

Asia Extra

supplement to Washington Magazine for readers throughout Asia

October 2011

Zebrafish Research Sheds Light on Limb Regeneration

by Michelle Merlin, Arts & Sciences Class of '12

When a human loses a limb, there is no chance of growing it back. But animals like salamanders and zebrafish can regenerate parts of their bodies without any problems.

Washington University School of Medicine researchers are shedding light on the phenomenon of zebrafish fin regeneration in the hope that one day their knowledge can be applied to human limbs.

Postdoctoral research scholar Shu Tu, PhD, performed the study as part of her doctoral thesis under Stephen L. Johnson, PhD, associate professor of genetics at the School of Medicine. They examined the regenerated cells of amputated zebrafish fins and found that cell types do not transdifferentiate (become a different cell type). Instead, they maintain their identity throughout the regeneration process.

This finding goes against a commonly held theory that regenerated fins are grown from the same kind of pluripotent stem cells, which can turn into any type of cells.

"If you look at the blastema [cells that form from the stump of a limb] under a microscope, the cells all look the same, but they are not," Tu says. "Because these cells can make a variety of different cell types like skin, blood vessels and bones, people think they are pluripotent stem cells that are recruited to the site of the stump and make different cell types."

Although some previous work showed that the cells were somewhat restricted, it left room for the theory of transdifferentiation. Tu labeled individual cells by inserting their DNA with a transposon (a piece of DNA that can insert itself into the zebrafish genome) that encodes a green fluorescent protein (GFP). The original cells passed the DNA on to daughter cells that recreated the fin. These daughter cells glowed green, enabling Tu to track them.

Tu and Johnson observed that when skin cells in the stump were labeled with GFP, only skin cells glowed on the regenerated zebrafish fin. The same held true for the other kinds of cells. There was no chance that any given cell on the stump could regenerate a completely different kind of cell.

This finding was based on the identification of nine different cell lineages that form the fin: skin, nerves, pigment, bone, blood vessels, immune cells, etc.

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Postdoctoral research scholar Shu Tu examined the regenerated cells of amputated zebrafish fins and found that cell types do not transdifferentiate. Instead, they maintain their identity throughout the regeneration process. (Joe Angeles)

Biologists Find That Rice Originated Solely in China

by Michelle Merlin, Arts & Sciences Class of '12

Barbara Schaal, PhD, likes rice. She likes Indian basmati rice, Thai jasmine rice, Japan's japonica rice (found wrapped around sushi), and especially glutinous rice, or sticky rice mixed with coconut milk, which she sometimes brings in for her students.

But that's not all she likes about rice.

Schaal, the Mary-Dell Chilton Distinguished Professor and professor of biology in Arts & Sciences, has dedicated the past few years of her research to studying rice's origins and diversity.

Her group's most recent work suggests that rice originated solely in China 9,000 years ago in the Yangtze Valley — not in both India and China as previous studies have suggested.

Researchers from Washington University's Department of Biology in Arts & Sciences, New York University's Center for Genomics and Systems Biology and its Department of Biology, Stanford University's Department of Genetics, and Purdue University's Department of Agronomy conducted the rice study.

"The research results reflect how people were interacting with the natural environment, with each other, and how we've gotten to where we are with agriculture," Schaal says.

The study also has a practical application. "Our studies suggest that only a small part of the range of this native species was incorporated into domesticated rice," she says. "If you want to find new kinds of genetic variants that code for traits that are important for rice improvement, you can't go within rice itself, you need to go to the wild ancestor."

The single origin model suggests that the two major subspecies of rice, *indica* and *japonica*, were both domesticated from the wild rice, *O. rufipogon* in China. The multiple-origin model suggests that the two varieties were domesticated separately in different parts of Asia.

"Rice has an extraordinary history," Schaal says. "The wild ancestor is all over Asia, so it could have been picked up by humans in all sorts of places." And all of the trading between different Asian cultures over several centuries means that rice has a very complex history. Recent studies suggest rice domestication began about 10,000 years ago. Since then, it has been cultivated into the thousands of varieties that exist today.

