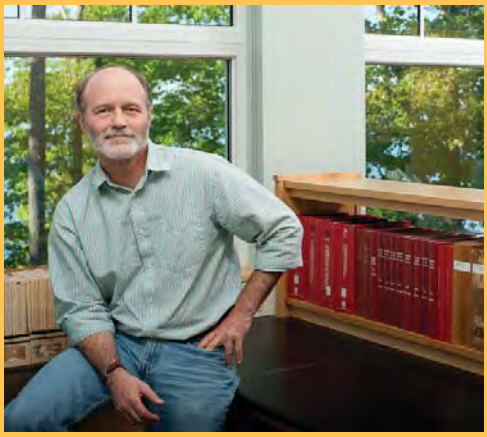
MDIBL
Connections

FALL 2012

MOUNT DESERT ISLAND BIOLOGICAL LABORATORY
CONNECTING SCIENCE, ENVIRONMENT AND HEALTH

The Genome Generation



MDIBL has come a long way over the last three years. We've recruited four outstanding new faculty members, built a new, state-of-the-art laboratory building, and launched seven innovative new courses, with more on the way. In this past summer alone, we've enjoyed unprecedented success with public programs like "Art and Science," the MDI Science Cafés, and restoration and conservation efforts in Frenchman Bay, and we received a wonderful million-dollar endowment to help support our research education programs.

MDIBL's stature is on the rise and today we are viewed as a vigorous and innovative growing institution. Without a doubt, much more hard work lies ahead to achieve our long-term scientific and educational goals and to attain greater financial security in this challenging and rapidly changing funding environment, but it's clear that we have momentum on our side. This momentum will help us as we continue recruiting the most promising young scientists and develop new signature courses that bring scientists and students from around the world to Salisbury Cove.

This issue of *Connections* features some of the people and events that make MDIBL such an invigorating place. Aric Rogers, now at the Buck Institute for Research on Aging, will be arriving at MDIBL in February, as you can see on p. 3. Dustin Updike moved into the Davis Center this past August, and on p. 8 there's an overview of his cutting-edge research into the structures that make some cells "immortal."

Our unique course on personal genetics for high school students integrates hands-on research with in-depth discussions of the ethical issues surrounding the fast-moving world of genomics and personalized medicine (p. 5). After taking the course, students leave MDIBL excited and energized, knowing their generation faces great challenges in dealing with the rapid flow of scientific advances, but certain that with integrity, creativity, and hard work, they can meet those challenges.

Kevin Strange, Ph.D.
Professor and Director

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Correction: On p. 10 of the Spring 2012 issue of *Connections*, the young man in the photograph with Barbara Colley was incorrectly identified as Chuck Wilde. In fact, Chip Wilde is pictured. We regret the error.

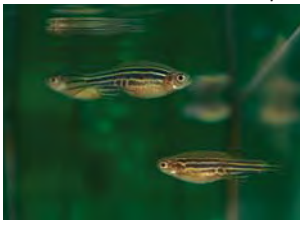
MDIBL Connections

FALL 2012

Alumni News p.12

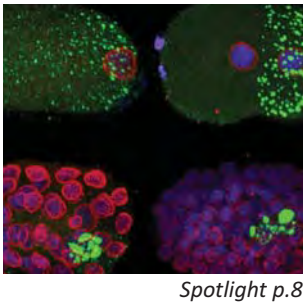
CONTENTS

Lab Notes p.2

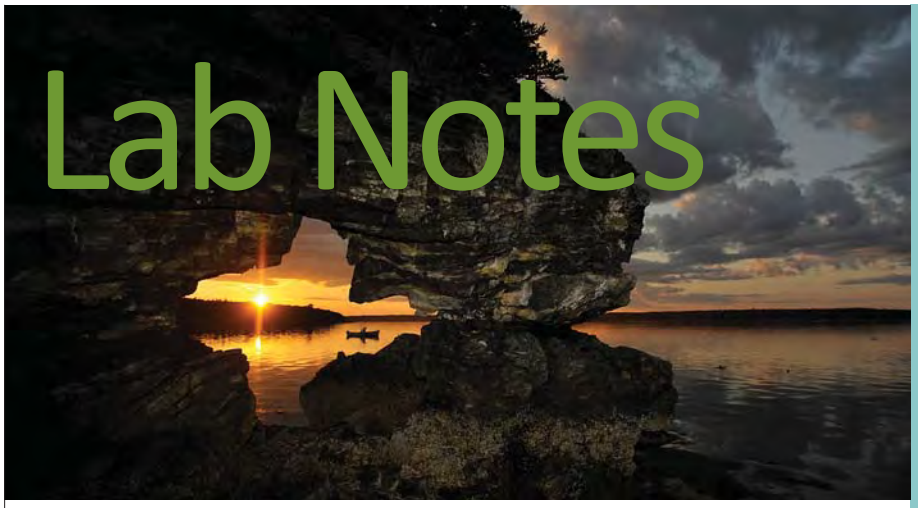


Spotlight p.5

Voices p.10



Spotlight p.8



Davis Center Dedication

Mrs. Davis with Kevin Strange, Congressman Mike Michaud, and James Boyer, Chairman of MDIBL's Board of Trustees.

