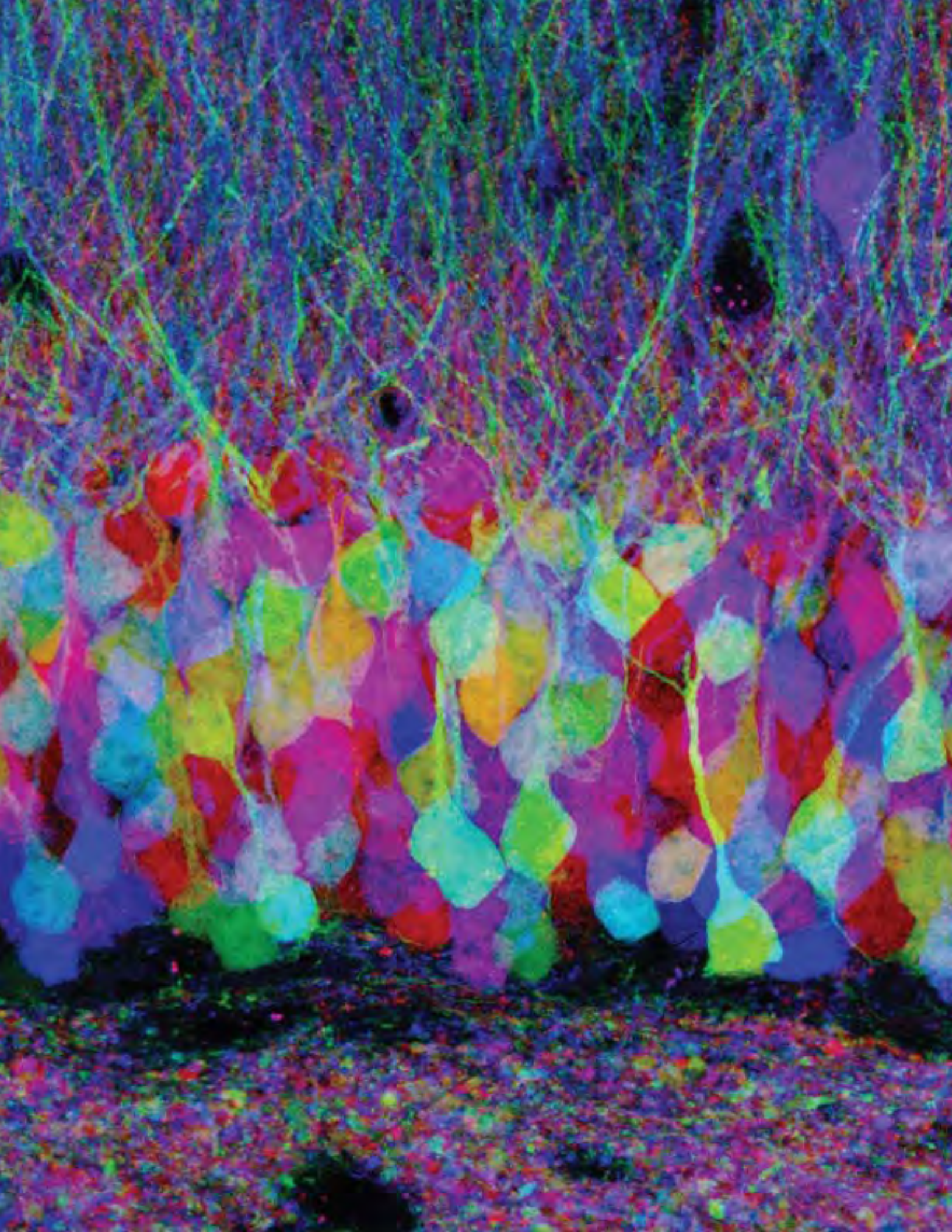
THE SEARCH

the race to inner space

Take a deep breath
Catalyzing CF research

Where our world can unite
Igniting a passion for science

The Jackson Laboratory: Leading the search for tomorrow's cures Vol. 1 No. 1



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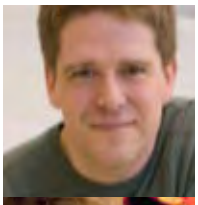

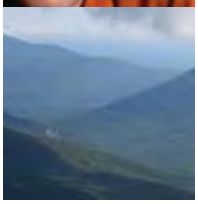

Departments

Stunning science

The striking image to the left has two facets. It won the Olympus BioScapes Digital Imaging Competition for its resemblance to a "vivid impressionist painting." It also represents a scientific breakthrough that will greatly help brain research and get us closer to knowing how learning, action and sensation take place in our brains. *(See "Rainbows on the brain" in News & notes to learn more.)*

Cover photography by Stanton Short

News & Notes

Rainbows on the brain

Harvard University researchers led by Jeff Lichtman, M.D., Ph.D., had a problem. How can you investigate neuron connections when there are billions of them and they all look the same? With innovative thinking and a bit of good fortune, they have developed a new technique in mice that makes it much easier to distinguish neurons from one another. As reported in *Nature*, their idea yielded better-than-expected results, highlighting individual neurons with one of almost 90 different colors. The images are not only stunning (see inside front cover) but extremely valuable. As scientists delve further into the mysteries of our own brain—and how to heal it—these so-called "Brainbow" mice, now available from The Jackson Laboratory, are a powerful new tool for discovery.

