, former astronaut Col. Al Worden from the Apollo 15 moon mission visited NDSU. He met with students and their advisers to shake hands and pose for photos.

Assistant professor Yan Gu left NDSU to take a position at Auburn University.

Professor Kendall Nygard traveled to China in November and met with university officials at several institutions to discuss a new twinning agreement. Assistant professor Dianxiang Xu also visited China in January as part of a joint NDSU and Campus Development Group delegation to plan for a Fergus Falls development in 2010.

Geosciences

Film debuts and activities increase

Assistant professor Adam Lewis joined our faculty this year. Lewis, an outstanding teacher and researcher of glacial geology and long-term climate change, and distinguished professor Allan Ashworth completed another successful Antarctic expedition in 2008. Undergraduate Spencer Salmon was part of that trip. Ashworth and Lewis were featured in a film, "Ice People," directed by an Emmy Award-winning producer (www.icepeople.com). The film was shown to a large audience, including numerous alumni, on opening night of the Fargo Film Festival.

Our student numbers continue to grow, and senior lecturer Elaine Hatzenbuehler has her hands full with intro labs. The department complexion is changing with more emphasis on graduate study. Assistant professor Ken Lepper and assistant professor Peter Oduor have each shepherded two graduate students through their labs, with more on the way. Associate professor and chair Bernhardt Saini-Eidukat is involved in collaborative research on the origin of naturally high levels of heavy metals in North Dakota soils. And we recognize

professor Don Schwert's indelible imprint on so many students and colleagues during the years as he transitions to a more permanent administrative role at the university. Visit our Web site at www.ndsu.edu/geosci.

Mathematics

Grants awarded to assistant professors

Assistant professor Marian Bocea was awarded a three-year research grant in applied mathematics from the National Science Foundation that will support his work between 2008 and 2011. Assistant professor Sean Sather-Wagstaff received a two-year research grant in homological algebra from the National Security Agency from January 2009 until 2011.

The department hosted an undergraduate mathematics conference on April 24. Doug Anderson, Concordia College, Moorhead, Minn., and Scott Chapman, Trinity University, San Antonio, were the guest speakers.

Azer Akhmedov and Robert Hladky will join the department in tenure-track positions. Akhmedov is a visiting professor at NDSU from the University of California, Santa Barbara, and Hladky is currently at the University of Rochester, N.Y.

Psychology

Clinical psychologists join department

The Department of Psychology welcomes two new faces to the faculty. Assistant professor Kathryn Gordon earned her Ph.D. from Florida State University, Tallahassee, in 2008. She is a clinical psychologist specializing in eating disorders and suicidal behavior. Keith Donohue is also a clinical psychologist from Florida State. He teaches clinically related courses and is working on his dissertation. His research examines the influence of alcohol intoxication on emotions and attention. Professor James Council is back in the department after spending a couple of years as dean of libraries.

Despite difficult economic times, students in our program have benefitted tremendously from the generosity of friends and alumni. Recent donations to the Department Research Fund have supported two incoming freshmen. Mary Morth, Wheaton, Minn., and Leah Beckman, Eagan, Minn., were awarded \$1,000 research fellowships to get them involved in the laboratory early in their college studies. Erin Doerner and Konrad Bresin were named the E.V. Estensen outstanding psychology majors. Each received a monetary award and their names were engraved on a permanent recognition plaque in the department. They both plan to attend graduate school in psychology. New endowments to benefit student research and travel were named in honor of William Beatty and Kevin and Harriette McCaul. Thanks to everyone for being so generous with your support.

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