The new home of the Davis Center for Regenerative Biology and Medicine was dedicated at MDIBL on August 10. Congressman Mike Michaud congratulated the Laboratory on its achievement, and representatives of Senators Susan Collins and Olympia Snowe read celebratory letters. All those present thanked Mrs. Kathryn W. Davis, the 105-year-old philanthropist for whom the research center is named, for her vision, generosity, and enormous zeal for life. Mrs. Davis has made gifts totaling $2.75 million to MDIBL.

As MDIBL Director Kevin Strange remarked at the dedication ceremony, "Regenerative medicine holds enormous promise for improving human health on countless levels. The Davis building is allowing us to recruit a critical mass of outstanding scientists who work at the cutting edge of the field, and who as a group are taking a unique approach to understanding how tissues can be repaired and regenerated. The ultimate goal of their work is to figure out ways we can reactivate our own, innate regenerative processes and use those to repair and replace lost tissues."

The 10,000 square-foot building cost $4.8 million and contains laboratory space for four principal investigators and their students and technicians, as well as a conference room and animal care facility. The project was funded primarily by the National Center for Research Resources, part of the NIH, with a substantial portion of those funds coming from ARRA stimulus funds. Additional support came from private donors and the Davis Family Foundation of Falmouth, Maine.

A Gala Evening for MDIBL

Over 180 people gathered at the Asticou Inn in Northeast Harbor on a July night to celebrate MDIBL and the intertwined history of art, science, and conservation on Mount Desert Island. The Star Point Society, made up of individuals who generously donate over $250 per year to MDIBL, sponsored the gala, which will be an annual event.

During the cocktail hour at the sold-out event, partygoers were treated to an exhibit outlining the history of art and science on Mount Desert Island and demonstrations from scientists Voot Yin and Jane Disney. After a delicious dinner, Catherine Schmitt of Maine Sea Grant and Thomas Cech (see p. 10), Nobel Laureate and MDIBL trustee, spoke about the scientific heritage of Mount Desert Island and MDIBL.

Schmitt traced the history of art and science on the Island, noting that "There is no separation between science and art, because those who practice science practice on the edge of knowledge." Cech observed that, unlike other leading research institutions founded in the natural history fervor of the late 19th century, MDIBL has stayed connected to its heritage through the use of diverse, natural models in its research and environmental programs.

The second annual Star Point Society Gala is scheduled for July 26, 2013.

New Faculty Member

Aric Rogers, Ph.D.

Aric Rogers, Ph.D., will join the MDIBL faculty as assistant professor in February 2013. "As an investigator interested in the biology of aging, joining the Davis Center for Regenerative Biology and Medicine at MDIBL just made sense for me," Rogers says. "The center's focus on defining the cellular and molecular mechanisms of regeneration is an ideal fit because my goal is to understand the degeneration normally associated with aging in hopes of one day delaying its onset or even reversing it."

Rogers is currently a postdoctoral researcher at the Buck Institute for Research on Aging in California and the recipient of a prestigious "Pathway to Independence" award from the NIH. He studies the relationship between protein synthesis and longevity in the roundworm *C. elegans*.

"We are successfully recruiting top-notch scientists to MDIBL," says MDIBL Director Kevin Strange. "Aric will be a wonderful addition to the growing Davis Center and will bring new insights to the all-important field of aging."

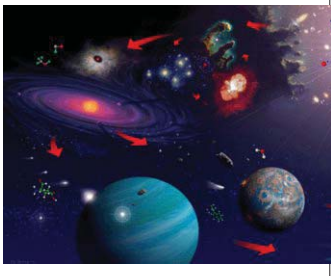
Diabetic Zebrafish?

MDIBL Assistant Professor Sandra Rieger is developing a new zebrafish model to help scientists understand the causes of diabetes-induced neuron injury and loss with the support of a $60,000 grant from the Diabetic Complications Consortium, a program of the National Institute of Diabetes and Digestive and Kidney Diseases.