A group of Chinese scientists praised this study for finally confirming the truth about rice's origin, while other groups of Asian scientists have suggested that the study is not definitive and called for more data.

"There's a lot of interest in the origin of rice," Schaal says. "There's also a sense of national pride in being able to say that the rice we all eat comes from India or China or Thailand."

Researchers conducted the study using genomic techniques, which allow them to study the entire rice genome. In past studies, scientists have been able to look at only small segments of DNA.

"With these new genomic techniques and powerful new analytic models, we think the preponderance of evidence suggests a single location of domestication," Schaal says. "We've also gone back and analyzed previous data. The science community has been positive in its



Professor Barbara Schaal has dedicated the past few years of her research to studying rice's origins and diversity. Her group's most recent work suggests that rice originated solely in China. (Joe Angeles)

reviews of the study saying that it adds new information to the debate."

Schaal has worked with rice for 10 years, beginning with a collaboration with researchers in Thailand. The study brought rice to her Washington University lab, and she has been working with it ever since. Her group, including undergraduate and graduate students, has also studied the evolution of starch genes, weedy rice and unique types of rice found in the hills of Thailand.

"It's fun working on something where you can understand basic science but everything that you do, regardless of your results, feeds into a larger effort to produce more food for the world," Schaal says. 🌐

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"If we can identify all the different lineages that make up a limb and identify how they regenerate to remake the lost structure, that could potentially affect regenerative medicine down the road for us," Tu says.

Inserting the GFP-expressing transposon into the DNA of cells helped Tu generate lineage-specific labels to follow the different lineages through regeneration.

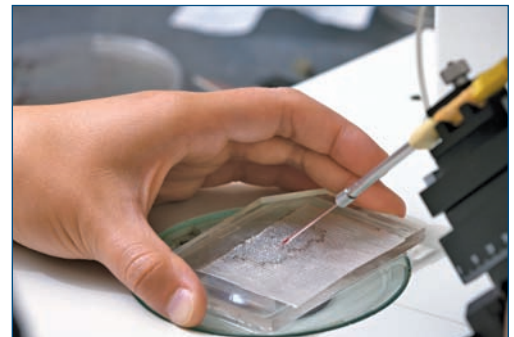
"That's why this method was special," Tu says.

Zebrafish have been used as model organisms to study a variety of tissue

regeneration. Studies like this could offer clues to regenerative medicine in humans.

"If we could figure out how the zebrafish regenerates its fins and then apply that to human regenerative medicine, we can make a new hand, and that would be really cool," she says.

Tu is now a postdoctoral scholar from China. She spent her undergraduate years at Goshen College before coming to Washington University's School of Medicine in 2005. 🌐



Tu injects transposon into DNA, which helps her follow the different lineages through regeneration. (Joe Angeles)

Conner Named Outstanding CEO in Singapore

by Michelle Merlin, Arts & Sciences Class of '12

David Conner, AB '74, held down all sorts of odd jobs growing up in St. Louis. Before coming to Washington University, he sold newspapers, worked at a hamburger joint, a spaghetti factory, a bowling alley and a records center of a gas utility. Once at school, he washed dishes in his fraternity, worked at an assembly line at a Chrysler plant, and bartended in Clayton.

He's come a long way since these odd jobs. Recently, the Singapore Business Awards, sponsored by Singapore's business daily, *The Business Times*, named Conner the Outstanding CEO of 2011.

Since 2002, Conner has been the CEO of Oversea-Chinese Banking Corp. (OCBC), Singapore's second-largest bank.

During his tenure at OCBC, Conner has more than doubled the bank's market capitalization from \$15.7 billion to \$32.3 billion. Since then, the bank has made several acquisitions, including ING Asia Private Bank (now renamed the Bank of Singapore).

Conner says the bank's success is due in part to his attitude about economic growth in emerging markets.

"I believe sustainable development can only be achieved through a thriving private sector," Conner says. "That means a private sector that generates profits, which can then be reinvested toward economic growth and continued job creation."

