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News about Biological Sciences at the University of California, Davis

News about Biological Sciences at UC Davis is a periodic publication of the College of Biological Sciences to inform alumni and parents of current students about the programs and activities at the College.

We welcome contributions from both graduate and undergraduate alumni. Please send us your news to infobiosci@ucdavis.edu.

Eisen Examines the Tree of Life

Jonathan Eisen

From his office window on the fifth floor of the UC Davis Genome Center, Professor **Jonathan Eisen** has a macroscopic view of the northwest landscape. His unique vantage point allows him to survey hundreds of miles of diverse landscape and biology, which pleases his insatiable thirst for considering distinct and compelling organisms. Eisen can usually see as far as the Coastal Range, sometimes even the Sutter Buttes. This incredible view complements the calming Davis flatlands, inspiring and refreshing this talented researcher. But Eisen spends his time trying to understand what the eye cannot see, delving into the world of microbes and emerging with discoveries about their evolution and how they work.

"Unlike animals and plants, you need the DNA of microorganisms to begin to understand them," says Eisen, "Almost everything I do is related to DNA sequence analysis."

"I'm an omnivore when it comes to science," says Eisen. "And I need a diversity of good biology to surround me."

Eisen arrived at UC Davis in November 2005 as a professor of evolution and ecology at the UC Davis Genome Center with a joint appointment at the UC Davis Medical Center's Department of Medical Microbiology and Immunology. Eisen earned a bachelor's degree, cum laude, in biology from Harvard College, and a Ph.D in biological sciences from Stanford University, after which he worked as a faculty member at The Institute for Genomic Research (TIGR) for eight years. One amazing accomplishment in his career so far is that he helped develop a new field of research called phylogenomics (a word he coined) where evolutionary methods are integrated with genome analyses into a single composite approach. **(continued on page 7)**

Ames Symposium Advances Nutritional Knowledge

On October 12-14, 2007, the UC Davis Center of Excellence in Nutritional Genomics, together with the College of Biological Sciences, hosted approximately 350 guests from around the nation and 10 countries for the **Second Bruce Ames International Symposium on Nutritional Genomics**.

Raymond Rodriguez, Craig Warden and I. Sadaf Farooqi at the symposium. (Sam Woo)

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In The News

Alien' Jaws Help Moray Eels Feed

Moray eels have a unique way of feeding reminiscent of a science fiction thriller, researchers at UC Davis have discovered. After seizing prey in its jaws, a second set of jaws located in the moray's throat reaches forward into the mouth, grabs the food and carries it back to the esophagus for swallowing.

"This is really an amazing innovation for feeding behavior for fishes in general," said **Rita Mehta**, a postdoctoral researcher in the Section of Evolution and Ecology at UC Davis.

The research shows the amazing diversity possible among living things, even in something as fundamental as feeding, Mehta said.

These X-rays show a moray eel's head and jaws: the top with the mouth slightly open and the bottom with the mouth wide open, revealing the second set of jaws. (Candi Stafford and Rita Mehta/UC Davis X-ray)

The researcher used a high-speed digital camera to film eels feeding in the laboratory, and was able to capture the rapid movement of these secondary pharyngeal jaws. She also used X-ray and other imaging equipment at the UC Davis School of Veterinary Medicine to work out how the jaws could move.

More than 200 species of moray eels are found in tropical waters worldwide, often living in holes in rocks and coral reefs. In the wild, they can reach 10 feet in length.

Most fish feed by suction. When it comes upon food or prey, the fish rapidly expands its mouth cavity, sucking in water and the food with it. Some fish feed by overtaking prey with their mouth open or grabbing it in their jaws, but most of those fish then use suction to move the food from the mouth to the esophagus.

But moray eels have little ability to generate suction through their mouths, Mehta found. Instead, they first grasp food with their powerful, toothsome outer jaws. Then the pharyngeal jaws, armed with large, curved teeth, reach forward and seize it. At the same time, the outer jaws release the prey and the pharyngeal jaws bring it back for swallowing. The whole process takes just fractions of a second.