Rieger, who studies the interactions between neurons and skin cells during wound healing and fin regeneration in zebrafish, says zebrafish larvae make ideal models for research on the complications of diabetes. Their glucose metabolism is similar to that of humans, but unlike mammals, they develop quickly and are transparent, making it easier to observe molecular processes.

Helping NASA Find the Origins of Life

Ben King, MDIBL staff scientist and biostatistician, will put his experience with a wide variety of genomes to work as part of a team of eminent evolutionary scientists and paleobiologists studying the origin, evolution, distribution, and future of life in the universe.



With the support of a major grant from NASA's Astrobiology Institute, King will collaborate with Kevin Peterson of Dartmouth College, a member of MDIBL's visiting faculty in 2011, to analyze microRNAs from targeted organisms. Their team, led by Roger Summons of MIT, will focus on applying knowledge about how signs of life are preserved in ancient rock on Earth to studies of Mars using the Curiosity rover.

Grant Helps Park Visitors Become Scientists

Visitors to Acadia National Park can help scientists assess the impact of environmental changes on animals and plants in the park using DNA barcoding to make accurate identifications, thanks to a new partnership between the National Park Service (NPS), the Schoodic Education and Research Center (SERC) Institute, and MDIBL. The National Science Foundation has awarded $250,000 to the new "BioTrails" project with Karen James, Ph.D., MDIBL staff scientist, as principal investigator.

"This partnership brings together three institutions with strong commitments to research, education, and conservation," says MDIBL director Kevin Strange. "It will give a new high-tech dimension to 'citizen science' in Maine and serve as a model for new collaborations between research institutions and national parks across the United States." More information on how you can get involved is available at www.mdibl.org/get_involved.

James Slater Murphy, M.D.

Murphy Fellowship Fund

A $1 million gift from an anonymous donor will establish the James Slater Murphy, M.D. Fellowship Fund at MDIBL. The fund will support outstanding high school, undergraduate, graduate, and post-doctoral students enrolled in one of MDIBL's research training programs.

"We are deeply grateful for this extraordinarily generous gift," says MDIBL Director Kevin Strange. "We are honored that the fellowship connects the Lab's commitment to the training of a new generation of young scientists with the scientific legacy of the late Dr. Murphy, not only because of his pre-eminence as a physician scientist but because of his lifelong love for Mount Desert Island and the people of Maine."

Dr. Murphy, who died in 2007 at the age of 85, was a distinguished virologist and a lifelong summer resident of Mount Desert Island. He received his medical degree from Johns Hopkins and spent more than forty years at Rockefeller University in New York City. His work was instrumental in the development of the first flu vaccine, and he pioneered use of the electron microscope and computer-generated mathematical models. During summers in Seal Harbor, he studied the life spans of *Daphnia* and other organisms collected from local ponds.

New and Honorary Trustees

Lewis Kinter, Ph.D., and Anne Lehmann joined MDIBL's board of trustees at the annual meeting in July, while three long-time trustees, Barbara Kent, Steen Meryweather, and Emy Leeser, were appointed honorary trustees.

Lewis Kinter, Ph.D.

New trustee Kinter has had a thirty-year career in the pharmaceutical industry and is now the senior director of regulatory toxicology for AstraZeneca Pharmaceuticals based in Wilmington, Delaware. "MDIBL played a seminal role in my career in research physiology, pharmacology and toxicology," he says. His father, William Kinter, Ph.D., was an MDIBL scientist, and Kinter became a specimen collector and then laboratory technician at the Lab. He received a bachelor's degree from Unity College and a doctorate in physiology from Harvard University.

Anne Lehmann

Anne Lehmann has been a seasonal resident of Salisbury Cove for the past 35 years. With an undergraduate degree from Denison University and a graduate degree from Marymount University, Lehmann worked for 14 years as a consultant for General Electric, Andersen Consulting, and Fidelity Investments. She now tends to her family in Concord, Massachusetts, and sits on four boards in the Boston area.

"Lew and Anne bring superb management skills to MDIBL as it continues its remarkable growth and development", says James Boyer, M.D., chairman of the MDIBL Board of Trustees. "We've been fortunate to have far-sighted board members over the past two decades, as you can tell from the Lab's current health and vitality."

Students from across Maine enrolled in MDIBL's high school laboratory course in personalized genomics, August 2012.

The Genome Generation

MDIBL's High School Course Tackles Genetics and Ethics

"Today's high school students are coming of age at a time when they can learn an unprecedented amount about their own DNA," says Dana Waring, a founder of the Personal Genetics Education Project based at Harvard Medical School who helps teach MDIBL's summer course in personal genetics for high school students. "They are the first generation that is going to have to make sense of all this genetic information and of personalized medicine."

