

Evolution, Synthesized

A giant in the field takes stock of his science.

by STEPHEN PALUMBI

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FEW PEOPLE would have the credentials, history, background, or brazen confidence to write a book with so definitive a title as *What Evolution Is*.

But few would deny the right of Ernst Mayr, S.D. '80, Agassiz professor of zoology emeritus, to produce such a volume. Former director of Harvard's Museum of Comparative Zoology (MCZ), winner of a galaxy of international prizes, Mayr's major contributions to the field of evolution stretch back well over 60 years.

Born in 1904, he is the last surviving member of a cadre of biologists who shook the world with their stunning blend of genetics, mathematics, natural history, and

paleontology in the 1930s, '40s, and '50s. This group produced what is now called the "evolutionary synthesis," a brilliant and

far-reaching set of papers, books, and discoveries that has charted the path of modern evolution ever since.

Now, more than half a century after Mayr's initial contributions to that advance, we have a chance to see what this icon of biological innovation thinks about the use we've made of the synthesis, what it has accomplished, and where it is going. *What Evolution Is* does not dwell on historical developments or "who said what." Instead it takes all that for granted and tries



to lay out for the nonscientific reader the power, accomplishments, and thrill of modern evolutionary science—a science, he notes, that we apply "to cope with an-

Ernst Mayr (right) and his Malay mantri (field assistant), Sario, emerging from two months of surveying birds in the interior mountains of New Guinea in 1928—a pioneering study of species formation.

What Evolution Is,
by Ernst Mayr
(Basic Books, \$26).

tibiotic resistance by pathogens, pesticide resistance by crop pests, the control of disease vectors (e.g., malaria mosquitoes), human epidemics, the production of new crop plants by evolutionary genetics, and many more challenges.”

Mayr has a lot of perspective to draw from, having published major evolutionary works—works that everyone in evolutionary science must read—every 20 years, and scores of other books, papers, monographs, and commentaries in between. He has contributed a great deal of hard data about evolution, but he has also arrived at critical insights and historical discoveries about how people over the past century have learned to *think* about evolutionary change. Mayr describes one of these key tools as “population thinking”: the ability to think about populations of organisms and how they thrive, rather than thinking merely about individuals, the way a zookeeper might, or species, as a museum curator might. Mayr himself exemplified the value of a curator: understanding the natural setting and intrinsic biological variability of species. Through his research on bird species and subspecies in the Asian tropics, Mayr realized the critical need to integrate nonmorphological information about species into the growing understanding we have of their evolution. Where do new bird species come from? Mayr would answer by inquiring about mating patterns and ecological differences and the geography of color-plumage variants.

In 1941, he received a prestigious invitation to present two Jesup Lectures at Columbia University—then a world powerhouse of evolutionary biology. The success of those lectures led naturally to *Systematics and the Origin of Species*, published in 1942—a book that would be-

come one of the pillars of the evolutionary synthesis. Already one of the world’s authorities on the taxonomy and classification of birds, Mayr also represented the vibrant heart of the rebirth of museum-based scientific research. He had realized that cradled in the careful collections of the American Museum of Natural History in New York City, one of the world’s most venerated zoological collections, where he was curator of birds from 1931 to 1953, lay a store of knowledge about natural history that was pivotal in the emerging understanding of the evolutionary process.

Natural history celebrates the geography, morphology, behavior, life styles, and ecology of the world’s species by unraveling their life stories and seeking to make sense of their interactions. Previously the pursuit primarily of wealthy gentry with their shell collections and plant presses, natural history in the twentieth century became one of the missions of major mu-

seums around the world. Stored in vaults, pinned in cabinets, displayed in drawers or rows of glass bottles, species from around the planet were at hand to reveal their stories.