Other fish are known to have pharyngeal jaws that can grind or crush food, but "nothing this spectacular," said **Peter Wainwright**, professor of evolution and ecology at UC Davis and co-author with Mehta on the paper. Only the moray eel seems to have a second, mobile set of jaws that can reach forward and grab prey.

At rest, the pharyngeal jaws sit behind the eel's skull. When they reach forward, they move almost the length of the animal's skull, but do not protrude beyond the powerful outer jaws.

"Eels are an amazingly diverse and bizarre group of fishes, and not very well known," Wainwright said.

The arrangement means that if the eel can sink in a few teeth to hold its prey, it can secure its meal with the pharyngeal jaws, the researchers note.

Mehta compared the eels to snakes, which also have to fit large food items through a relatively narrow mouth into a long, thin body. Snakes solve the problem by "ratcheting:" they can separate the left and right sides of their jaw, and hold onto the food with one side while they work the other side of the mouth round it.

Mehta and Wainwright are now investigating how the morays' extraordinary jaws evolved.

"Eels are an amazingly diverse and bizarre group of fishes, and not very well known," Wainwright said.

The research is published in the Sept. 6 issue of the journal *Nature* and was reported on in the *New York Times*, the *San Francisco Chronicle* and the *International Herald Tribune*.

Andy Fell at UC Davis News Service contributed this article.

Internal Clock, External Light Regulate Plant Growth

Most plants and animals show changes in activity over a 24-hour cycle. Now, for the first time, researchers have shown how a plant combines signals from its internal clock with those from the environment to show a daily rhythm of growth.

Using time-lapse photography, postdoctoral researcher Kazunari Nozue, with colleagues from UC Davis and the University of Lausanne, Switzerland, found that the shoots of Arabidopsis seedlings show a spurt of growth once a day. The timing of that growth spurt is controlled by both the plant's internal clock and by exposure to light, acting on two genes called PIF 4 and PIF 5.

"It's a nice, elegant mechanism for how these two systems interact," said **Julin Maloof**, assistant professor of plant biology at UC Davis, who is senior author on the paper.

The researchers identified the two genes, PIF 4 and PIF 5, that are connected to plant growth and regulated by the internal clock. The PIF 4 and 5 genes are "switched on" to make protein during the day, switch off after dark but then turn on again late in the night. But the proteins made by PIF 4 and PIF 5 break down when exposed to light. So while the internal clock drives transcription of the genes to produce proteins, external light removes the protein.

The PIF 4 and 5 proteins are thought to act as transcription factors that turn on other genes involved in growth.

The work is published online in the journal *Nature*.

Andy Fell at UC Davis News Service contributed this article.

Phylogenomics at Work

Eisen joined TIGR in 1998, just a few years after TIGR had published the first complete genome sequence of any organism. While at TIGR, Eisen focused on developing new phylogenomic methods and applying these to study the origin of novelty in microbes (how new functions and processes originate). In the course of doing this work, he was involved in projects to sequence hundreds of microbial genomes from pathogens to organisms from boiling hot springs. But what interested him most were microbial symbionts.

"Symbioses are interesting to me because they are such an elegant and simple way to evolve new functions and processes. Instead of evolving a process by oneself, why not just engage an organism that already has that process in a symbioses?" says Eisen.

One challenge with studying symbionts however is that most cannot be grown in the laboratory.

"This is a severe limitation, since most of what we know about microbes is based on culturing them in the lab. Fortunately, genome methods provide an alternative for "uncultured" microbes. We can study these organisms by extracting DNA directly from the environment and sequencing it, something called metagenomics."

Last year Eisen and his colleagues published a study in the journal PLoS Biology in which they used metagenomic methods to study the symbionts living inside the gut of an insect called the glassy-wing sharpshooter, which while feeding can infect agricultural crops such as wine grapes with a deadly bacteria that causes Pierce's Disease. They found a surprising result – that this insect depended on a symbioses with two distinct bacteria that make nutrients missing in the host's diet.

"Not only is this really cool biologically," said Eisen in an interview last year, "but in terms of attacking the sharpshooter, now we have a target."