That's one reason MDIBL launched the week-long course, "Infinite Variations," which combines hands-on laboratory work in genetics and bioinformatics with in-depth discussions about the ethical issues surrounding human genetics. Now in its third year, the course draws between fifteen and twenty teenagers from across the state who have an interest in science and have taken a year of biology or chemistry. The course is sponsored by Maine INBRE, a federally-funded network led by MDIBL that links thirteen Maine research institutions, colleges, and universities with a common goal of improving biomedical research and research training in Maine. There is no tuition, and the students who attend each year represent a cross section of the state's population.

"What makes this course so unique — and it really is unique — is the integration of the benchwork and the discussion around the social and ethical issues in genetics," Waring says. Students meet with Waring every day of the course to discuss some ethical aspects of genetics. "When you're covering ethics every day, it doesn't get relegated to some sort of second class status," she adds, noting that many programs give ethics only perfunctory consideration by scheduling a single, token session on the topic.

Indeed, an awareness of ethical issues permeates every aspect of the course, in and out of the laboratory. Charles Wray, Ph.D., MDIBL's director of scientific resources, designed and leads the course. He explains, "We wanted the students to gain an appreciation for the value and importance of their own genomes at a personal level. One of the things we emphasize is that there's no such thing as 'mutant' or 'normal.' There are just 'variants.' Everyone's unique. Everybody carries variations."

Student D.J. Brooks preparing a DNA genotyping assay.

In pursuit of that understanding and to develop their biomedical research skills, students in the course assay their own DNA to identify variations related to drug metabolism, athletic prowess (slow twitch/fast twitch muscle), male-pattern baldness, immunity to the Norwalk virus, and twelve other traits. They use four different techniques or assays, ranging from "old-fashioned" methods such as PCR followed by DNA sequencing to new, high-throughput techniques using fluorescent tags to find variations. Students are also introduced to bioinformatics, the use of computers and specialized software to analyze genetic information. As Wray says, "Today's students need to understand how to filter, use, and assess the immense amounts of biological data now available. They need to be able to drink effectively from the current fire hose of information."

Lab Work and Informed Consent

Though the DNA tested in the course comes from participant saliva, every sample is anonymous. No one knows whose sample they are working with, and every student is given the opportunity not to donate a sample. This year, two students declined to give samples, though Wray can't say why. "I take a very hands-off approach and do not ask why they might not want to participate. I firmly believe this is their decision. I like to think that I am giving them useful and adequate information before we begin so they can make informed but private decisions." Says Waring, "This concept of informed consent is one of the aspects of the course that connects the science and the ethics."

Dana Waring

Waring helps the students make direct connections between the science and the ethics. "The discussions were riveting," says Olivia Lopez, a student from Waterville Senior High School. Waring, who has a background in sociology and history, brings up issues ranging from personalized medicine, DNA data banking as a crime-fighting tool, eugenics, preimplantation genetic diagnosis and fetal selection, and athletic performance.

Attention-Grabbing Topics

"One of our challenges," Waring says, "is finding how best to engage young people in thinking about these questions that are so much about health and disease. That's not necessarily going to grab a whole lot of high school kids. That's why we talk about the pursuit of a genetic explanation of athletic traits. And certainly they can appreciate the complexity of the issues around reproductive genetics." Teenagers are in the process of asserting their own identities, Waring says, and the idea of parents selecting their children's traits always gets their attention.

Waring designed her portion of the course to promote discussion and independent thinking. "We're going through a time in history when people are really looking to genetics for answers, and I think talking about some of these complex traits and decisions, and getting the students to really think them through, will serve them not

just in college, but beyond. We want them to think about these issues in an analytical way before they're making a decision in a doctor's office."

Waring asks students to consider each issue on a scientific, personal, and societal basis. She started the Thursday session this summer by resuming a discussion of pre-implantation genetic diagnosis, where one cell of an eight-cell embryo is sequenced for certain traits and a decision is then made about whether or not to keep the embryo — "a very contentious subject," as Waring says. "How would you make rules about this?" she asks the students. "How would you enforce them?"

> **"What makes this course so unique — and it really is unique — is the integration of the benchwork and the discussion around the social and ethical issues in genetics."**

The subject had apparently already led to a heated discussion in the MDIBL dining hall. Back in session, one student ventured that it should be okay to choose for things like eye color. Others quickly pointed out that such decisions could lead to treacherous waters, with attempts to select for strength, intelligence, or good looks. "You really need to think about the extremes of what you're doing," another student said. Wray spoke up from the back of the room, "Do you guys really think you can select for intelligence, or is it just hypothetical?" Waring reminded the class that even a "simple" trait like height has been associated with at least 140 genes.