Hope for better leukemia therapies

Led by Leonard Shultz, Ph.D., of The Jackson Laboratory, researchers recently developed a new way to investigate a dangerous cancer, acute myelogenous leukemia (AML). Chemotherapy treatments for AML are generally effective at first, but research has implicated rare cells called cancer stem cells in the high incidence of cancer recurrence. As reported in *Nature Biotechnology*, Dr. Shultz and collaborators created a way to research human leukemia in mice. Using their system, the researchers characterized where the stem cells locate within the bone marrow, demonstrated that leukemic stem cells can initiate and renew the disease, and showed that they are highly resistant to conventional chemotherapies. Working with the new research techniques, scientists now have the ability to focus on the development of patient-specific AML therapies that are targeted to leukemic stem cells.

Victor McKusick awarded the Japan Prize

Victor A. McKusick, M.D., co-founder of the internationally renowned Short Course on Medical and Experimental Mammalian Genetics held each year at The Jackson Laboratory, is the 2008 recipient of the prestigious Japan Prize in Medical Genetics and Genomics. Dr. McKusick is a trustee emeritus of the Laboratory and currently University Professor of Medical Genetics at the Johns Hopkins University School of Medicine. The Short Course has attracted a long list of top genetics researchers through the years and

The Search

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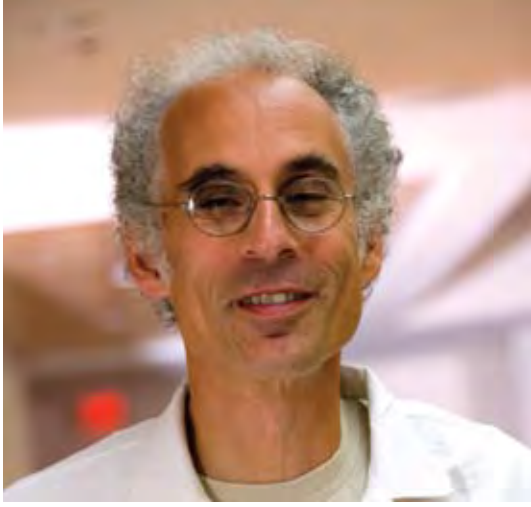
The Search: Welcome to The Jackson Laboratory

Visitors to The Jackson Laboratory have a near-universal response. They are impressed. And they are surprised. Surprised by how big we are, how strong our research program is, how profoundly we contribute to biomedical research around the world. "Leading the search for tomorrow's cures" isn't something we just say—we live it every day. There's much more to what makes the Laboratory truly unique and important, however, and the "more" is what impresses and surprises.

In *The Search* we introduce you to the Laboratory and the extraordinary people who contribute so much to its mission of advancing human health. See where we work, think and explore. Perhaps one day you will be able to come to our campus in beautiful Bar Harbor, and we hope you come away impressed. But not surprised.



Clifford Rosen, M.D.

will celebrate its 50th anniversary in July 2009.

"Dr. McKusick is most deserving of this award, which many in the scientific community compare in stature to the Nobel Prize," said Jackson Laboratory Director Richard Woychik, Ph.D.

Robert Braun, Ph.D., selected as chair for research

The Jackson Laboratory selected a distinguished scientist in its field of reproductive genetics, Robert Braun, Ph.D., as its new associate director and chair for research. Dr. Braun joins the Laboratory from the University of Washington School of Medicine. Laboratory Director Richard Woychik, Ph.D., described Dr. Braun as "an internationally prominent scientist with the highest research credentials." Dr. Braun earned his undergraduate degree in molecular, cellular and developmental biology, chemistry and mathematics at the University of Colorado, Boulder, and his Ph.D. in the Tufts University School of Medicine department of microbiology. He started with the University of Washington in 1986, when he joined as a postdoctoral fellow. The recipient of many honors and awards, Dr. Braun previously worked at The Jackson Laboratory as a visiting scientist in 2001-2002.

Upcoming courses and conferences

The Jackson Laboratory sponsors a wide variety of courses and conferences for researchers and students.

Courses

Colony Management: Principles and Practices

University of North Carolina, Chapel Hill, N.C., May 16 - 18

Frontiers in Microscopy: Whole Animal Imaging

The Jackson Laboratory, Bar Harbor, Maine, June 30 - July 3

49th Annual Short Course on Medical and Experimental Mammalian Genetics

The Jackson Laboratory, Bar Harbor, Maine, July 20 - August 1

Meetings

Discovery Strategies Conference: Modeling Human Autoimmune Diseases in the Laboratory Rodent

UCSF, San Francisco, Calif., May 27 - 29

See details and the full listing of courses and other educational opportunities at www.jax.org and go to "Courses and education."