Mayr himself had uncovered many new species, particularly of the birds of New Guinea and the Pacific. But he knew there was more information in a museum than just its species lists. By adding geographic information to those lists, Mayr realized that he could chart each species’ position relative to the positions of similar species. His maps told him a simple but powerful fact: the most closely related species—for example, those that differ by just a few colored feathers—usually had close but non-overlapping distributions. (A map from *Systematics* graphically illustrates the point, showing the separate ranges of upland species of New Guinea birds of paradise, genus *Astrapia*, whose brightly colored males differ in plumage—evidence of rapid evolution of mating displays among diverging species.) Species that were more different, those that had diverged from one another long ago, often had such overlapping distributions that individuals of both species regularly inhabited the same places.

From these simple maps, and from other data drawn from the natural history of species, Mayr proposed that most species arose from geographically separated populations of one species. The new, young species start out with non-overlapping ranges because the original populations that formed them were separated, but over time the diverging species spread out and come back into contact. By then, these species are so different that they can’t or won’t interbreed, and the multiple species persist. Forcefully promoted and ex-

Mayr at Harvard

In 1953, a decade after the triumph of his *Systematics and the Origin of Species*, Harvard attracted Mayr—by then the world’s leading ornithologist—to the Museum of Comparative Zoology. The University would prove a spectacular incubator for him. Mayr published his second academic blockbuster in 1963, *Animal Species and Evolution*. Muses another noted Harvard evolutionary biologist, Steven J. Gould, in his new book, just published by Harvard University Press, *The Structure of Evolutionary Theory*: “This work shaped my own evolutionary thinking more than any other book—and I am confident that most naturalists of my generation would offer the same testimony.”

Mayr’s impact was felt keenly at the MCZ. He brought with him a reputation for intellectual energy and academic drive that could intimidate undergraduates—but not all of them. In the spring of 1953, the first prospective senior thesis writer landed in Mayr’s office. Robert Treat Paine III ’54, scion of a storied Boston family and a lineal namesake of a signer of the Declaration of Independence, was the best young bird watcher in the state.

“I’ve asked about you,” Mayr told the young man, agreeing to direct his thesis. But not on Paine’s proposed topic—redwing blackbirds. Instead, Mayr directed him to re-examine the relationships and classification of sparrows.

“I got one of the world’s best educations into the details of the species concept,” Paine remembers. Now emeritus himself, a member of the National Academy of Science in his own right, and a world-renowned ecologist, Paine got his first training in how to write a scientific paper through his intense internship with Mayr. “We spent hours in the collections,” looking carefully at the morphology of specimens that only the Museum of Comparative Zoology could boast, Paine recalls. But that wasn’t all. Mayr directed Paine to think carefully about many other features of sparrows that were key to understanding their species status: nest construction, how nests were lined, ranges of subspecies, molting plumage, diets, et cetera. For Paine, this was a seminal experience that helped launch a career that shook the world of ecology. For Mayr, it was just the way to do ornithology. ~S.P.

OFF THE SHELF

Recent books with a Harvard accent

The Age of Science: What Scientists Learned in the Twentieth Century, by Gerard Piel '37 (Basic Books, \$40). The founder of *Scientific American* offers an elegantly written, accessible, panoramic, and hopeful account of “what I have learned about what scientists learned in the 20th century, in sum: The work of science is converging on seamless comprehension of the world around us and the identity of ourselves in it.”

The Future of Life, by Edward O. Wilson, Ph.D. '55, Jf '56, Pellegrino University Research Professor (Knopf, \$22). “An Armageddon is approaching at the beginning of the third millennium...,” writes Wilson. “It is the wreckage of the planet by an exuberantly plentiful and ingenious humanity. The race is now on between the technoscientific and scientific forces that are destroying the living environment and those that can be harnessed to save it....If the race is won, humanity can emerge in far better condition than when it entered, and with most of the diversity of life still intact.”

Poetry Speaks: Hear Great Poets Read Their Work from Tennyson to Plath, edited by Elise Paschen '81 and Rebekah Presson Mosby (Sourcebooks, \$49.95). An anthology of work by 42 poets, with three audio CDs on which each reads. Dylan Thomas reading “Do Not Go Gentle into That Good Night” alone is worth the price of admission.