One of the great challenges in using metagenomic methods to study microbes lies in sorting through the data which comes in the form of bits and pieces of the genomes of all the organisms in a sample. The more complex the sample, the harder this sorting is. Developing the bioinformatics tools for analyzing these data sets, and for integrating them with other information, is one of the major foci of Eisen's research now.

Time to Teach

When Eisen found himself wanting to teach a few years ago, he set out to find an institution where he could continue microbial research, teach students and interact more with faculty in other disciplines. And he found UC Davis.

"UC Davis really has biological research diversity," says Eisen, "It's different than anywhere else I considered."

One example of this diversity became apparent while Eisen was organizing a group of UC Davis faculty interested in acquiring equipment needed to study microbial diversity. So far the group consists of over 40 members, with interests in human nutrition, engineering, soil microbiology, veterinary medicine, and more

"I'm an omnivore when it comes to science," says Eisen. "And I need a diversity of good biology to surround me. It's amazing the depth <u>and</u> diversity of interests relating to microbes that are at this university."

Eisen will teach an undergraduate phylogenomics course this winter quarter, about the mechanism of how microbes evolve. This quarter he taught a one-unit course for the population biology graduate group, and he gave four lectures for CLIMB, the Collaborative Learning at the Interface of Mathematics and Biology program. Eisen is also developing the microbial lab curriculum for a new basic biology course.

The Eisen family at Bodega Bay (Eisen)

Books, Blogs, and Family

Eisen publishes regularly to his blog Web site, The Tree of Life, at **http://phylogenomics.blogspot.com**. In his blog, he writes about topics ranging from the origin of novelty in microorganisms to the issue of "Open Access" scientific publishing.

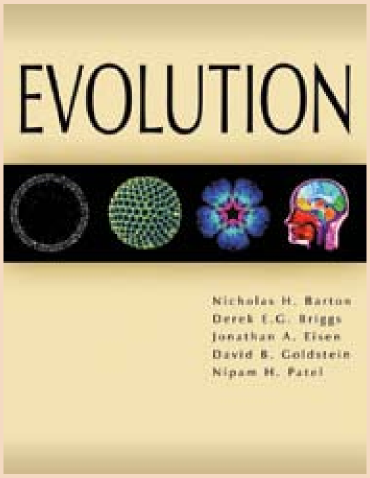
"My blog is the most fun thing I do in my career," says Eisen. "Scientists desperately need to embrace public interaction more, and a blog is a relatively easy way to do that. Plus it is also a great way to communicate with scientists"

Eisen is co-author on a new college-level textbook that incorporates recent developments in genomics and molecular biology alongside traditional evolutionary principles titled ***Evolution*** (see "In Print" on page 6). The textbook also has a Web site with supplemental material: http://evolution-textbook.org/.

When asked how he engages his children in science, Eisen shared that he takes an approach similar to his parents, both of whom were scientists.

"My daughter and I try to go outside each day and look at the trees and the bugs and the birds and talk about it," said Eisen, "I think a very simple thing we can do to interest our children in science is to help them develop an appreciation for the diversity of life."

In Print



Jonathan Eisen, a professor at the UC Davis Genome Center, has coauthored a new textbook that combines the most recent developments in genomics and molecular biology with traditional evolutionary biology, to provide a comprehensive, up-to-date text on evolutionary biology. ***Evolution*** (Cold Spring Harbor Press, 2007) is intended for undergraduate courses in evolution and for biologists looking for a guide to the current state of evolutionary science.

In addition to UC Davis' Eisen, the authors are Nicholas H. Barton, University of Edinburgh, U.K.; Derek E.G. Briggs, Yale University; David B. Goldstein, Duke University Medical Center; and Nipam H. Patel, UC Berkeley. An accompanying website, http://evolution-textbook.org/, will contain supplemental illustrations, additional online chapters, class problems and other material, all freely available.