Conner didn't start his career in the business world. After graduating from Washington

University, Conner joined the Peace Corps and worked as a secondary school teacher in Nepal, where he met his future wife, Selina. He became enamored with her father's work for the World Health Organization in Nepal, so he decided to pursue a career in the developing world.

Conner went back to school to earn his MBA from Columbia University. He started his career in 1976 with Citibank, working primarily in the Asia-Pacific region. Spending more than 26 years with Citibank, he served as managing director and market manager of Citibank Japan, chief executive officer of Citibank India, and country corporate officer of Citibank Singapore.

"On being offered the job as CEO at OCBC, I leapt at the opportunity," Conner said in a speech to the Singapore International Chamber of Commerce this summer. "Here was a bank that aspired to invest more and grow in the developing world, and that fit with my long-term goals perfectly. I never aspired to be a CEO, but somehow the stars aligned to make it happen. Happily so, because not only do I get to live in Singapore, a delightful place, but at OCBC we've also invested more than a billion dollars in Malaysia, Indonesia, China and Vietnam during my time."

In addition to his work at OCBC, Conner remains involved with Washington University. He serves as a member of the Board of Trustees, chairman of the International Advisory Council for Asia, and an interviewer of students for the Alumni and Parents Admission Program.



Alumnus David Conner was named the 2011 Outstanding CEO in Singapore. He is the CEO of Oversea-Chinese Banking Corp. (WUSTL Photographic Services)

His daughter, Marian, AB '03, also attended the university, where she majored in English and American literature. His son, Daniel, MSCE '10, holds a master's degree in environmental, energy & chemical engineering and is currently pursuing an MBA at Olin Business School.

Conner is convinced that his education helped him reach his goals.

"A liberal arts degree from Washington University instilled in me a voracious appetite for lifetime learning," Conner says. "That's what achievement is all about, learning all the time." 🌐

Volunteer Spotlight

Kyle Hill, MBA '05

Even though Kyle Hill, MBA '05, is busy working at A.O. Smith on the other side of the world from his alma mater, he still finds time to volunteer as the leader of the Shanghai Olin Alumni Association.

"Olin prepared me to have an international outlook," Hill says. "There is no way I would have come to Shanghai to work had it not been for my time at Olin."

Hill, who works for a company in China that manufactures water heaters and electronic motors, helped create the Olin International Mentorship Program and the Washington University Olin Business School LinkedIn Group.

"I don't consider it volunteering really; I'm just paying back," Hill says. "My degree has opened a lot of doors, and I know many alumni who can say the same."

"It is just common sense to work to strengthen the ties between alumni and students. It not only boosts the value, prestige and rankings of our degrees but also keeps us in contact with the exceptional students, graduates and culture that make up Washington University." 🌐



Alumnus Kyle Hill (right) resides in Shanghai with his wife, Irene Zhang, and their twin daughters, Hannah (left) and Sophia. (Courtesy photo)

News Briefs

Taiwan Washington University Scholarships Established

Washington University and the Ministry of Education, Republic of China (Taiwan) are collaborating on a scholarship program for postgraduate students called the Taiwan Washington University Scholarships. These scholarships will support Taiwanese students with outstanding talents on PhD degree courses at the university. Chancellor Mark S. Wrighton traveled to Taiwan on June 24 to sign an agreement with Tony W.T. Lin, the director-general of the Bureau of International Cultural Educational Relations for the Ministry of Education, Republic of China (Taiwan). The scholarship program will commence in August 2012. David Ho (right), professor of biology, played a critical role in the establishment of this new program.



Chancellor Mark S. Wrighton (second from left) signed an agreement in Taiwan for a scholarship program for postgraduate students called the Taiwan Washington University Scholarships. (Courtesy photo)

Spector Prize Goes to Bhide, Leach

Each year, the Department of Biology in Arts & Sciences awards a prize to a graduating senior in memory of Marion Smith Spector, a 1938 WUSTL graduate who studied zoology under the late Viktor Hamburger, PhD, professor of biology and a prominent developmental biologist who made many important contributions while a WUSTL faculty member. In 2011, the Spector Prize was shared by two recipients: Adeetee Bhide and Matthew Leach. They were nominated by their research mentors for their outstanding work and the contributions they made to the field of biology.