18 Students, 18 Points of View

"I don't know the answers," Waring says. "What we're trying to do is present multiple viewpoints on complicated social issues." After the discussion about reproductive genetics, she says, the students completed a survey asking if they agreed, strongly agreed, disagreed, or strongly disagreed with several statements. "No one agreed on anything!" she says. "So here was this great example of eighteen kids from Maine, who have been through the same course, and who came to eighteen different conclusions about the use of genetic information and reproductive decision making! And that, to me, is a success."

Waring clearly enjoys her work at MDIBL. "These kids were well informed, engaged, excited, and bright. It's great to have a chance to talk with people who have different opinions and are willing to speak up about them. If you want a strong diversity of opinion, go talk to a bunch of teenagers! They're the best, because they're just coming into their own. It's a great developmental age."

Course director Charles Wray (right) and assistant teacher Chelsea Bowers from Southern Maine Community College.

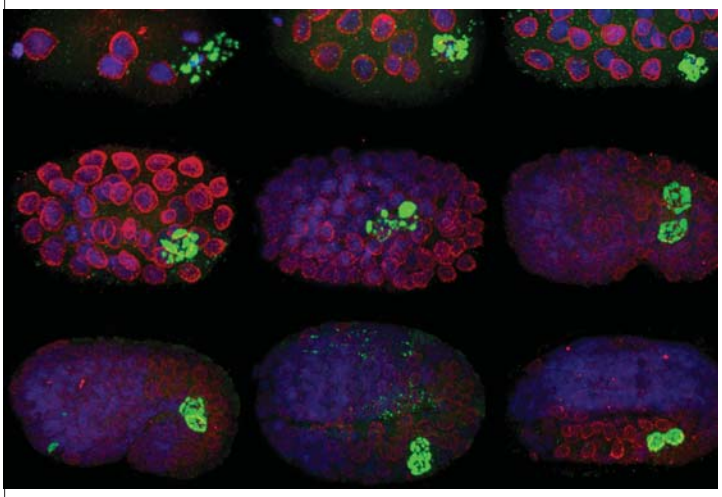
"The entire program really opened my eyes to the implications of all the new research being done in this field," says Jesse Lupica-Nowlin, a junior at Portland High School. "Dana stressed the fact that the complexity of the questions we were considering would only increase as time went on," comments D.J. Brooks, a senior at John Bapst Memorial High School in Bangor. "The realization that these issues will become more and more prevalent for my generation made the greatest impression on me."

Teenagers are at the threshold of their lives, choosing education and career paths. "I talk to them about some of the careers that are out there," says Waring. "There's a huge need for people who are scientifically literate, particularly in genetics, in all sorts of fields — not just medicine, but also law, public policy, and genetic counseling. I tell them, 'There will be opportunities for you!'"

This project was supported by the National Center for Research Resources and the National Institute of General Medical Sciences of the National Institutes of Health through Grant Number P20 GM103423. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agency.

The Secret to Immortality?

No individual organism lives forever; but its genes and traits may be passed along from generation to generation thanks to its germ cells. Germ cells are the progenitors of sperm and eggs, and the ability of any species to perpetuate itself depends on the ability of its germ cells to give rise to all the cells of each subsequent generation. That ability — the capacity of a cell to become, by dividing and differentiating, any and all parts of a given organism, including the next generation of germ cells — is called "totipotency." It's an extraordinary property that essentially confers immortality on germ cells. And when it comes to stem cells and possible stem cell therapies, totipotency is what you want.



In these images of a *C. elegans* embryo, germ granules have been tagged with a green fluorescent protein.