Cover of Evolution. The images, from left to right, are of (1) a map of the genome of the bacterium Deinococcus radiodurans R1, which was sequenced by Professor Jonathan Eisen and is the most radiation resistant microorganism known (2) a mineral skeleton of a radiolarian (marine), (3) a grasshopper embryo (image duplicated and rotated fivefold) and (4) an enhanced brain MRI image.

Alumna Focus: An Aggie in space

By Ann Kim, California Aggie Features Editor

Lara Warren '96 talks about her experiences at UC Davis

Q: What do you do now?
My job title is Deputy Project Scientist for flight analogs at NASA Johnson Space Center. We're interested in what happens to the human body when we go into space. It's difficult to study the body in-depth while in space, so we've developed analogs to do such studies on the ground – one of those analogs is bed rest, where we put people in bed for extended periods of time with their heads slightly lower than their feet, which simulates some aspects of being in space. I help run those studies and make decisions as to which projects get studied and what countermeasures get worked on. I've been working here for a little more than three years.

Lara E. Warren earned a bachelor's degree in neurobiology, physiology and behavior in 1996 from UC Davis (courtesy)

Q: Do you feel like your major relates to the work you do now?
The NPB major at Davis is so top-notch and the things that students get to do in the laboratory courses are amazingly cool. I talk to physiology majors all the time and they never got to do what the lab courses offer [at UCD]. So absolutely, I use the knowledge that I gained as an undergrad on a daily basis.

Q: What work experience did you have before landing your current job?
I did take a little bit of a detour and worked for one year in a cell biology lab at UCSF and I investigated the role of dietary fatty acids on prostate cancer. I learned that I wasn't a very good cell biologist [laughs] and that I prefer studying the whole human body as a system.

Q: How did you land your job?
A little bit timing and partly who I knew. There was this trial program offering postdoctoral opportunities at any NASA center, so I took a trip to Johnson Space Center and sat down and talked with a bunch of scientists that I would be interested in working with. I whittled the choice down and I wrote a proposal to do a postdoc experiment with that person, and I won the award to do a postdoc with them.

Q: What was your favorite class at Davis?
One would definitely be the human anatomy course. I think it was on cell and human anatomy. My other favorite course was probably cardiovascular and renal physiology in the NPB department.

Q: What advice do you have for students pursuing a career track similar to yours?
You've got to be persistent. I had to deal with a detour to [get] where I wanted to be and I kept trying and when someone says no that doesn't always mean you stop there. That means you ask someone else.

Q: In what ways do you think UCD prepared you for life outside college?
You really become the person you're going to be in college. It's a formative time and you decide what kind of person you're going to be and it gives you the tools in life to be who we want to be. Also, I didn't learn how to study until I went to grad school, and it was pure fear-motivation of getting bad grades [laughs].

From the Dean

As I write these words, I am in Kyoto, Japan; attending a prize ceremony and symposium in honor of a Stanford professor, David Hogness, who was my mentor when I was a PhD student in the early eighties. As I join with his former students from across the country and around the world for a two day conference starting the day before Thanksgiving, several thoughts are brought to mind.

First, I am reminded once again of the remarkable influence that faculty have on the lives of the students in their laboratories and classes. In the same way that children join an extended family of ancestors and relatives, so too do students join a scientific family that spans the globe and includes decades of scientific history. As these students progress and develop careers of their own, the family grows and produces subsequent generations, each contributing to the success of the family. In every laboratory in the college, this remarkable process continues as undergraduates, graduate students and postdoctoral students join the college in our ongoing quest to understand life in all its forms.

Thanksgiving is also a time of year when we think about the bountiful harvest brought in from seeds planted earlier. In research, ideas are like seeds – they grow and develop and eventually become the source of future ideas. Each generation reaps a harvest from the work and ideas of the previous generation. In this issue of the newsletter, there are several articles on research in the area of genomics, which is revolutionizing our ability to understand the diversity of life forms inhabiting the planet. The tools of genomics also represent a harvest of ideas from the past. The professor we are honoring in Japan this week was one of the first to lay out the idea of how a whole genome could be characterized and studied, planting in the 1970s the seeds for the field of genomics. His work has led to an abundant harvest of new ideas that are changing our understanding of the world around us. Similarly, the work our faculty and students are pursuing today will provide future harvests for science and society.

