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## FACT SHEET – FRANCISCO J. AYALA

**March 12, 1934:** Francisco José Ayala is born in Madrid, Spain, the fourth of six children of Soledad (Pereda) Ayala, a housewife, and Francisco Ayala, a businessman. His family and extended family's pursuits largely center on business and finance with no interest in science. Two years after his birth, the Spanish Civil War engulfs his nation, ending with the victory of Franco's fascist forces. His education, like all facets of life in Franco-era Spain, is constrained by the strictures of dictatorship.

**1939 – 1950:** Ayala attends private Catholic primary and secondary schools in Madrid. At age 12, a general science class taught by a priest fires his passion for astronomy, physics and biology and intrigues him with stories about scientists and their pioneering discoveries, thus setting the young student's life-long trajectory.

**1951 – 1955:** To the surprise and chagrin of his family, he eschews economics and law and opts instead to study physics at the University of Madrid. Toward the end of his bachelor studies, he reads *Le Phénomène Humain* ("The Phenomenon of Man") by Pierre Teilhard de Chardin, a Jesuit paleontologist and philosopher who lays out a vision of an evolving world of matter and life that has brought about the human species, with greater developments to come. He is inspired to study genetics and evolution by Teilhard's philosophical, scientific and theological questions and speculation about the purpose, meaning, and future of human existence.

**1955:** Receives B.Sc. in physics from the University of Madrid.

**1955 – 1960:** Studies theology at the Pontifical Faculty of San Esteban in Salamanca, Spain. Higher education suffers in Spain as a result of the Franco dictatorship, but while in Salamanca, he is befriended by two professors (Fernando Galán and Antonio de Zulueta, arguably the first important geneticist in Spain and the only one to make a major discovery in the early years of genetics) who, though twice his age, pull him into their circle of colleagues. They encourage him to continue studies abroad, particularly at Columbia University in New York.

**1960:** Ordained as a Dominican priest in Salamanca but chooses to leave priesthood and continue studies in genetics, in agreement with his superiors (with the understanding that he won't leave the priesthood for at least five years, but will not need to perform priestly duties).

**1961:** Despite a limited grasp of English – some reading competence but almost no conversational skills – Ayala moves to New York and begins studies in genetics at Columbia University. With an introduction from his colleagues in Salamanca, he meets Ukrainian-born scientist Theodosius Dobzhansky, a central figure in shaping the unifying modern evolutionary synthesis and considered by many to be one of the 20<sup>th</sup> century’s most distinguished geneticists and evolutionary biologists.

**1963:** Receives M.A. in genetics from Columbia.

**1964:** Under the tutelage of Dobzhansky, awarded a Ph.D. in genetics with a thesis detailing new methods of measuring the population fitness of *Drosophila* (fruit flies) and demonstrating that the rate of evolution depended on the level of genetic variation. The following year, the journal *Genetics* publishes “Relative fitness of populations of *Drosophila serrata* and *Drosophila birchii*.”

**1964 – 1965:** Encouraged to stay in the U.S. by Dobzhansky who arranges his appointment as research associate at Rockefeller University in New York, which had hired Dobzhansky before he reached Columbia’s retirement age.

**1965 – 1967:** Assistant professor of biology at Providence College, Rhode Island.

**1967 – 1971:** Returns to Rockefeller University as assistant professor of biology. Working with Dobzhansky, he uses powerful molecular methods to relate the amount of genetic polymorphism to the rate of evolutionary change. He combines laboratory experiments with the investigation of natural populations of *Drosophila* species in the American tropics. His resulting publications establish a new understanding of the mechanics of adaptation and the role of genetic variation in evolution.

**1968:** With Dobzhansky as his best man, marries Mary Henderson, a Radcliffe graduate, in Dublin, New Hampshire. They have two sons: Francisco José (b. 1969) and Carlos Alberto (b. 1972).

**1971:** Becomes a naturalized United States citizen. Named assistant professor of genetics at the University of California at Davis, and made full professor in 1974, a post he holds until 1987. Retiring from Rockefeller University, Dobzhansky, his former mentor who is now colleague and close personal friend, joins him at UC Davis.

