

MILLER INSTITUTE NEWSLETTER

Miller Fellow Focus: Clarissa Henry

FALL 2003

Second year Miller Fellow Clarissa Henry uses an integrative approach to understand vertebrate embryonic development, specifically the development of segmentation. Most recently, her research has focused on 1) The role that two evolutionarily conserved genes, (*hairy/enhancer of split related 1 and 7*) play in the segmentation of early embryos and 2) How muscle forms during early development.

When one looks at a lobster, ant, or honeybee, it is fairly obvious that its body plan is divided into specific segments. Although not as visually obvious, the vertebrate body plan is also divided into segments as can be seen in the pattern of the vertebrae and ribs.

During development, vertebrae and ribs form from transient structures called somites. Somites are epithelial “balls” of cells, demarcated by a so called “somite boundary”. Somites themselves form from a sheet of mesenchymal cells, called the presomitic mesoderm. The formation of somites underlies much of the segmentation seen in the vertebrate adult. Not only do somites give rise to segmented structures like vertebrae and ribs, but somites also pattern much of the segmented nature of the peripheral nervous system and vasculature and give rise to most of the muscle in the body.

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DEADLINE DATES

MILLER PROFESSORSHIPS
Monday, September 22, 2003

VISITING MILLER PROFESSORSHIPS
Monday, September 29, 2003 (Fall)
Monday, February 9, 2004 (Spring)

MILLER RESEARCH FELLOWSHIPS
Thursday, October 2, 2003

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(L-R) Miller Fellows Clarissa Henry and Anne Pringle along with former Miller Fellow Ray Jayawardhana at the Miller Institute’s 7th Annual Interdisciplinary Symposium at the Marconi Conference Center, Tomales Bay, California.

Miller Fellow Focus: Clarissa Henry

Thus, disruption of normal somite development can have wide ranging developmental effects and has been implicated in such diseases as muscular dystrophy. Clarissa is utilizing genetics, molecular biology, reverse genetics, and cell biology to gain a better understanding of the steps involved in somite development. She uses zebrafish embryos as a model system.

A major question in evolutionary developmental biology is, did segmentation of the body plan arise multiple times? Or did our primitive ancestors utilize a common mechanism for segmentation? This question is still unanswered, but in recent years the general opinion in the field has been that segmentation most likely evolved multiple times. However, research by Clarissa, in collaboration with Sharon Amacher (UC Berkeley) and Charles Kimmel (UO Eugene) (*Development*, 2002), and Dearden et al., (*Development* 2002) hints that a similar mechanism may underlie segmentation in basal arthropods and vertebrates. In a very well studied system, the fruit fly *Drosophila melanogaster*, it is known that a gene called *hairy* plays a role in segmentation. If the function of *hairy* is disrupted, every other segment is missing. Thus, *hairy* is called a “pair-rule” gene. Clarissa asked what function *hairy*-like genes play in zebrafish segmentation. In zebrafish, *hairy*-like genes are called *hairy/Enhancer of split-related genes* (*her* for short). Clarissa asked what happens when the function of *her1* and *her7* are compromised during early development. Surprisingly, she observed that every other (on average) somite boundary was better, or stronger, than its neighbor. This is tantalizingly similar to the phenotype observed in the fruit fly when the function of *hairy* is disrupted. Interestingly, Dearden et al., found that 2 other “pair rule” genes are expressed in a striped pattern



(implying expression in every other segment) in a non insect arthropod. Thus, together, Clarissa’s work and Dearden et al.’s work revisit the issue of the evolution of segmentation, and suggest that perhaps a primitive ancestor to both arthropods and vertebrates was segmented, and utilized these “pair-rule” genes during development to achieve that segmentation.