In one of those beautiful coincidences that are often found in the highly interconnected world of biology, our very own Professor **Mel Green**, who we honor in the final article in this newsletter, was one of the eminent scientists sought out by Professor Hogness in 1968 when he was seeking advice on how to approach the problem of studying a whole genome. Professor Green advised Professor Hogness to use the chromosomes of Drosophila in his research, which turned out to be an inspired choice and contributed to the success we are celebrating in Japan this week. We are very thankful to Professor Green for his generous gift to the college, in honor of his wife Kathleen, that will support future generations of young people as they join the family of science. We are also grateful to all of you reading this newsletter for your continued support of the college, and I wish you all the best for the holiday season.

Kenneth C Burtis

Dean, College of Biological Sciences

Ames Symposium... *Continued from page 1*

Professor **Raymond Rodriguez** of the Section of Molecular and Cellular Biology was the symposium organizer. The lead sponsor for the symposium was former UC Davis graduate student, Dr. Roger Newton, founder of the Esperance Family Foundation and co-discoverer of Lipitor.

The three-day event involved workshops and seminars on a wide range of topics related to nutrition, genomics and health. The theme for this year's symposium was "Resolving the Diet-Gene Paradox". Speakers and attendees engaged in lively discussions about how diet and genetics interact and how certain constituents of the diet, such as vitamins, minerals and phytochemicals, can alter gene activity in predictable and coordinated fashion to promote health and prevent disease.

Professor Bruce Ames kicked off the symposium by speaking about "hidden hunger" and how the prevalence of vitamin/mineral deficiencies in children can rob other organs and tissue of these essential nutrients setting the stage for late-stage diseases such as heart and Alzheimer's disease.

Another notable speaker was Dr. I. Sadaf Farooqi of Cambridge University who is recognized internationally for her pioneering work on leptin and obesity. Using congenital leptin deficient individuals, Dr. Farooqi is the first to visualize appetite in the human brain. She concludes that obesity is as much a problem of how we perceive food reward as it is a problem of genetics or nutrient partitioning. Farooqi also gave a Storer Lecture during her visit.

Many other renowned researchers and professors spoke: more than can be mentioned here. To download slides, video and audio from the symposium, visit

http://nutrigenomics.ucdavis.edu/.

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Science Notebook

Unknotting DNA Clue to Cancer Syndrome

A new UC Davis study that explains the actions of a gene mutation that causes early onset cancer provides a fundamental insight into the mechanism of DNA-break repair. The paper was published in the July 27 issue of the journal *Cell*.

People with Bloom's syndrome, a rare genetic disease, typically develop cancer in their twenties. The underlying cause is a mutation in a gene called Blm, which encodes a member of the RecQ family of DNA-unwinding enzymes, or helicases, that are involved in repairing DNA.

Neil Hunter, assistant professor of microbiology at UC Davis, and his colleagues studied the equivalent protein in yeast, SGS1. They found that when SGS1 was defective, yeast chromosomes became more promiscuous in combining with each other as they attempt to repair breaks in the DNA.

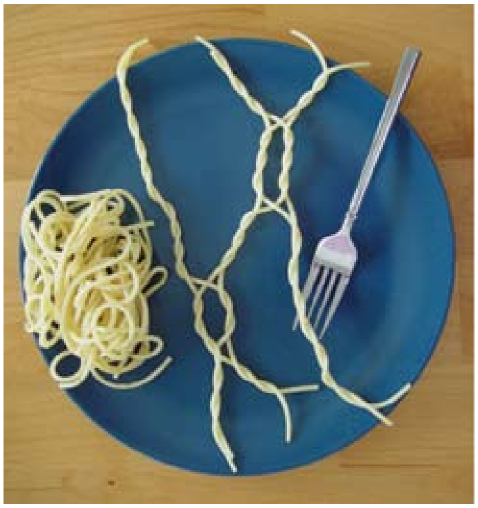
Normally, to repair broken DNA, matching chromosomes associate so that an intact chromosome can act as a template for the damaged one. The DNA strands are then exchanged to form four-way structures called Holliday junctions. To complete repair, these junctions are resolved in one of two ways: either leaving the original chromosomes intact, or exchanging the chromosome arms to form a crossover.