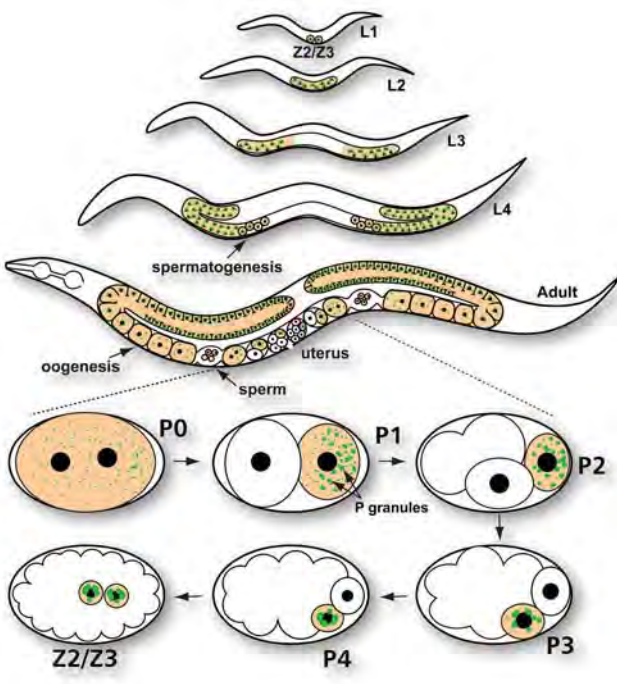
What makes germ cells totipotent? Dustin Updike, who joined the MDIBL faculty in August, studies small aggregates called "germ granules" that are found just outside the nucleus of germ cells. Initially described over 100 years ago, the granules were long thought to be simply markers that identified germ cells. But recent research has shown that they play a critical role in maintaining the totipotent and immortal properties of the germ cell line. Take away an organism's germ granules, and it becomes sterile. Find a way to add them to non-germ or "somatic" cells in some organisms, and those cells become fertile germ or stem-like cells. The remarkable regenerative abilities of planaria, which can be cut into hundreds of pieces and grow a complete individual from each piece, depend on cells called neoblasts. Neoblasts, it turns out, contain these same granules.

Dustin Updike

If, as Updike suspects, germ granules help keep germ cells from growing into more specific cell types, then learning how they apply those particular brakes may help us control cancer. Germ cells may also hold some of the keys to understanding the process of aging. After all, to perpetuate the species, an organism's germ cells must resist the effects of aging and of stressors within the environment. So Updike studies what role germ granules may play in avoiding senescence.

Though germ granules have been found in every animal in which they've been sought, the tiny roundworm *C. elegans* makes an ideal model for learning how they work. The worms are transparent and mature to adulthood in only three days. As Updike says, "You can do a lot in a short amount of time with *C. elegans*." The species has been so thoroughly studied that every cell has been mapped and numbered (see illustration). It also provides an abundant supply of germ cells — so many that it's been called a "crawling gonad." While the number of somatic cells in a single worm remains constant at 959, the germ line makes on average about 1,000 additional cells. "It's like a test tube for the germ line," Updike says.

In his work as a postdoctoral fellow in Susan Strome's laboratory at the University of California, Santa Cruz prior to coming to MDIBL, Updike defined the physical properties of germ granules. He found that they create a "micro-environment" held together with water-repelling bonds at the edge of the nuclear envelope — the double layered membrane that encloses the cell nucleus.



This figure shows the distribution of germ cells, colored orange, and germ granules, colored green, in C. elegans. *(Germ granules are known as P granules in* C. elegans *because they are found in the P-cell lineage.) At top is an immature worm with two only germ cells. As the worm matures, its germ cells reproduce.* C. elegans *is hermaphroditic. When egg and sperm meet, the new cell divides, giving rise to a non-germ cell and a germ cell containing germ granules. You can follow the germ cell lineage through repeated cell divisions.*

The nuclear envelope is perforated with openings created by large protein structures known as nuclear pore complexes. Those complexes serve as "bouncers" for the nucleus, deciding which molecules may enter or exit. Many of those molecules are strands of RNA, bound for the cytoplasm where the code they carry from the nucleus's DNA will determine which proteins the cell produces. Germ granules lie over these nuclear pore complexes and, Updike discovered, add another layer of control over how RNAs exit the nucleus. The interior of each granule consists of sieve-like proteins that can trap RNA molecules before they can enter the cytoplasm. If specific RNAs encode factors that would cause germ cells to differentiate into a particular cell type, germ granules have the ability to "turn off" those RNAs.

"If, as Updike suspects, germ granules help keep germ cells from growing into more specific cell types, then learning how they apply those particular brakes may help us control cancer."

In this way, germ granules ensure that the cells of the germline remain totipotent.

To test this hypothesis, Updike removed all the germ granules from germ cells. "It's a tricky thing to do," he says, "but once you do it, the cells begin to change and lose their totipotency." So the function of germ granules is not so much to make a cell into a germ cell, but to prevent the events that would otherwise cause the germ cell to differentiate. Or, as Updike puts it, "Germ granules maintain totipotency in the germ line by repressing the translation of factors that promote somatic fate."