America's Children, by James Thackara '67 (Overlook Press, \$26.95). Thackara is an American working in London. His vast World War II novel, *The Book of Kings*, appeared in a U.S. edition in 1999, and now his first novel is published here. It concerns J. Robert Oppenheimer and how it happened that we created the means of our potential annihilation.

Bazaar to Piazza: Islamic Trade and Italian Art, 1300-1600, by Rosamond E. Mack, Ph.D. '72 (University of California Press, \$65). Independent scholar Mack

shows how art objects imported from Asia profoundly influenced Italian decorative arts. She writes of silks, paintings, carpets, ceramics, glass, bookbindings, and inlaid brass, and supports her interesting text with a profusion of illustrations of objects from many collections, excellently reproduced.



Medici grand dukes epitomized Italian fascination with exotic ceramics. This soft-paste porcelain flask from a palace workshop in Florence, circa 1574 to 1587, adopts a motif from Turkish ceramics of the day—scrolls of peony blossoms. From the book and the National Gallery of Art, Washington, D.C.

The Wedding, by Imraan Coovadia '92 (Picador, \$23). Ismet Nassim, a shambling clerk of modest prospects from Bombay, looks out the window of a train and sees on the station platform the most beautiful woman in the world. He marries her next day despite her vow neither to love nor obey him. Their comic misalliance is deftly chronicled by Coovadia, who bases his novel on family stories he heard growing up.

The Paradox of American Power: Why the World's Only Superpower Can't Go It Alone, by Joseph S. Nye Jr., Ph.D. '64, dean of the Kennedy School of Govern-

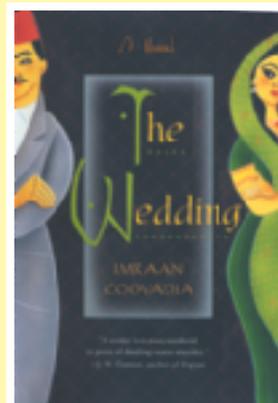
ment (Oxford University Press, \$26). Nye warns about a foreign policy that combines “unilateralism, arrogance, and parochialism” and argues for a broader, more cooperative, and more responsible engagement with the rest of the world.

First Fruit: The Creation of the Flavr Savr™ Tomato and the Birth of Biotech Food, by Belinda Martineau '80 (McGraw-Hill, \$24.95). Here's an insider's story of the rise and demise of the first genetically engineered whole food ever brought to market—by Calgene, a California biotech start-up, in 1994—a “slow-to-rot” tomato with some genes that had been effectively switched off.

Venice Forever: A History of the Serene Republic for Travelers, by John D. Irany, M.P.A. '86 (Clipper Ship Publishing, \$19.95, paper). Visitors to Venice cannot fail to be seduced by it, writes Irany, and, strolling across the Piazza San Marco, captivation will be complete if one knows the history of the beautiful, vital *Serenissima Repubblica*. Nonstrollers may welcome this book as well.

The Tangled Wing: Biological Constraints on the Human Spirit, by Melvin Konner, Ph.D. '73, M.D. '84 (Times Books, \$35). A revised edition of a seminal work published 20 years ago, since when lots has been learned about why we act and feel the way we do.

The Encyclopedia of World History, Peter N. Sterns '57, Ph.D. '63, general editor (Houghton Mifflin, \$59.95). This sixth edition of a reference classic, first edited by Harvard professor William L. Langer and last updated 30 years ago, comes with a CD-ROM (PC-compatible only) containing the entire text, allowing the user to search by keyword.



tensively documented by Mayr throughout the last half of the twentieth century, geographic speciation—now called allopatric speciation—has reigned for 60 years in evolutionary theory as the pre-eminent mode of species formation.

MAYR'S VIEWS GREW to dominate our understanding of species formation, but *What Evolution Is* generously offers perspective on new ideas since his breakthrough documentation of the geographic basis for species formation in *Systematics*. In this new book, Mayr discusses the success of competing theories that de-emphasize geography and allow for the formation of species without any prior geographic separation. The key observations of Guy Bush, Ph.D. '64—made while Bush was a graduate student—as well as new information about species flocks in African lakes, provide some of the best evidence for so-called sympatric (e.g. “living together”) speciation.

