



EVO: Ten Questions Everyone Should Ask about Evolution

EVO is a portal into the wondrous story of life on earth. The exploration is divided into ten questions, which are best viewed one at a time followed by discussion, reflection, and debate. Of course, you can watch EVO in one sitting, but to give your brain a break, EVO is divided into two parts. Part 1 explores the fundamentals of evolutionary biology, while Part 2 focuses on social and humanistic approaches to biological evolution:

EVO Part 1: *The Basics (1-5)* (59 minutes)

EVO Part 2: *The Continuing Story (6-10)* (48 minutes)

Background

The World Summit on Evolution was held June 9-12, 2005 in Ecuador's Galapagos archipelago, the islands that helped spark Darwin's revolutionary ideas that changed how we view life on Earth. The Universidad San Francisco de Quito (USFQ) hosted this conference to celebrate the opening of its Galapagos Academic Institute for the Arts and Sciences (GAIAS). The Summit brought together some of the world's preeminent evolutionary biologists and thinkers to discuss and debate current issues in evolutionary biology. The conference consisted of short presentations followed by questions, and an open discussion amongst the speakers and participants.

Filmmaker John Feldman was invited to lead a two-month production workshop of international college filmmaking students to document this event. Over the course of the following five years, Mr. Feldman made EVO. The scientists who were interviewed for the film all attended the Summit, although some of the interviews were shot after the Summit. Wildlife footage for the film was shot by Mr. Feldman in the Galápagos and, mostly, in his home state of New York.

Director's Statement

When I traveled to the Galápagos Islands in 2005 to lead a workshop filming the World Summit on Evolution, little did I know that I would spend the next five years studying evolution and the ways that film can assist in teaching science. My partners and mentors in this journey have been the incredibly insightful and expressive scientists we interviewed at the Summit as well as other generous and experienced members of the scientific community, science teachers, educators, and students.

I take the charge of educating through film seriously. This film is based on respect for science and for the way that science matters in providing us with a way to respond intelligently, effectively and ethically to our responsibilities as citizens of the earth.

Every day's breaking news brings more evidence that we cannot afford to be ignorant about evolution. The study of evolution encourages a deep awareness of the interdependence of all organisms and an appreciation for environmental dynamics through time. It deepens our understanding of the environment and ecology and encourages an unsentimental respect for the natural world.

In making *EVO* I have returned to my first love: nature filmmaking. I made my first film *A Sense of Existence* (1967) when I was 13, my goal then, as it is now, was to share my fascination and reverence for the natural world. It is my hope that people will find ways to use *EVO* as a tool for learning about evolution and for further investigations into life in their own back yards.

John Feldman, Hummingbird Films

Biographies

Scientists

Prof. Leticia Aviles (University of British Columbia, Canada) focuses her research on the evolution of sociality, the evolution of sex ratios in subdivided populations, and the evolution of life history traits and local population dynamics in metapopulations. She has published in a variety of journals including *Evolution*, *Ecology* and *American Naturalist*.

Prof. William H. Calvin (University of Washington, USA) is a theoretical neurobiologist and the author of a dozen books, mostly for general readers, about brains and evolution including *A Brief History of the Mind: From Apes to Intellect and Beyond* (Oxford, 2004)., His book with Derek Bickerton, *Lingua ex Machina: Reconciling Darwin and Chomsky with the Human Brain* (MIT, 2000) is about the evolution of structured language..

Prof. Daniel C. Dennett (Tufts University, USA) is a noted philosopher whose research focuses on philosophy of mind, philosophy of science and philosophy of biology. He is the author of over a dozen books including *Darwin's Dangerous Idea* (Simon & Schuster, 1995). He has received two Guggenheim Fellowships, a Fulbright Fellowship, and a Fellowship at the Center for Advanced Studies in Behavioral Science. He was elected to the American Academy of Arts and Sciences in 1987.