Shedding light on osteoporosis

Osteoporosis, a disease of low bone mass and deterioration of bone tissue, afflicts about 10 million Americans, mostly women. According to the National Osteoporosis Foundation, it causes 1.5 million bone fractures with a direct cost of $20 billion a year.

The Jackson Laboratory in January organized the 13th annual Maine State Symposium on Osteoporosis to help improve the outlook. Co-chaired by Clifford Rosen, M.D., of the Maine Medical Center and The Jackson Laboratory, and Larry Raisz, M.D., of the University of Connecticut, the symposium gathered scientists and clinicians to share research, present case studies and discuss diagnostic developments. Bringing scientists and clinicians together is critical for moving scientific knowledge into the clinic for the benefit of patients.

Scientists at the Laboratory continue to study osteoporosis in both clinical and laboratory environments. It's a formidable challenge to find the genes involved, but it's clear that genetics plays an important role in the development of osteoporosis. The research findings are vital to developing the next generation of therapies.

Take a deep breath

by Mark Wanner Photography by Ned Johnston

About five years ago,
Steve Murray arrived with his family in Bar Harbor, Maine, to start a new chapter in their lives.

For Dr. Murray, a newly minted Ph.D. biochemist, The Jackson Laboratory offered a challenging research position using mouse genetics. And he and his wife Rebecca, emerging from urban Boston, thought Bar Harbor looked like a good place to raise their 4-year-old son and yet-to-arrive daughter.

Dr. Murray began work as a postdoctoral fellow with Professor Tom Gridley, whose lab investigates the intricate mechanisms that direct early development and growth. But soon life for the Murrays was forever changed by a different kind of developmental anomaly. Rebecca went for a routine ultrasound that turned up a disquieting image. Genetic tests revealed that both parents were carriers for cystic fibrosis (CF), and an amniocentesis confirmed that their unborn daughter had the disease.

Five years later, Dr. Murray is excited about a new development that promises to improve CF research, a mouse that models the disease's impact on the lungs. As a scientist, he explains the research and genetics involved, but as a father his sense of purpose and goals extend far beyond his lab.

"I'm working in science, and I'm in a position to help the human condition," Dr. Murray reflects. "I can improve mouse models and help bring them to other researchers, which will make pre-clinical testing more effective. I'm also looking to build relationships with other CF research groups and help create synergy in the effort. But in the end, it's about translating the research to human medicine."

A different kind of development

Dr. Murray is affable and soft-spoken, but his piercing intelligence is quickly apparent. The terms and concepts of his work come thick and fast, easy and familiar in his world, but leaving the non-scientist sprinting to catch up.

After receiving his bachelor's degree in biology at highly regarded Carleton College in Minnesota, Dr. Murray headed east to work as a research assistant, then entered a Ph.D. program in biochemistry at the Boston University School of Medicine. His work there consisted mostly of studying "cells in a dish."

His move to postdoctoral work with Dr. Gridley was a logical next step in what was, to that point, a fairly typical progression for a promising young scientist. He settled into the grueling postdoc routine of intensive bench work while supporting his young family.

"I'm in a position to help the human condition," Dr. Murray reflects. "I can improve mouse models and help bring them to other researchers, which will make pre-clinical testing more effective."

Then came the news that was to shape Dr. Murray's outlook and future path. Learning about their daughter's condition before she was born, while traumatic, eased some of the transitions that awaited the family.

"Most children aren't diagnosed until they're two or three years old," says Dr. Murray. "There's no way I can know for sure, but I think it was very helpful for us to know before Maggie was born. We were able to work with a genetic counselor and raise issues beforehand so we could have everything properly arranged for her."

Maggie stayed in the hospital for 13 days and had surgery soon after birth. But she thrived after that and had few complications as she progressed through toddlerhood. The Murrays felt some pressure to relocate somewhere near

Understanding **cystic fibrosis**

Cystic fibrosis, or CF, is a fatal disease, but the prognosis is far better than it was 50 years ago. At that time few children lived into their teens, but advances in clinical research and treatments now make it common for people with CF to live into their 30s and beyond. Of course, the ultimate goal of research is to find an outright cure, but continued progress in managing the disease already holds the promise of a much brighter future.

CF is caused by mutations in a gene called CFTR. The CFTR gene is important for establishing the proper flow of water and chemicals in and out of cells. Mutations in CFTR can disrupt this flow, leading to widespread consequences. The immediate effect is on the body's production of mucus, the viscous, slippery substance that lines and protects our airways, digestive system and other tissues.

People with CF produce mucus that is abnormally thick, leading to problems in the organ systems in which mucus plays crucial roles. The most prominent symptoms involve the lungs, where mucus accumulates and sometimes obstructs the airways. This causes breathing difficulties and encourages bacterial infections. The abnormal mucus can also interfere with pancreatic duct function, leading to digestive problems.