**1970s:** With a range of new techniques including the study of proteins and DNA at a molecular level, Ayala is able to examine and compare the genetics of all sorts of species that earlier could not be studied, because they cannot be bred in the laboratory. These techniques now allow for comparisons between remotely related species, such as fruit flies with mice or even humans.

He also investigates genetic diversity concerning the paleontological record to determine factors contributing to expanding diversity and to mass extinctions. He and colleagues compare genetic diversity of species living in stable, resource-rich environments such as coral reefs, with species living in stable environments with limited resources such as the deep sea. They find that species in both areas show immense genetic diversity, proving that environmental stability aids genetic variation, regardless of available resources. These results open new insights on major diversifications and extinctions observed in the fossil record.

**1974:** *Studies in the Philosophy of Biology* (which he co-edits with Dobzhansky) published, with contributions from scientists (including four Nobel laureates) and philosophers (including Karl Popper and Donald Campbell), a work widely credited with originating the modern development of the philosophy of biology.

**1975:** Theodosius Dobzhansky dies.

**1977:** Elected member of the American Academy of Arts & Sciences.

**1979:** Awarded Medal of the College of France.

**1980s:** Extensive study in Latin America and the Caribbean makes Ayala acutely aware of Chagas disease, a severe parasitic affliction infecting millions of impoverished people in the world's tropics. He and collaborator Michel Tibayrenc study the parasitic protozoa that causes Chagas, *Trypanosoma cruzi*, and discover that the three or four variations of the effects of Chagas come from three or four varieties of the protozoa. They demonstrate that their reproduction is clonal (reproduction by splitting) and not sexual. Their clonal theory of parasitic protozoa is of great significance for medicine, with implications in the development of vaccines and curative drugs.

**1980:** Purchases property near Sacramento, California as a weekend retreat, and begins producing several varieties of grapes for various wineries. Over the years he expands his vineyard holdings to more than 2,400 acres in Sacramento and San Joaquin counties. Elected member of the National Academy of Sciences. *Modern Genetics* (co-written with J.A. Kiger) published (2<sup>nd</sup> edition, 1984).

**1981:** Serves as an expert science witness at the McLean v. Arkansas Board of Education creationism trial challenging the "Balanced Treatment for Creation-Science and Evolution-Science Act." The U.S. District court strikes down the law saying that creation-science lacks scientific merit, educational value as science, and unconstitutionally entangles the state with religion.

**1982:** *Population and Evolutionary Genetics: A Primer* published.

**1984:** As a result of the 1981 Arkansas creationism case, he is principal author of *Science, Evolution, and Creationism* for the National Academy of Sciences. Later he recalls his rationale to the Academy's president at the time: "What was at stake was not a particular branch of science, but the survival of rationality in this country. If we allowed the Book of Genesis to be taught as science, that would be as bad for science as it would be for religion." Elected member of the American Philosophical Society.

**1985:** After his first marriage ends in divorce, Ayala marries Dr. Hana Lostakova, an ecologist, in Prague. Receives the W.E. Key Award from the American Genetics Association.

**1987:** Named distinguished professor of biological sciences at the University of California, Irvine. Receives the Scientific Freedom and Responsibility Award of the American Association for the Advancement of Science.

Helps prepare the National Academy of Sciences' amicus brief to the U.S. Supreme Court for *Edwards v. Aguillard* in opposition to a Louisiana law requiring parallel teaching of creation science and evolution in public schools. The Court rules the law unconstitutional, citing its intent to advance a particular religious view. The ruling, however, also says "teaching a variety of scientific theories about the origins of humankind to school children might be validly done with the clear secular intent of enhancing the effectiveness of science instruction."

**1989:** Named Donald Bren Professor of Biological Sciences and Director of the Bren Fellows Program at the University of California, Irvine. Also named professor of philosophy, UC Irvine. Elected Foreign Member, Royal Academy of Sciences of Spain.