Dr. Kevin de Queiroz (Smithsonian Institution, USA) is a Research Zoologist and Curator at the National Museum of Natural History. His current research centers on the phylogenetic relationships of various groups of lizards. He is also interested in phylogenetic nomenclature, and is the co-originator of the somewhat controversial PhyloCode which could replace Linnaean taxonomy.

Dr. Niles Eldredge (American Museum of Natural History, USA) is a paleontologist and curator of the American Museum of Natural History. He is the co-discoverer with Stephen Jay Gould of the theory of punctuated equilibria, a milestone in evolutionary theory. His specialty is the evolution of trilobites. His books include *Darwin: Discovering the Tree of Life* (WW Norton, 2005), *Why We Do It: Rethinking Sex and the Selfish Gene* (WW Norton, 2004) and *The Triumph of Evolution and the Failure of Creationism* (Holt, 2000), *Reinventing Darwin: The Great Debate at the High Table of Evolutionary Theory* (Wiley, 1995)

Prof. Douglas Futuyma (Stony Brook University - State University of New York, USA) is author of the popular textbooks: *Evolutionary Biology* (Sinauer Associates, 3 editions), *Evolution* (Sinauer Associates, 2005, 2009) and *Science on Trial: The Case for Evolution* (Sinauer Associates, 1982, 1995). His research concerns the evolution of interactions between herbivorous insects and their host plants and the speciation of insects. He is the editor of *Annual Review of Ecology, Evolution and Systematics* and has been the editor of *Evolution*. He has been president of the Society for the Study of Evolution and the American

Society of Naturalists from which he received the Sewall Wright Award. He was made a member of the National Academy of Sciences in 2006.

Prof. Pierre-Henri Gouyon (Université Paris-Sud, France) is recognized for his work on evolution and genetics. He is co-author of *Gene Avatars: the Neo-Darwinian Theory of Evolution* (Belin, 1996; English translation, Springer, 2002). He is the subject of a film by Nicholas Ribowski entitled *Pierre-Henri Gouyon: génétique et évolution*. (2005). He is a professor at the Muséum national d'histoire naturelle de Paris and at Sciences Po, Paris (École libre des sciences politiques) and managing editor of the European Society of Biological Evolution's *Journal of Evolutionary Biology*.

Prof. Peter Grant (Princeton University, USA) and **Prof. Rosemary Grant** (Princeton University, USA) are widely known for their remarkable long-term studies of over 35 years which demonstrate evolution in action on Darwin's finches on the Galápagos Islands. In 2005 they received the Balzan Prize for Population Biology which praises their "seminal influence in the fields of population biology, evolution and ecology." In 2008 Peter and Rosemary Grant were among the thirteen recipients of the Darwin-Wallace Medal, which is presented every 50 years by the Linnean Society of London. In 2009 they were recipients of the annual Kyoto Prize in basic sciences, an international award honoring significant contributions to the scientific, cultural and spiritual betterment of mankind.

Prof. Laura Katz (Smith College, USA) researches the eukaryotic tree of life, the phylogeography of coastal ciliates and genome evolution in microbial eukaryotes. She is the editor of the book *Genomics and Evolution of Microbial Eukaryotes* (Oxford, 2006) and was associate editor for the journal *Molecular Biology and Evolution* (2003 – 2008). She was on the scientific advisory board for the National Evolutionary Synthesis Center (NESCent) when it was newly-formed (2005-2007). In addition to teaching at Smith she is on the graduate faculty at the University of Massachusetts, Amherst.

Prof. Antonio Lazcano (Universidad Autónoma de México, Mexico) is a leading scholar in the study of the origin of and early evolution of life and is the author of *El origen de la vida (The Origin of Life)* (1984). He is the first Latin American scientist to have served as president of the International Society for the Study of the Origin of Life (ISSOL).