While it has been well established that CFTR causes the disease, other genetic factors are thought to strongly influence its severity and course. The CFTR mutation affects different people in different ways, indicating that a person's genetic background, including mutations in genes other than CFTR, probably contributes to moderating or exacerbating effects. Environmental factors are also likely to play a role, although the exact causes and effects are still not entirely clear.

a major medical center for Maggie's care, but Dr. Murray stayed with his postdoctoral work. After his final paper as co-author with Dr. Gridley appeared in the prestigious *Proceedings of the National Academy of Sciences* (PNAS) in 2006, Dr. Murray faced some important decisions. As he pondered how he wanted to proceed, he reached some not-so-typical conclusions.

"I tested the waters a bit in the faculty job search market, but I'm not a lung biologist. It would take quite a long time to learn the nuts and bolts of the field and get my own program. Also, we didn't want to move—we had become attached to Downeast Maine. Maggie was receiving topnotch care. We are fortunate that there are great doctors in this area. So I was unsure of exactly what I wanted to do."

Finding his way

The opportunity to make a difference and stay in Bar Harbor came at a perfect time. A position opened in Genetic Resource Science (GRS) at the Laboratory about a year ago, just as Dr. Murray was finishing his postdoc and considering his next career move. While it didn't provide him with his own laboratory, it did significantly speed his ability to contribute to CF research.

Among his other tasks, Dr. Murray is working to develop a cystic fibrosis repository. The repository would gather mouse models for CF in one place, fully characterize their genetic backgrounds and mutated gene(s), and make them available to biomedical researchers. Dr. Murray is aware of 15 or so different mouse models for CF that have been used in published work, but they are scattered in different laboratories and are not easy for other researchers to use. The repository would be a boon to the CF research field, providing a resource for research and a hub through which scientists can interact.

The CF mouse that excites Dr. Murray is from a group at the University of North Carolina. Helping to build relationships with other institutions and create a collaborative effort is a big part of his goals for the repository.

With his own research, Dr. Murray hopes to address three crucial needs. The first is to improve the new mouse model by altering its genetic background,

"On the one hand you want to protect and shield her but you also want her to have fun and be a kid."

mitigating both the age of onset and severity of the disease. Second, because different patients with the same mutation in the CF gene (CFTR) can have very different disease progressions, he is looking to define the genes that affect disease progression. It is these genes that could be ideal targets for future drug development. Finally, he wants to provide pharmaceutical companies with the ability to test new drugs in a variety of genetic backgrounds.

"Testing drugs in different genetic backgrounds would improve drug development," Dr. Murray says. "It would also prevent a lot of wasted time and resources spent on developing drugs that might work well in a particular strain but are ineffective or dangerous with other genetic backgrounds."

A balancing act

Today, Maggie is a bright 5-year-old who plays, swims and dances with her peers. Common colds and other illnesses are significant challenges to CF patients, so coordinating her activities is a fine balance that her parents have mastered well.

"On the one hand you want to protect and shield her," Dr. Murray says, "but you also want her to have fun and be a kid. Maggie is doing well, active and happy, and that's what counts."

Her father is coming to terms with balance in his life, too. Outside the Laboratory, Dr. Murray is active in the Cystic Fibrosis Foundation, working with fellow employee Woody Leighton, who founded the local chapter years ago after his daughter Katie was born with the disease. Katie is now in college, and the Leighton and Murray families collaborate on the annual Great Strides Walk fundraiser. At the Laboratory, Dr. Murray toils to push CF research progress forward. But at the end of the day, he stops his work, sets other things aside—and plays with his children.

"Ever since Maggie was born I've wanted to go into CF research, and a lot of PIs [principal investigators] in the field have a personal connection to the disease. My wife and I have thought about and discussed the wisdom of me going into work that can become so all consuming. The CF repository is a part of my job now, not all of it, and that's probably a good thing."

5 ques

tions...

Jim Yeadon, Ph.D., Technical Information Scientist/Specialist, The Jackson Laboratory

Q: How did you get interested in science?

A: I have early memories of turning over rocks to find toads, walking to a nearby pond to catch frogs, and looking at plants. I grew up in Vermont and was always intrigued by wildlife. By the time I got to high school I knew I wanted to be a scientist; I just didn't know what kind.

Q: What kind of scientist did you become?

A: Different kinds! I got my Ph.D. in developmental neurobiology from MIT, but I realized along the way that I didn't have a passion for bench work. So I landed a job as research assistant in horticultural taxonomy at the Brooklyn Botanic Garden, which turned out to be wonderful. And now I'm a Technical Information Scientist/Specialist here.

Q: What do you do as a Technical Information Scientist?

A: I answer questions from researchers around the world when they call asking advice about how to best use mice in their research. I answer maybe 25 questions a day.

