Sean B. Carroll Receives 2009 Viktor Hamburger Outstanding Educator Prize

Sean B. Carroll is the 2009 recipient of the Viktor Hamburger Outstanding Educator award, in recognition of his pioneering role in elucidating the genetic and molecular basis of morphological evolution, and for his exceptional contributions to making scientific advances in this field accessible to both students and the general public.

Biologists have long sought to understand how the great diversity of animal forms evolved. From the time of Darwin it has been understood that changes in embryological development must underlie anatomical change; and with the incorporation of genetics into the modern synthesis of evolutionary theory came the understanding that changes in genes must underlie this. The emergence of the new field of evolutionary developmental biology ("evo-devo") over the last two decades has further transformed our understanding of the evolutionary process, and Sean Carroll is an internationally recognized leader of this new discipline.

Dr. Carroll earned his undergraduate degree at Washington University and carried out his Doctoral work at Tufts University under David Stollar, in the field of immunology. Even then he was fascinated by evolution, and for his Post-doctoral work he would change fields in order to study how body plans develop from their embryonic origins. He joined Matt Scott's lab at the University of Colorado, Boulder, at a time when they were pioneering the study of genes that help to divide a fruit fly's body into equal segments. One of these genes, called *fushi tarazu*, had just been cloned. Dr. Carroll put his expertise in generating antibodies to good use, and was the first to show that the protein it encoded was expressed in an amazing pattern of stripes within the developing embryo. For many developmental biologists, understanding the mechanisms underlying the establishment of such fundamental patterns is a driving force behind their research. This has certainly been the case for Carroll, as he has continued his exploration into the relationship between gene function and the formation of body patterns throughout his career. A notable highlight has been his elegant studies of how the fruit fly wing is patterned from a simple field of cells into a complex instrument of flight.

It was from his studies of the *Drosophila* wing that Dr. Carroll's evo-devo research took flight. He was among the first to compare how genes known to play important roles in one insect work in a different insect. He compared the fruit fly to the butterfly, and made some surprising discoveries, including that both conservation and variation in body pattern can be achieved with a single gene. One of his first major discoveries examined how co-option of regulatory genes could drive morphological novelties such as butterfly eyespots. This seminal work demonstrated that the diversity of body plans could be achieved, and indeed is most frequently achieved, by deploying very old genes in new ways, rather than from the evolution of new genes.

Dr. Carroll has since studied the same principles at work in constructing body segments, limbs, sensory hairs, and body pigmentation, all as a Professor and Howard Hughes Medical Institute

(HHMI) investigator at the University of Wisconsin, Madison, where he first established his laboratory in 1987. His influential body of work includes more than 120 papers, and is extraordinary in its depth and breadth, and also in its crossing of typical disciplinary boundaries. He has pushed the envelope of evolutionary biology by championing the idea that changes in cis-regulatory sequences, rather than protein coding regions, play a driving role in the evolution of body form. His impressive scientific achievements have been recognized by his election to the National Academy of Sciences in 2007, as a fellow of the American Association for the Advancement of Science in 2002 and a fellow of the American Academy of Arts and Sciences in 2009. He has received the Kowalevsky Medal (Russia) for evolutionary developmental biology, and has held numerous honorary lectureships both in the United States and abroad.

For most academics this would have been more than achievement enough. Dr. Carroll, however, has also led a second life, equally successful, as a public educator in the realm of evolution. He has written multiple highly acclaimed books including "From DNA to Diversity: Molecular Genetics and the Evolution of Animal Design," "Endless Forms Most Beautiful: The New Science of Evo Devo and the Making of the Animal Kingdom," "The Making of the Fittest," "Into the Jungle: Great Adventures in the Search for Evolution" and the newly released "Remarkable Creatures." These books are important and noteworthy in many respects, but perhaps most so because Carroll is a natural story-teller whose clarity of thought is beautifully paired with an engaging style and wit. These attributes have earned his books widespread critical acclaim, major awards, and devoted readers around the world, helping to spread the gospel of modern evolutionary thought well beyond the Ivory Tower. Indeed, the philosopher Michael Ruse has opined that if Charles Darwin were alive today, there would be no scientist that he would rather spend an evening with than Sean Carroll.

The SDB Board of Directors established the Viktor Hamburger Outstanding Educator Prize in 2002, in honor of Dr. Viktor Hamburger, to recognize teachers who have contributed exceptionally to the field of developmental biology education. It is fitting in that in 2009, as we celebrate the anniversaries of Charles Darwin's birth (200th) and of the publication of *The Origin of Species* (150th), we recognize Dr. Sean B. Carroll, a pioneer of modern evolutionary biology, with this award. Dr. Carroll was SDB President 2001-2002.

To learn more about Sean Carroll's research and writings:
http://www.molbio.wisc.edu/carroll/
http://www.hhmi.org/research/investigators/carroll.html
http://seancarroll.com

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