Besides discussing species formation, Mayr provides vignettes and brief commentary on many other issues bubbling up in current evolutionary science. Devel-

opment of animal body plans and how this delicate process evolves occupies the imagination of many of evolution's key thinkers. Mayr offers a summary of this research, including a few pivotal observations—like the fact that similar genes are involved in eye formation in animals with extraordinarily different eyes, such as insects and mammals. We also see Mayr engaging other issues outside his normal ambit, like the evolution of genomes and the patterns of molecular evolution that shape them. Here, as elsewhere, Mayr can be refreshingly clear and direct: “Perhaps the most unexpected result of modern molecular studies of the genome was the discovery of the great age of many genes. The sequence of base pairs is often so conservative that one can determine that a certain mammalian gene is also part of the genome of the fruit fly *Drosophila melanogaster* or the nematode *Caenorhabditis*. Indeed, it seems possible to trace some genes all the way from animals or plants to bacteria.”

Human evolution does not escape scrutiny, and Mayr offers his own interpretations in this fast-moving and

CHAPTER & VERSE

A correspondence corner for not-so-famous lost words

Thomas Bettman requests the source of a fragment from Hart Crane that he remembers: “The poetry of despair is beautiful, alas, but I must have”...*what?*

E. J. Barnes seeks the name of the (political?) speaker alleged to have exclaimed, “I smell a rat! I can see it floating in the air! And if it is not nipped in the bud, it will start a conflagration that will drown us all!”

Timothy Jacobs would like to learn the original source of the assertion “Every love story is also a ghost story,” a quotation he came across in a short story by David Foster Wallace.

“notable Americans” (November-December 2001). Philip F. Zeidman, who wrote the speech for Vice President Hubert Humphrey soon after the 1964 election, reports that its “droll litany of the most obscure and forgotten vice presidents” was intended to show that

Humphrey didn't take himself too seriously and to say, in effect, to President Lyndon Johnson, “I know my place.”

“botanically correct” (January-February). Mary Reyes was the first of many readers to suggest in answer the song “Misalliance,” the sad saga of a bindweed and a honeysuckle, with words by Michael Flanders and music by Donald Swann, from their late 1950s revue (and subsequent recording) *At the Drop of a Hat*. (Details are available at <http://timothyplatypus.tripod.com/FaS>.) Other readers suggested the red rose-greenbrier union found in popular ballads such as “Lord Lovel” and variants of “Barbara Allan.” Dean Estabrook proposed an old Mexican song, “Dos Arbolitos,” recorded by Linda Ronstadt on her 1988 album *Canciones de Mi Padre*.

Send inquiries and answers to “Chapter and Verse,” Harvard Magazine, 7 Ware Street, Cambridge 02138.

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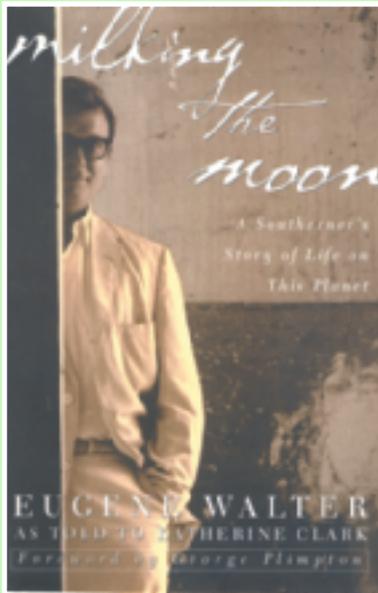
First poor Southern boy with no formal education or career ambitions, then writer, poet, actor, translator, cryptographer, puppeteer, costume designer, and gourmet chef, Eugene Walter (1921-1998) lived what one commentator calls a “pixilated wonderland of a life.” He managed to be a ubiquitous presence in the Greenwich Village art scene in the 1940s, in expatriate café society in Paris in the '50s, and in the world of cinema in Rome in the '60s. He was in at the start of the *Paris Review*. Princess Marguerite Caetani, a literary mutual friend, told Walter about the magazine and the editors about Walter, he recalls in *Milking the Moon: A Southerner's Story of Life on This Planet* (Crown, \$25), an oral memoir told by Walter late in life to Katherine Clark '84.