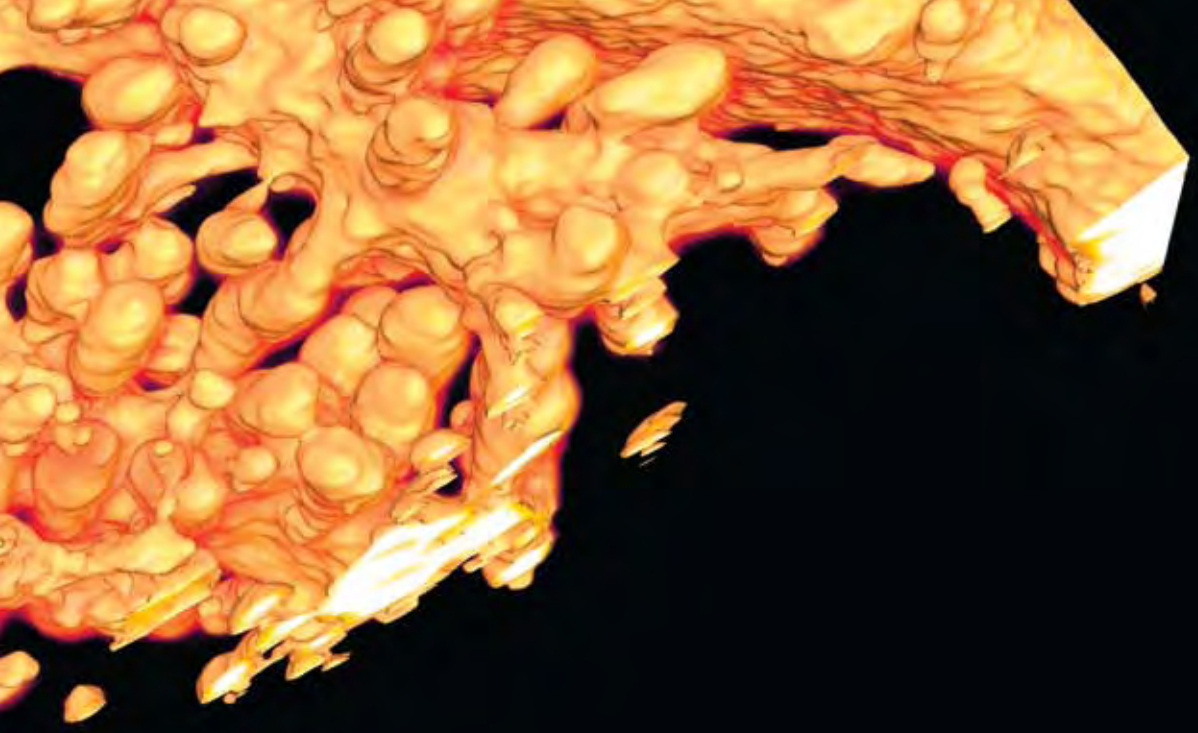
Q: What do you like about your job?

A: There's always something new to learn. I get asked something completely new almost every day, and in the course of answering those questions I get to talk with Jackson Lab researchers, leaders in the fields of diabetes, heart disease, cancer, neurological disorders . . . it's always interesting.

Q: What are your outside interests?

A: I am an avid hiker, explorer and amateur botanist, with a passion for orchids. I grow a modest collection of mostly tropical orchids at home, but with a wonderful wife, a 4-year-old daughter and 1-year-old son to keep me busy, my plants probably don't get as much attention as they should!

"I realized that I wanted to do work that mattered to people beyond a small group of colleagues and that helped people by advancing medical research."