Both yeast and human cells contain two copies of each chromosome, one from each parent. During the cell division cycle, each chromosome gets copied, so for a while there are four of each.

Textbook models show only one end of a DNA break exchanging strands with the template chromosome, while the other end waits passively, Hunter said. But the new study clearly shows that both break ends can autonomously fish around to capture repair templates. Furthermore, when SGS1 is defective, all four matching chromosomes present can get entangled in a multichromosome Holliday junction.

"It's a lot less tidy than we thought, but with both break ends being capable of exchange the repair process will also be more efficient. The drawback is that it's also more risky," Hunter said.

Resolution of multichromosome Holliday junctions increases the risk of rearranging chromosomes, with chunks of DNA ending up in the wrong place. Such rearrangements can lead to cancer.



UC Davis microbiologist Neil Hunter used spaghetti as a model to explain the gene mutation that causes early onset cancer. (UC Davis courtesy photo)

In their normal forms, the SGS1 and Bloom's proteins keep the situation under control by separating the entangled chromosomes and preventing undesirable crossovers. While these experiments were done in yeast, Hunter predicted that the results could be extended to human cells.

"This is a fundamental insight into the mechanism of DNA-break repair," he said.

Circadian Clock Controls Plant Growth Hormone

The signal that causes plants to flower, or "florigen," has been identified by researchers at UC Davis, the University of Arizona, Tucson, and collaborators in New Zealand and Mexico.

"This is the Holy Grail of plant biology," said **William J. Lucas**, professor of plant biology at UC Davis and senior author on the paper published in the May issue of the journal Plant Cell.

Working with pumpkins and squash, Ming-Kuem Lin, a visiting postdoctoral researcher in Lucas' lab and colleagues showed that a protein, FT, is transported through the phloem sap from the body of the plant to the growing tips to trigger flowering.

Many plants, including important crops such as rice, maize and wheat, flower in response to lengthening days in the spring or shortening days in fall. Researchers thought that florigen is made in the leaves as the length of the day changes and it is transported to the meristems, or growing tips of the plant, through the phloem network, which actively transports water, sugars and other molecules from the center of the plant to the periphery.

"This is the Holy Grail of plant biology," said Dr. Lucas.

Lucas' research group works with common pumpkins (*Cucurbita maxima*), because of the large amount of sap they produce. But pumpkins do not flower in response to day length. So the team searched more than a hundred strains of related plants to find a wild squash, *C. moschata*, which flowers only in short days.

When the *C. moschata* plants were infected with a virus carrying the FT gene, they flowered regardless of day length. The viruses were found only in the leaves and stems, but not in the flowering buds, ruling out another possible candidate, the RNA produced by the FT gene.

The researchers grafted *C. moschata* onto *C. maxima*. Again, the plants flowered, as the signal was carried from the *C. maxima* leaves to the *C. moschata* meristems. The pumpkin FT protein was isolated from the phloem.

The experiments provide absolute, direct evidence that the FT protein moving through the phloem is the florigen, Lucas said. Phloem contains about 1,900 other proteins, many of which are also likely to be signals of one kind or another, he said.

In addition to opening up new ways to understand how plants regulate themselves, the findings could eventually have widespread applications in agriculture, Lucas said.

Evolution and Fly Genomics

New work on fruit fly genomics suggests new ways to look at the much larger human genome, and gives insights into the role of adaptation in evolution.

In two recent papers, researchers led by **David Begun** and **Charles Langley**, professors of evolution and ecology at the UC Davis Center for Population Biology, compared the whole genomes of several individuals of the fly *Drosophila simulans* to close relatives *D. melanogaster* and *D. yakuba*.

The same approach could be extended to the much larger genomes of humans and our close relatives, Begun said, showing which changes in the genome are uniquely human.