Bhide, a Churchill Prize recipient, worked in the lab of Bradley L. Schlagger, MD, PhD, the A. Ernest and Jane G. Stein Associate Professor of Developmental Neurology, associate professor of radiology, of anatomy & neurobiology, and of pediatrics in the School of Medicine. Bhide's thesis explored priming, or the tendency for a visual stimulus to affect response to a stimulus immediately following it.

Leach worked with Rodney Newberry, MD, associate professor of internal medicine at the School of Medicine. Leach's thesis discussed how the intestinal immune system decides whether or not to mount an immune response to substances in the gut.

Brown School Forms Alliance with Fudan University

The George Warren Brown School of Social Work recently launched a formal alliance with Fudan University, one of the leading universities in China. As part of this growing relationship, Fudan and the Brown School held a summer institute in Shanghai to develop policy and management skills for the first generation of social work leaders, NGO leaders and government officials. Other initial areas of collaboration between the schools are visits and exchange of faculty and doctoral students, educational programs, joint research, practicum opportunities and access to library resources.

Students Organize Global Leadership Conference

A coalition of eight student groups worked for nearly a year to organize a conference to discuss what makes a great leader on a global scale. The 2011 Global Leadership Conference featured a keynote address by Jimmy Wales, founder of the international web-based encyclopedia Wikipedia. Other speakers included Theresa Wilson, the first nonprofit winner of the Olin Cup competition and founder of the Blessing Basket Project in St. Louis, and Soo K. Chan, alumnus, founder and principal architect of internationally award-winning SCDA Architects in Singapore. "We wanted to bring in diversity not only from different regions of the world, but also from various career paths and industries," says Chris Cassidy, Architecture Class of '13, and vice president of the conference.