the race to inner space

by Joyce Peterson Photography by Stanton Short

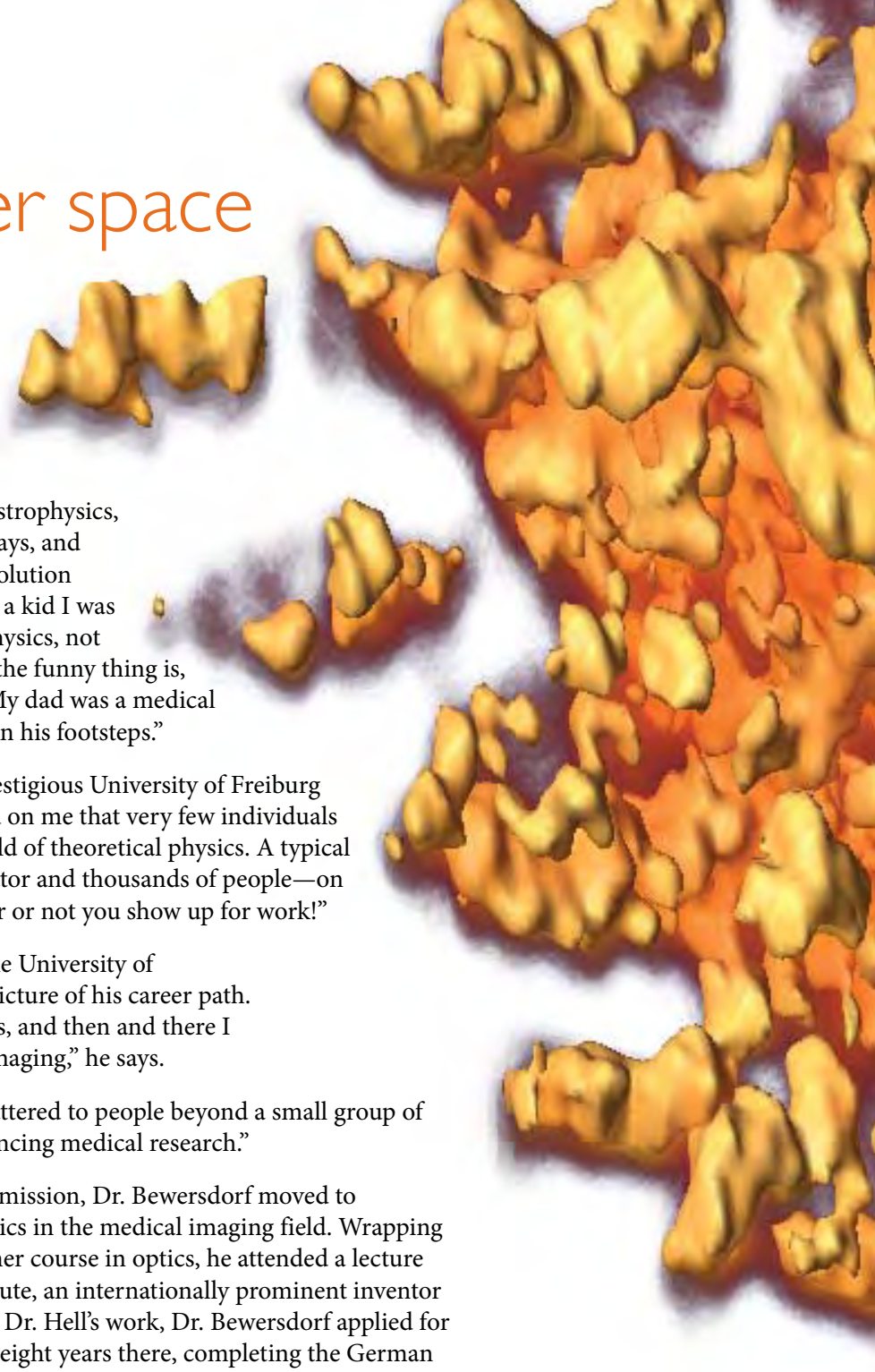
"Can I meet you tomorrow instead?" Joerg Bewersdorf is in a hurry, and not just the usual scientist's write-this-grant-application-so-I-can-hire-that-postdoc kind of hurry, or finish-this-paper-today-because-I-have-a-conference-tomorrow kind of hurry. Dr. Bewersdorf is in a new kind of space race: competing with other top research institutions to see the smallest structures within a living cell.

Dr. Bewersdorf looks like a college undergrad, but is in fact a 36-year-old research scientist who joined The Jackson Laboratory's Center for Molecular Biophysics (CMB) in 2005. He works with the Laboratory's 4Pi confocal laser scanning microscope, the only instrument of its kind in the Western Hemisphere. Using opposing lasers, the 4Pi is capable of imaging the contents of a cell nucleus in three dimensions, at the unprecedented resolution of 100 nanometers. (For comparison, the paper this article is printed on is at least 100,000 nanometers thick.)

Like NASA scientists watching new space telescope images appear on their computer screens, Dr. Bewersdorf and his colleagues were the first people on earth to see some awe-inspiring natural structures. Branch-like Purkinje cells from the cerebellum part of the brain covered with unexpected doorknob-shaped protuberances. Chromosomes caught in the act of reproducing themselves in the cell nucleus.

But 100 nanometers' resolution is not fine enough for Dr. Bewersdorf and the rest of the CMB team. They're now working on a new-generation instrument, code-named "Biplane" as a pun on the microscope's scanning action along two planes, not just two axes like the 4Pi. "The ultimate goal," he says, "is to image proteins." That's right: to look directly at molecules.

the race to inner space



Born with an eye for science

Given that Dr. Bewersdorf grew up in Aalen, Germany—headquarters of world-famous Carl Zeiss, Inc., and dozens of other optical imaging companies—and had an early interest in astrophysics, it's only natural he would now spend his days, and many of his nights, working with high-resolution optical instruments. However, he says, "As a kid I was interested in cosmology and theoretical physics, not stargazing, and definitely not optics. And the funny thing is, I also thought biology was really boring. My dad was a medical doctor, and I had no interest in following in his footsteps."

Instead, Dr. Bewersdorf enrolled at the prestigious University of Freiburg to study physics. "But," he says, "it dawned on me that very few individuals are able to make a major impact on the field of theoretical physics. A typical project involves one giant particle accelerator and thousands of people—on a given day it doesn't really matter whether or not you show up for work!"

During a year as an exchange student at the University of Glasgow in Scotland, he gained a clearer picture of his career path. "I attended a lecture about medical physics, and then and there I decided to switch my studies to medical imaging," he says.

"I realized that I wanted to do work that mattered to people beyond a small group of colleagues and that helped people by advancing medical research."