Stretches of DNA that showed a lot of variability within D. simulans did not match up with areas that were most divergent between species. That could be because when beneficial mutations occur, natural selection increases their frequency and reduces variation at nearby sites. The data provide a comprehensive view of adaptive protein evolution, Begun said.

"You can let the genome tell you what processes have experienced adaptive evolution," Begun said. "The organism is telling you what's been important in its history."

The researchers also found the first evidence that the fly's X chromosome is evolving faster than other parts of the genome. The work is published in the journal *Public Library of Science (PLoS) Biology*.

Drosophila melanogaster (courtesy)

A second recent paper by postdoctoral researcher **Alisha Holloway** and colleagues explores the relationship between genomic variation in *D. simulans, D. melanogaster* and *D. yakuba* and gene expression, or the pattern in which genes are turned on or off. That work is published in *PLoS Genetics*.

Holloway found that genes relatively highly expressed in *D. simulans* have experienced adaptive evolution in the three-prime regions immediately downstream. Those regions can regulate how DNA is translated into RNA. Genes that evolved higher expression levels in one species when compared with the others were also decelerating in their rates of evolution at the protein level, Holloway said. That agrees with previous work showing that highly expressed genes evolve slowly.

Begun, co-author Langley and two other UC Davis researchers are also among about 100 authors on a paper in the Nov. 8 issue of *Nature* describing the genomes of 12 species of *Drosophila* flies, including *D. simulans, D. yakuba* and *D. melanogaster.*

How 'Mother of Thousands' Makes Plantlets

New research shows how the houseplant "mother of thousands" (Kalanchoe diagremontiana) makes the tiny plantlets that drop from the edges of its leaves. Having lost the ability to make viable seeds, the plant has shifted some of the processes that make seeds to the leaves, said **Neelima Sinha**, professor of plant biology at UC Davis.

Many plants reproduce by throwing out long shoots or runners that can grow into new plants. But mother of thousands goes further: the plantlets are complete miniature plants that become disconnected from the mother plant's circulatory system and drop off, allowing them to spread rapidly and effectively. The houseplant has lost the ability to make viable seeds and only reproduces through plantlets.

Helena Garcês, a graduate student in Sinha's laboratory, Sinha and colleagues looked at two genes, STM and LEC, in mother of thousands and close relatives, some of which make seeds instead of plantlets. STM controls shoot growth, while LEC is involved in making seeds.

Expression of STM in leaves was essential for making plantlets. In most plants LEC is expressed in seeds, but mother of thousands' version of the gene, LEC1, was expressed in leaves as well. When the researchers transferred the LEC1 variant into other plants, they were unable to make viable seeds.

Mother of thousands appears to have lost the ability to reproduce sexually and make seeds, but transferred at least part of the embryo-making process to the leaves to make plantlets, Sinha said. The findings could be useful in manipulating plant reproduction, she said.

The houseplant "mother of thousands" makes the tiny plantlets that drop from the edges of its leaves. (Neelima Sinha/UC Davis photo)

The paper was published online by the journal *Proceedings of the National Academy of Sciences.*

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College Events

Please check http://biosci.ucdavis.edu/seminars/ or call 530-752-2358 for upcoming events.

Green Scholarship for Women in Biology Established

A scholarship for undergraduate women who are pursing a degree in the biological sciences was established in October by **Melvin M. Green,** professor emeritus of genetics in memory of his wife, Kathleen C. Green, who was a biologist.

"My wife believed very strongly in the power of education," says Mel Green, "and it is my desire to make a substantial difference in the lives of individuals who have limited financial resources and are demonstrating outstanding academic achievement."

"My wife believed very strongly in the power of education," says Mel Green.


Kathleen C. Green in 1971 (courtesy)


Professor Emeritus Mel Green (courtesy)

The scholarship, to be named the **Kathleen C. Green Scholarship in Biology**, will be awarded annually to two or more female students in the College of Biological Sciences. Scholarship recipients will be selected based on a combination of outstanding scholastic achievement and financial need from junior and senior year students.

Thank you Dr. Green for contributing so thoughtfully to undergraduate education!

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