Chockalingam, Choi Recognized as Outstanding Graduates

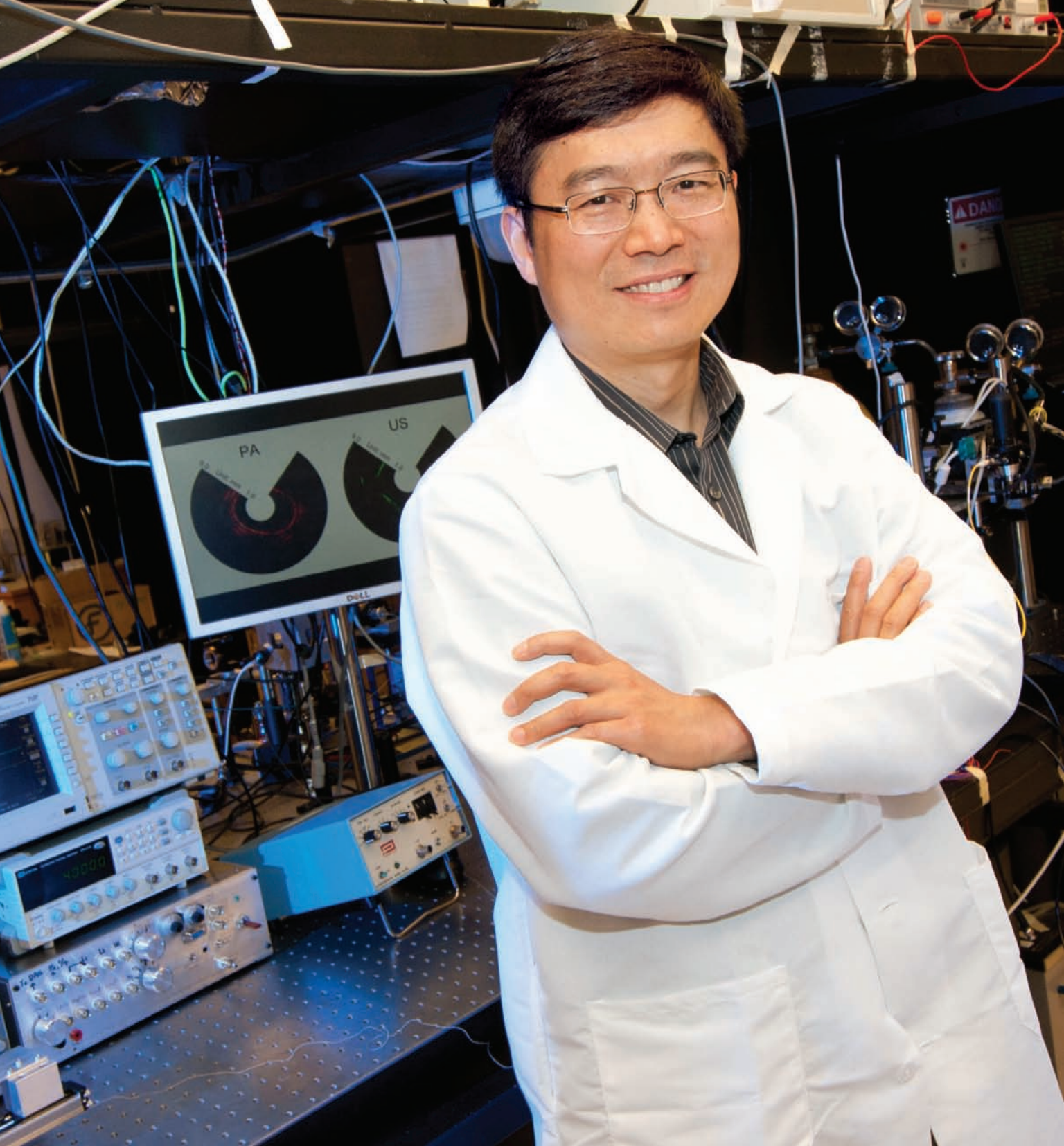
Ravikumar Chockalingam (below), MD, was recognized as an outstanding graduate in the George Warren Brown School of Social Work in 2011. An inaugural member of the Master of Public Health program, Chockalingam is using his public health training to help improve health systems in his native India and beyond. Before coming to the university, he founded a community health worker program in rural India. In summer 2011, he and Ramesh Raghavan, PhD, assistant professor at the Brown School, took a group of students to rural south India for an immersion course. "This summer, 14 students worked very closely with the community-based health system model that I have been working on," Chockalingam says. "They came up with evidence-based community and household-level interventions to common health problems like sanitation, diabetes, maternal and child health, and oral health."



Youngjee Choi was recognized as an outstanding graduate in the School of Medicine in 2011. Choi co-founded the Geriatrics Outreach Group, through which medical, occupational therapy and St. Louis College of Pharmacy students reach out to older adults in the community. After her third year of medical school, Choi spent the summer in the West African country of Guinea-Bissau. She worked with patients with HIV₂, a less-common strain of HIV that occurs primarily in West Africa. The data she collected from taking patient histories and performing neurological and psychological assessments helped David Clifford, MD, the Melba and Forest Seay Professor of Clinical Neuropharmacology in Neurology, with his research. Now an internal medicine resident at Barnes-Jewish Hospital, Choi hopes to work in academic medicine, which combines clinical care with research. 🌐



While a student, Youngjee Choi (right) worked with Professor David Clifford on his HIV research. (Robert Boston)



Glimpses

Lihong V. Wang, PhD, the Gene K. Beare Distinguished Professor of Biomedical Engineering, was awarded the C.E.K. Mees Medal from the Optical Society. Wang and his lab are the founders of a new area of scientific inquiry — one that combines light and sound to create a new form of functional imaging — with many potential applications for cancer research. (Robert Boston)

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Alumni, parents and friends of the university often help identify students who would benefit from a Washington University education. Refer names and addresses of talented prospective students to:

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