Updike is now identifying the RNAs that reside in germ granules and studying how they influence the germline. He has devised a way to create germ granules in intestinal cells, where they are not normally found, to see if they promote cell survival and stress resistance. Everything he learns about germ granules contributes to our understanding of regeneration and stem cells. "Germ granules aren't the only factor that confers or maintains totipotency," Updike says, "but they are an important factor. Sometimes they are neglected, because a germ granule is a complicated beast. But we're figuring them out."

LEFT: Cech giving the keynote address at MDIBL's Star Point Gala. BELOW: Cech with the members of his lab in Colorado.

MDIBL Voices

Name: Thomas R. Cech, Ph.D.

Current Positions:
Distinguished Professor of Chemistry and Biochemistry, University of Colorado, Boulder
Director, University of Colorado Biofrontiers Institute
Investigator, Howard Hughes Medical Institute

Former Position:
President, Howard Hughes Medical Institute, 2002–2009

Awards:
Albert Lasker Basic Research Award, 1988
Nobel Prize in Chemistry, 1989
National Medal of Science, 1995

MDIBL Affiliation
Member, Board of Trustees

Q: You were the president of the Howard Hughes Medical Institute (HHMI), the nation's largest private biomedical research organization, for nine years. Now you're back in your lab at the University of Colorado full time. What's the best thing about being back at the bench?

A: When I commuted to my lab once a month from HHMI in Maryland, I missed the daily interactions with students, lab personnel, and colleagues. Now when someone in my lab has a "hot new result" or has run into problems, they can poke their head into my door for a chat, instead of waiting until my monthly visit or using e-mail. It's much more natural.

Q: What are you most proud of accomplishing at HHMI?

A: I had a great team at HHMI, and together we were able to enhance what was already a great institution. In terms of biomedical research, we moved into interdisciplinary areas and also built the Janelia Farm Research Campus as a new model for interdisciplinary research. We established a program to increase the number of students from underrepresented groups getting Ph.D.s, and the impact thus far has exceeded expectations.

In the international arena, we continued to support individual researchers around the world and also launched a partnership with the University of ZwaZulu-Natal in South Africa to investigate the relationship between HIV and tuberculosis.

Q: Did winning the Nobel Prize change your life?

A: Prior to the prize, I was well known in the scientific community, but enjoyed a wonderful obscurity in my personal life. After the prize, I couldn't even shop in the grocery store without being asked for autographs. Fortunately, that's calmed down a lot, although I still find it uncomfortable to be put on a pedestal.

Q: You came to MDIBL for the first time in 2007 to give the Boylan lecture "RNA and the Origins of Life." What made you decide to join the MDIBL Board of Trustees?

A: MDIBL's transition to a year-around research institution was full of both opportunities and challenges, and I thought my experience could be useful. The research mission, particularly the move towards regenerative biology and medicine, is very exciting. Engaging students in hands-on research is a passion that I share with MDIBL. And finally, Terence Boylan, who was then chairman of the board, is extremely persuasive, especially when he's wielding his guitar!

Alumni News

Thousands of science professionals and students at all levels, from high school through medical school, have come to MDIBL for research fellowships and training programs. Our alumni have contributed to science and other fields in critical ways and help give MDIBL its global reach. Here's some of the news we've received recently.

If you are an alum, we want to hear what you're up to. Let us know what's new through the alumni page on www.mdibl.org or via Facebook. Better yet, come visit and deliver your news in person!

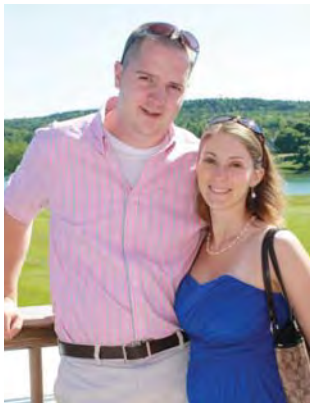
Dacie Manion

Dacie Manion, MDIBL '10, '11, and '12, has been awarded a Department of Defense SMART Scholarship. SMART scholarships offer full tuition and generous annual cash awards to students who have demonstrated ability and special aptitude for excelling in science, technology, engineering, or math. The scholarship will continue through 2015, when Manion plans to graduate from MIT with a degree in mechanical and biomedical engineering.

After graduating, Manion will work full-time for three years at the U.S. Army's Tank Automotive Research, Development, and Engineering Command (TARDEC), in addition to completing summer internships at TARDEC over the next two summers. Manion credits her time at MDIBL with helping her prepare for the award. "The past three summers at MDIBL have truly shaped the way I view my academic career, and firsthand research experience has been an invaluable component of my education. I am thrilled about the opportunity the DoD SMART Scholarship offers me to continue applying and expanding my studies in an innovative research environment, as I was fortunate to do at MDIBL."