Prof. Lynn Margulis (University of Massachusetts-Amherst, USA) is renowned for her original contributions to the study of microbial evolution and cell biology. She is best known for her theory on the origin of eukaryotic organelles, and her contributions to the endosymbiotic theory. Dr. Margulis has contributed to James E. Lovelock's Gaia concept. Yale ecologist G. E. Hutchinson credits her with creating a "quiet revolution in microbiological thought." She received the National Medal of Science from President Clinton and Germany's Alexander von Humboldt Prize. In 2008 she was one of only thirteen recipients of the Darwin-Wallace Medal, which is granted every 50 years by the Linnean Society of London. She has co-authored a number of books with her son Dorion Sagan including *Symbiotic Planet: A new look at evolution* (Basic Books, 1998) and *Acquiring Genomes: A theory of the origins of species* (Basic Books, 2002).

Prof. Geoff McFadden (University of Melbourne, Australia) studies protists (eukaryotic microorganisms) and endosymbiosis. He has identified the relict chloroplast in malaria parasites and is developing herbicides as antimalarial drugs. He has published in journals such as *Nature*, *Science*, *EMBO J*, and *PNAS*. Prof. McFadden has been awarded among others the Australian Academy of Science's Frederick White Prize, two Howard Hughes Medical Institute Scholar's awards, the Royal Society of Victoria Medal, and is a member of the Australian Academy of Sciences. Geoff surfs as much as he can.

Prof. Richard Michod (University of Arizona, USA) researches the evolution of interactions within populations, particularly cooperative interactions and conflict. He has specifically examined the evolution of sex, origin of individuality, origin of life, and the evolution of social behavior. He has written

Darwinian Dynamics (Princeton, 1999), *Eros and Evolution, A Natural Philosophy of Sex* (Addison Wesley, 1995), as well as edited books on the evolution of sex and human values.

Prof. Joan Roughgarden (Stanford University, USA) currently focuses her research on linking ecology with economic theory. Her books, which have generated debate in the scientific community, include *The Genial Gene: Deconstructing Darwinian Selfishness* (Univ. California Press, 2009), *Evolution and Christian Faith: Reflections of an Evolutionary Biologist* (Island Press, 2006) and *Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People* (Univ. California Press, 2004, 2009).

Prof. Frank Sulloway (University of California-Berkeley, USA) has written about the nature of scientific creativity and published extensively on the life and theories of Charles Darwin. He is a Visiting Scholar in the Institute of Personality and Social Research at the University of California, Berkeley. His book *Freud, Biologist of the Mind: Beyond the Psychoanalytic Legend* (1979) received the Pfizer Award of the history of Science Society. Dr. Sulloway is a former MacArthur Fellow, a Fellow of the American Association for the Advancement of Science and a recipient of the Golden Plate Award of the American Academy of Achievement.

Production

John Feldman (filmmaker) is a pioneering independent filmmaker whose work as a director of independent dramatic films and documentaries has earned him numerous awards including the New American Cinema Award from the Seattle International Film Festival. His feature films *Alligator Eyes* (1990), *Dead Funny* (1995), and *Who the Hell is Bobby Roos?* (2002) have enjoyed considerable international acclaim. He is highly regarded as a writer and director of short non-fiction films and has developed a reputation for his ability to explain complex ideas to a lay audience in a visually engaging way. He is currently focusing his efforts on educational films and revitalizing the use of film in the classroom. John has an MFA in filmmaking from Temple University and a BA in biology from the University of Chicago.

Sheila Silver (music) is an important and vital voice in American music today. She has written in a wide range of mediums: from solo instrumental works to large orchestral works; from opera to feature film scores. Silver has received numerous awards and fellowships and is Professor of Music at the State University of New York, Stony Brook. Her music is recorded on various labels. Sheila Silver and John Feldman are married and have collaborated on films and music for over twenty years.

Guido Alvarez (graphic design) is a cutting-edge new media artist. He received a Fulbright Scholarship, a BFA in Graphic and Craft Design, an MFA in Design and Visual Communication and is finishing his Ph.D. in Media Art & Text from the Virginia Commonwealth University. He developed and animated original characters for the film including the EVO character itself.