Thus returning from Scotland with a new mission, Dr. Bewersdorf moved to Heidelberg, a world center of applied physics in the medical imaging field. Wrapping up his undergraduate studies with a summer course in optics, he attended a lecture by Dr. Stefan Hell of the Max Planck Institute, an internationally prominent inventor of microscope technologies. Fascinated by Dr. Hell's work, Dr. Bewersdorf applied for an internship in his lab. He spent the next eight years there, completing the German equivalent of a Ph.D. (Dr. rer. nat.) and postdoctoral fellowship while also working at the Leica company developing one of Dr. Hell's inventions: the 4Pi microscope.

And so to Maine

Once the 4Pi technology was perfected, the first microscope to leave Heidelberg was destined for The Jackson Laboratory. The Laboratory had secured more than $1.2 million in funding from the National Science Foundation and the Keck Foundation to purchase the microscope and cover other expenses associated with operating it, including salaries.

"When I learned the Laboratory was hiring someone to work with the 4Pi, I knew I wanted to be that person," Dr. Bewersdorf says. "It was clear to me that the U.S. is truly the land of scientific opportunity, where so many German scientists had established successful careers.

"It was also time for me to leave Dr. Hell's lab," he comments. "In many ways that was the perfect work environment—all the funding you needed, the best applied optical physics lab in Germany—but I felt I had to prove I could work independently and make it on my own."

While Dr. Bewersdorf was building his career, his family was also growing, and he arrived in Bar Harbor with his wife Connie, then seven months pregnant with a daughter, Emmy, and 2-year-old daughter, Annika. "Naturally, Connie was a little apprehensive, moving to a foreign country with little ones," Dr. Bewersdorf says. "But she was also very excited and very supportive of my career. And just four weeks after we moved here some people we hardly knew had arranged a baby shower for Connie. That made us all feel very welcome and really helped to connect us quickly to the community." In December 2007, the Bewersdorfs welcomed a new baby, Philip, and all three of their children are thriving in their adopted country. Annika, now 5, plays in English, and 2-year-old Emmy is already bilingual.

Soon after joining the Center for Molecular Biophysics, Dr. Bewersdorf was struck by the collegial, even familial, atmosphere of The Jackson Laboratory. Welcomed by Center directors Dr. Barbara Knowles, vice president of the Laboratory for education, training, and external scientific collaborations, and Dr. Michael Grunze of the University of Maine and University of Heidelberg, he says he felt "they wanted to help me more than themselves. That's a great situation for a young scientist."

He also noted that the Max Planck Institute is almost as big as The Jackson Laboratory, but had only eight principal investigators, compared to 38 here. "At MPI the heads of each lab have too much to do just managing all the staff, and they don't really talk to each other," he says. "Our model is much more collaborative, which I think is better for science."

Teaming up for progress

In that spirit of collaboration, a number of Jackson Laboratory scientists in different fields have brought scientific questions to Dr. Bewersdorf that can only be answered by extremely high-resolution imaging. For example, Jackson Assistant Professor Kevin Mills is studying defects in chromosomes that can lead to certain kinds of cancers, including childhood leukemias. "What is it about those chromosomes—how they're arranged, or how they're structured—that turns normal cells into abnormal ones?" Dr. Mills asks. "Scientists have been trying to get a good look at chromosomes for a hundred years, and only here and now, thanks to Joerg's team and the 4Pi, can we get this level of detail, almost down to the level of DNA fiber."

Seeing chromosomes that close up is more than just gee-whiz cool. Dr. Mills says it is the first step toward future cancer diagnostics. "The changes we're capturing on the 4Pi are occurring long before cancer actually begins. In a clinical setting, this opens the possibility of someday screening people for these subtle changes and designing strategies to prevent the cancer from occurring."

Today, with research assistants Mark Lessard and Michael Mlodzianoski, and undergraduate students Manuel Juette and Stefanie Kirschbaum of the University of Heidelberg, Dr. Bewersdorf is hard at work perfecting the next generation of nanoscale microscopes.

Microscopes are, in a sense, time machines. The smallest components of a living cell are also the fastest-moving, so there's a time dimension to consider in capturing images of them. "The single protein level, that's on the millisecond level," Dr. Bewersdorf notes. "To be able to observe structures on an individual protein—that's the goal."

Besides the excitement of invention itself, he says he's driven by "very strong, friendly competition" with some of the world's leading research institutions. The January edition of the influential journal *Nature Methods* cites "seeing fluorescence at super-resolution"—the technology behind the 4Pi and Biplane microscopes—as one of the top methods "on the cusp of profoundly impacting their field."

Dr. Bewersdorf believes that collaboration with colleagues at The Jackson Laboratory and partner institutions, including the University of Maine and University of Heidelberg, gives his team the edge in the race to inner space. "I want us to get there first," he says with quiet confidence.

Where Our World Can Unite

by Luther Young Photography by Tofer Carlson

Exclamation points abound when Seanna Pieper-Jordan talks about almost anything. But ask about her participation in the 2007 Summer Student Program at The Jackson Laboratory, and the floodgates open: "It was a wonderful and life-changing experience! It ignited within me an ever-burning passion for science!"