IT WAS GEORGE PLIMPTON, John Train, Peter Matthiessen, Donald Hall, and Billy Pène duBois. They had all just finished Harvard and were doing their *Wanderjahre* in Europe: a Harvard-to-Paris graduation ceremony. And they'd all had something to do with the Harvard *Advocate* in some way or another, and they just wanted to do a publication....

I just dropped in on the office unannounced. George was rather unsmiling at first, and then he said something like “Well, Eugene Walter, the princess speaks very highly of you.” And I said, “I speak very highly of the princess.” Ask me something, you know. I think the Harvard boys were nervous with me because I was an unknown quantity. I had never been to college but had published in snobby reviews, and the princess had praised me. But they couldn't figure out what wavelength I came from. What was I? Was I a sharecropper's child or the great-grandson of Robert E. Lee? you know. (I'm both, and more besides.) I think they thought they were fishing salmon and had suddenly caught something native to the Gulf of Mexico, you know, maybe a big catfish or something like that....

I liked all of those *Paris Review* boys right away. I got the right vibrations.

Now George is as much a mystery to me as I am to him. I realize it was a Harvard/Boston thing. And he was more Harvard than Boston. I only saw his real humor the second or third time. Being New England, he fears exuberance or extravagance. I'm perfectly certain that if he were in the slums of Rostov-on-Don, and drunk on vodka, and it was Carnival time, we might see him take all his clothes off and dance in the street as a satyr. But I don't think he's gotten around to it yet. Thus speaks one who has swung from an iron bar three floors above the street and gone in Mardi Gras costume to a Brooks Brothers party in New York....George sometimes mutters things under his breath just like my Mobile friend Emily Lynn. In the middle of that rackety-rackety and everybody talking about themselves, she was brushing white hairs off her navy blue velvet dress and saying, “What I really need is a navy blue cat.”...



They called me “Tum-te-tum.” I did say that, I guess. It's one of those Southern expressions. Somebody says something with which you do not agree or disagree; you say, “Tum-te-tum,” or “We'll talk about it later” is what it means....George never writes “Dear Eugene,” he writes “Dear Tum-te-tum.” At his age. At my age.

perennially controversial field: “What is perhaps most astonishing is the fact that the human brain seems not to have changed one single bit since the first appearance of *Homo sapiens*, some 150,000 years ago.”

Mayr's new book is not a textbook, and so he returns often to a few keystone controversies—such as which line of dinosaurs gave rise to the modern birds—in order to keep from confusing the general reader with too many disparate examples. Nor is this book a comprehensive exposition of current evolutionary

Its conversational tone is hauntingly similar to sitting in Mayr's MCZ office and being regaled with opinions and ideas.

issues. Its conversational tone may seem unstructured sometimes, but it is hauntingly similar to actually sitting in Mayr's MCZ office—still stacked with his many books and specimens—and being regaled by Mayr himself with opinions, ideas, and historical fact.

In that sense, *What Evolution Is* lays out the perspectives and views of one of evolutionary science's most recognized figures, informing us all how one of the original architects of the evolutionary synthesis thinks about modern biology, as a science and in its wider reaches. What would Mayr say about human races or the Cambrian explosion? What does he think about the persistent creationists who are trying to confuse the teaching of science to America's school children? What is the next step that Mayr expects evolutionary scientists to take? *What Evolution Is* serves as readers' best chance to catch up on what this academic giant has to say. ♣

Stephen Palumbi, professor of biology and curator of invertebrates in the Museum of Comparative Zoology, is the author of The Evolution Explosion.