**1990s:** Continuing his research on parasitic protozoa, he turns his interest to malaria, which annually infects 300 to 500 million, mostly in Africa. Since malaria causes high fevers every third or fourth day, hundreds of millions are seriously ill about two days every week, a fact rarely considered by those who dismiss the continent as economically "undeveloped." By reconstructing the evolution of the agent responsible for 90 percent of malarial deaths, *Plasmodium falciparum*, he shows that its spread throughout the globe's tropics started very recently, only about 5,000 years ago. Because the species is genetically largely uniform except for mutations recently evolved in response to the human immune system and to medicines, it may be possible to develop a universal cure for malaria.

**1990 – 1993:** Serves as a member of the National Advisory Council for the Human Genome Project, where he advocates that that three to five percent of the council's budget be used to evaluate the ethical, legal, and social implications of the project's results.

**1993:** Elected president and chairman of the board of the American Association for the Advancement of Science (AAAS), posts he holds through 1996. During his tenure, Ayala promotes the development of a standing office for the "Dialogue on Science, Ethics, and Religion" and is chairman of its advisory committee for several years.

**1994:** Appointed by President Clinton to the U.S. President's Committee of Advisors on Science and Technology, serving until 2001. Awarded Gold Honorary Gregor Mendel Medal for Merits in the Biological Sciences, Academy of Sciences of the Czech Republic. Elected Foreign Member, Russian Academy of Sciences. Elected Foreign Member, Russian Academy of Natural Sciences.

**1995:** Awarded UCI Medal, University of California, Irvine.

**1996:** Elected Foreign Member, Mexican Academy of Sciences.

**1997:** *Genetics and The Origin of Species* published.

**1998:** *Evolution and Molecular Biology: Scientific Perspectives on Divine Action* (co-edited with R.J. Russell and W.R. Stoeger) published. Awarded Gold Medal of the Academia Nazionale dei Lincei (Italian National Academy of Sciences) in Rome, the oldest scientific academy in the world, founded in 1603.

**1999:** Principal author of the second edition of *Science, Evolution, and Creationism*. A *New York Times* article dubs him “Renaissance man of evolutionary biology.”

**2000:** Named professor of logic and the philosophy of science, UC Irvine. Sigma Xi, the Scientific Research Society of the United States, awards him the William Procter Prize for Scientific Achievement from Sigma Xi. Receives Honorary Gold Medal of the Accademia Nazionale dei Lincei.

**2002:** At the White House, President George W. Bush awards him the 2001 National Medal of Science, noting his “discoveries opened up new approaches to the prevention and treatment of diseases that affect hundreds of millions of individuals worldwide.”

**2003:** Appointed University Professor, the highest title in the University of California system and the only professor currently holding the title at the University of California, Irvine. Elected Foreign Member, Serbian Academy of Sciences and Arts.

**2004:** Elected president of Sigma Xi for a two-year term.

**2006:** *Darwin and Intelligent Design* published.

**2007:** *Darwin’s Gift: to Science and Religion* published. *Human Evolution: Trails from the Past* (co-written with C.J.Cela-Conde) published. Receives American Institute of Biological Sciences (AIBS) Distinguished Scientist Award. Elected Member, L’Académie Internationale de Philosophie des Sciences, Brussels. Named Fellow, American Academy of Microbiology and Fellow, Linnean Society of London.

**2008:** Chairs the authoring committee at the National Academy of Sciences for the third edition of *Science, Evolution, and Creationism*.

**2009:** Ayala and colleagues show that the form of human malignant malaria caused by *Plasmodium falciparum* originated from a closely related parasite found in chimpanzees in equatorial Africa. The paper in the September 1 issue of *Proceedings of the National Academy of Sciences USA (PNAS)* reports that the parasite was transmitted to humans from chimpanzees possibly through a single mosquito.

Presents lectures at more than 30 universities in six nations and at the Vatican on the occasion of the 200<sup>th</sup> anniversary of Charles Darwin’s birth and the 150<sup>th</sup> anniversary of the publication of Darwin’s *Origin of Species*.

**2010:** “African great apes are natural hosts of multiple related malaria species, including *Plasmodium falciparum*,” published in the January 26 issue of *PNAS*, shows that this human parasite is now present in apes. Thus, if malaria were eradicated from human populations, humans could be re-infected again by transmission from gorillas or chimpanzees.

Awarded the Templeton Prize by the John Templeton Foundation.

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