Somites also give rise to the vertebrate musculature. Recently, Clarissa has been investigating muscle formation. Specifically, she has been analyzing muscle cell elongation. Muscle cells are very long cells. This length facilitates the contractility of muscle. Therefore, muscle cell elongation is critical for normal muscle function. There are two different types of muscle, slow and fast. Although there is a good deal known about slow muscle formation in zebrafish, less is known about fast muscle formation. Clarissa began by describing the elongation of fast muscle cells in zebrafish embryos. She found that cells elongate at the midline of the embryo before cells elongate at the side of the embryo. Because muscle cell elongation began in the middle of the embryo, Clarissa tested the hypothesis that a major signaling protein, Hedgehog, may be involved in fast muscle cell elongation. Surprisingly, she found that Hedgehog function is critical for normal fast muscle cell elongation. This was surprising because Hedgehog was known to be required for slow muscle development, but a role for Hedgehog in fast muscle development had not been described.

Clarissa plans to continue to study fast muscle formation in zebrafish. In addition, she will begin to investigate how muscle cells that are going to contribute to the musculature of the fin move from the middle of the embryo to the fin. When not in the lab playing with zebrafish embryos, Clarissa can most likely be found outside at one of the many great parks/beaches/hiking trails around playing with her husband, son, and dog.



Stork News

Congratulations to Anne Pringle and David Johnson on the birth of their daughter Penelope Arden Pringle Johnson. Penelope, born June 11, 2003, joins older sister Zoe in the Pringle-Johnson family.



Introducing Executive Director Jonathan Arons

Dear Miller Institute Members and Friends:

I'd like to introduce myself as the new Executive Director of the Institute. Raymond Jeanloz is a hard act to follow - so I won't! But I do look forward to continuing the Miller Institute's long record of excellence in bringing young (and not so young) scientists to Berkeley, to share in the excitement of research into the widest possible spectrum of basic scientific knowledge. Berkeley provides a wonderful opportunity for the Miller Fellows and Visiting Miller Professors to deepen, broaden and improve their research lives. Just as important, the fresh points of view and energies brought to Berkeley serve to refresh and enliven the research climate of Berkeley's permanent inhabitants. I expect to promote and carry on these long standing programs of the Institute. Combined with the Miller Professors program, which releases Berkeley and other University of California faculty for full time research, these programs provide an invigorating contribution to intellectual life at Berkeley and to the international research community.



**Executive Director
Jonathan Arons**

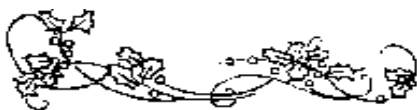
The Executive and Advisory Committees of the Institute have taken up a conversation over the last year, turning over thoughts on possible new directions the Institute might follow. If you have ideas in this regard which you think we should consider, which fit within the general framework of the Institute's purpose, to support excellent research at Berkeley, please communicate your thoughts to me. With high hopes for a stimulating year to come, I am

Very cordially,

Jonathan Arons, Executive Director



The Miller Institute would like to say thank you to Raymond Jeanloz for his 9 years of service on the Executive Committee. At the June Symposium he was presented with a certificate of appreciation by Kathryn Day, Executive Assistant. Speakers George Oster and Fred Nijhout look on.



Awards



At the annual meeting in April, The American Philosophical Society, founded in 1743 by Benjamin Franklin and the oldest learned society in the United States devoted to the advancement of scientific and scholarly inquiry elected a number of Miller Institute alumni to its ranks. Included in the honor are: **MARVIN COHEN**, (Miller Professor - Fall 1988, 1976-77, 1969-70) **GERALD FINK** (member of the Institute's current Advisory Board), **SIMON LEVIN** (Visiting Miller Professor - Spring 2003), and **RONALD EKERS** (Visiting Miller Professor Fall 2001).

The American Academy of Arts & Sciences has elected **LAWRENCE CRAIG EVANS** (Miller Professor - Fall 2001 and Fall 2002) and **WILLIAM DIETRICH** (Miller Professor - CY 1998) to its membership. The academy was founded in 1780 "to cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people". William Dietrich was also elected to the National Academy of Sciences. This organization was founded in 1863 by a congressional act of incorporation, signed by Abraham Lincoln, which calls on the academy to act as an official adviser to the federal government, upon request, in any matter of science or technology.