For Seanna, 18, a high school senior in Honolulu, the distance to Bar Harbor last summer was measured in more than miles. Raised by a single mother on the Blackfoot reservation in Montana and now living with a foster family in her native Hawaii, this remarkable teenager is pursuing an uncommon dream for someone of her ethnic heritage and challenging background.

"What can I say? I am one of the few Native Hawaiian/Native Americans looking at a future career in biological sciences," she says. "I grew up in an environment that one would assume would doom me to the common statistics of natives: poverty and drug abuse. But somehow as a child I knew I wanted more in life than minimal education and a string of dead-end jobs."

Her application to the Summer Student Program was encouraged by science teachers at the Kamehameha High School, part of a renowned system of private

"If I learned one important thing this summer, it is that science is where our world can unite, where our fellow humans can be cured, and where our children can gain a better future."

schools on the Islands founded and endowed by a descendant of Hawaiian royalty to educate native children. Seanna, who boards at the highly selective school on full scholarship, says her summer internship at the Laboratory was viewed back home "as a way to improve the science program at Kamehameha and to expand the opportunities for Native Hawaiian children who love science."

The Laboratory's 83-year-old Summer Student Program, under the direction of Jon Geiger, Ph.D., welcomed 31 students last summer: 20 college undergraduates and 11 high school students from 19 states, Puerto Rico and one foreign country. They spent nine to 11 weeks learning, growing and bonding as they pursued individual research projects with scientific staff mentors. After long hours spent in the lab, life at Highseas, the Laboratory's oceanfront residence, and recreational adventures throughout Maine rounded out the students' experience.

Seanna interned in the laboratory of Associate Professor Gregory Cox, Ph.D., under the guidance of Kimberly Huebsch, Ph.D., a postdoctoral fellow in the Cox lab. Her project, "The effect of myostatin blockage on mdm (muscular dystrophy with myositis) mouse skeletal muscle," explored a molecular pathway that holds promise for development of a therapy for muscular dystrophy in humans. Her research was funded in part by grants from the Howard Hughes Medical Institute and the Horace W. Goldsmith Foundation.

"Seanna had a great summer and made some important contributions to the lab," says Dr. Cox. He points to a discovery she made that both he and Dr. Huebsch at first doubted. Based on her painstaking observations, Seanna found "the earliest degenerative changes yet observed in this research model. We are now expanding on her findings," Dr. Cox says.

Seanna describes the discovery as "cool," and adds, "More than anything, I got to understand the dynamics of a lab. I experienced what life was like to do research every day, and I realized that I would enjoy working as a researcher. Kim was a great mentor. She gave me enough freedom that I could analyze data on my own, but she also kept an eye on me to help me if I got lost."

Lab work is only part of the program, and students often make lifelong friends during their summer in Bar Harbor. Her soulmate was Hope Kronman, a high school student from Connecticut whose "views, opinions and energy influenced me" and helped persuade her to apply for admission to Yale University.

Seanna returned to Hawaii in mid-August, but her ties to The Jackson Laboratory remain strong. In the fall, she arranged for Dr. Geiger to visit the Kamehameha High School and showcase the Summer Student Program to her fellow science students. In November, her summer research project won first place at the Pacific Symposium for Science and Sustainability, and she is set to compete in May in the national symposium in Orlando, Fla.

In December, Seanna received word of her early admission to Yale. She plans to join her friend Hope in the Class of 2012, pursuing "a double major in neurobiology and philosophy." Later plans include "grad school and a Ph.D. in a biological science field. Also, at some point I want to go to law school. I'm thinking about being a science advisor to lawyers."

And then? "I do not plan to walk away from The Jackson Laboratory with knowledge gained only for myself," Seanna says. "I plan on educating those who are unable to make it to Maine. If not now, then in the future, I want to provide opportunities such as this for other native children."

For more information about the program, visit www.jax.org and go to "Courses and education."

[A Minute to understanding]

phenotype

[fē-nə-tīp]

Phenotype: the collection of observable characteristics of an organism.

Phenotype is a word one hears a lot at The Jackson Laboratory. A mutation in an important gene will usually change the phenotype of an organism. Of particular interest is what's known as a disease phenotype. But while phenotype is an important term, its full meaning is hard to pin down.

A phenotype includes traits visible to the eye, such as height, eye and hair color, and so on. It also includes less obvious traits, such as metabolic rate and organ function.

Phenotypes reflect a combination of genes and environment. It's important to note that the same genes in a different environment can produce different phenotypes. For example, a mouse (or a person!) fed a high-fat diet will weigh more and have more fat tissue than a mouse with the same genetics fed a restricted-calorie diet. Therefore, phenotype is a key component of disease research. In fact, the Mouse Phenome Project at the Laboratory has data for about 1,000 characteristics relevant to a great variety of human diseases.

Our neighborhood

Joyce Peterson of the Communications Office enjoys a fresh snowfall near the Laboratory. Best known for its cool, beautiful summers, Mount Desert Island provides wonderful recreation opportunities year-round.

Photography by Kimball Wade

The Jackson Laboratory

Leading the search for tomorrow's cures

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