Jason Rafferty

Jason Rafferty, MDIBL '03 and '04, received a doctorate in medicine and master's in public health from Harvard University in May. A graduate of Bates College, Rafferty taught eighth-grade math before beginning his graduate studies at Harvard. He previously completed an Ed.M. from the Harvard Graduate School of Education, where he was recognized with the Intellectual Achievement/ Faculty Tribute Award for dedication to scholarship that enhances the academic life of the community and positively impacts fellow students. His current residency at Brown University combines pediatrics, psychiatry, and child/adolescent psychiatry.



Julie and Jason McFarland

Julie Burns McFarland, MDIBL '03 and '04, received her M.D. from Brown University this past spring and is now an OB/GYN resident at the Maine Medical Center in Portland. She and her husband are expecting their first child this November.

"My husband (who is also from Bar Harbor) and I are very excited to have moved back to Maine, and couldn't imagine leaving again so I can confidently say I'll be sticking around to practice somewhere in the state," McFarland reports.

Sarah Reisman

Sarah Reisman, MDIBL '96, has received numerous awards for her work as an assistant professor of chemistry at the California Institute of Technology. This year she was designated an Alfred P. Sloan Research Fellow and awarded the prestigious Cottrell Scholar Award for Science Research and Teaching. In August, she received the 2013 American Chemical Society's Arthur C. Cope Scholar Award recognizing "outstanding achievement in the field of organic chemistry," while earlier in the year, the Women Chemists Committee of the same society named her a "Rising Star."

Reisman's laboratory at Caltech works to develop new ways to synthesize in the laboratory chemical compounds that are produced naturally by plants, bacteria, or fungi. Reisman says, "I actually think of my summer at the MDIBL frequently; it was such a fantastic opportunity for a high school student. I now collaborate with a colleague at Caltech to study novel synthetic molecules (prepared in my laboratory) that block ion channels — using the same experimental techniques that I learned at MDIBL!"

Stacy Littlechild

Stacy Littlechild, MDIBL '09, received her bachelor's in biology from the Kansas State University in May and is heading to Cardiff University in Wales to earn a doctorate in biophysics with a full international fellowship. During her work at MDIBL and Kansas State, Littlechild developed a new glue mixture that may reduce risks after laser vision correction surgery. She is lead author of two papers in the journal *Investigative Ophthalmology & Visual Science* detailing her discovery.

"The summer I spent as an intern at MDIBL is where my 'super glue to immobilize the LASIK flap' project was born," Littlechild says. "The collaborative and energetic atmosphere of the lab inspired innovation and progress. With all the encouragement from staff and fellow students alike, I always felt supported. On top of that, I made unforgettable memories playing sand volleyball and hiking in Acadia National Park with students who became close friends that I keep in contact with, years later."

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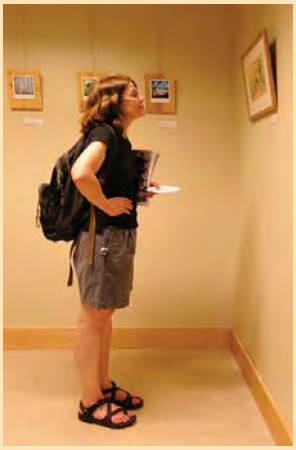

MDIBL: Where Art & Science Meet

Scientific images, alive with fluorescent colors and intriguing patterns, joined the work of twenty local artists on the walls of the new Davis Center for Regenerative Biology and Medicine this past summer for the exhibit, "Where Art and Science Meet." Sculptures in stone and metal graced the newly landscaped grounds and one, called "Einstein's Rattle," hung amid the spruce trees along the Lab road.

Many visitors to the exhibit found themselves in a laboratory for the first time. The opening reception and tours throughout the summer offered conversations with scientists working in the Davis Center in addition to opportunities to see the artwork. "What MDIBL created this summer wasn't simply an art show," explained Julia Bretz, Development intern and tour guide. "It was an invitation for visitors to connect with something that at first seemed outside their realm of understanding. The art show turned newcomers into MDIBL enthusiasts and advocates."

Annette Carvajal of Mount Desert served as co-curator of the exhibit along with Bonnie Gilfillan of the Development office. "Science and art share a path," Carvajal says. "Both look through the known to the unknown, see through the obscure, seek solutions, and accept new possibilities." Plans are underway for future collaborations between artists and scientists. Stay tuned!

Photos: Metal sculpture *Cloud Series, Sunset 2007* by Melita Westerlund; inside the Davis Center; *Rugosa Reach* by Linda Perrin