JUDITH KLINMAN (Miller Professor 2003-04, Fall 1992) was named the first David Sigman Memorial Lecturer at UCLA's Molecular Biology Institute.

This award recognizes outstanding researchers in Chemical Biology. She was honored for two groundbreaking discoveries in enzymology.

GIBOR BASRI (Miller Professor - 1997-98) was honored in May 2003 with the Chancellor's Community Service Award for his commitment to Oakland youth. Basri has been on the board of the I Have a Dream foundation since 1996. The foundation works with a cohort of Oakland youth doing fundraising and mentoring to help them succeed.

BRIAN HALL (Visiting Miller Professor - Spring 1997) has received a number of honors, including:

- the 2002 Gerhard Herzberg Canada Gold Medal for Science and Engineering for his work in how embryonic movement causes stem cells to switch from bone to cartilage development. Dubbed "Canada's Stephen Jay Gould," he is an international trailblazer in explaining how developmental changes in the embryo are a factor in evolution.
- and the Alexander Kowalevsky Medal, Saint-Petersburg Society of Naturalists, Saint Petersburg, Russia, 2001 (awarded to the most distinguished scientists of the twentieth century in comparative zoology and evolutionary embryology).

Next Steps

The Miller Institute congratulates outgoing Miller Fellows on their next endeavors.

BOJKO BAKALOV

Assistant Professor of Mathematics
North Carolina State University

ILYA BEZEL

Director's Postdoctoral Fellow of Physics
Los Alamos National Laboratory

HYOUNG JOON CHOI

Professor of Computational Science
Korea Institute for Advanced Study

TAYLOR FEILD

Assistant Professor of Botany
University of Toronto

SANG-HEON "DAN" SHIM

Assistant Professor of Earth, Atmospheric
& Planetary Science
Massachusetts Institute of Technology

ANDY SUAREZ

Assistant Professor of Integrative Biology,
Departments of Entomology & Animal Biology
University of Illinois-Champaign-Urbana campus

Miller Institute's 7th Annual Interdisciplinary Symposium



Elchanan Mossel explains his research to Mimi Koehl, Fred Nijhout and Zack Powell.

Gaven Martin, Sir Michael Berry, John Spence and Dandu Popescu in deep discussion.



Sid Nagel and YounJoon Jung discuss their work.



Sheila Patek leads the pre-symposium kayak adventure on Tomales Bay.



Miller Institute News
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Recent Publications

Please view complete lists of publications on the Miller Institute website. Publications are listed under Miller News at

<http://socrates.berkeley.edu/~4mibrs/Miller%20Newsletters/Table%20of%20Contents.htm>

Jon Arons, Miller Professor (2002-2003) published one paper during his Miller Professorship term. He also has four papers in press.

Robert Bergman, Miller Professor (Spring 2003) published nine papers as a result of his Miller Professorship. He also has four papers in preparation and two in press.

Dmitry Budker, Miller Professor (2002-2003) published nine papers during his year long Miller Professorship. He also has one in preparation and one in press.

Jon Magne Leinaas, Visiting Miller Professor (Fall 2002) published one paper along with Dung Hai Lee, Miller Professor (Spring 1999). He has two in press.

Christopher Lowe, Miller Fellow (1998-2001) recently published "Anteroposterior patterning in hemichordates and the origins of the chordate nervous system". *Cell*, June 2003;113(7):853-65

Andy Suarez, Miller Fellow (2001-2003) published six papers during his Miller Fellowship term. He also has one in press and two in review.

Brian J. Staskawicz, Miller Professor (2002-2003) published one paper during his term and has one in press.

Xander Tielens, Visiting Miller Professor (Fall 2002) has written a perspective for *Science* entitled "Peering into stardust" which was recently published (*Science*, 300, 68 (2003)).

The Miller Institute is "dedicated to the encouragement of creative thought and the conduct of research and investigation in the field of pure science and investigation in the field of applied science in so far as such research and investigation are deemed by the Advisory Board to offer promising approach to fundamental problems."