



# Odyssey of a Naturalist

Wallace eagerly explored places and ideas.

BY ANDREW BERRY

*Alfred Russel Wallace, age 39, in Singapore, 1862, at the end of his eight years exploring Southeast Asia*

## Alfred Russel Wallace

is one of the most appealing figures in all the history of science. His status as an unfairly forgotten underdog helps: he was, with Charles Darwin, the codiscoverer of evolution by natural selection, arguably the most important idea in biology, but, while today Darwin's name is synonymous with the theory, Wallace is mostly relegated to the footnotes of biology textbooks. But perhaps the biggest reason for Wallace's appeal is his story. He came from a disadvantaged background, endured harrowing and demoralizing setbacks in his struggle to establish himself as a scientist, but nevertheless, forever upbeat and resilient, persisted to become one of the era's most lauded thinkers. Moreover, despite his successes, he never forgot his roots, becoming politically active in a wide variety of causes on behalf of "the working men of England," as he referred to them in the dedication of one of his socialist tracts. Also, throughout his long life, Wallace remained almost preternaturally modest: for example, what could have become an ugly priority dispute with Darwin became instead a close friendship, with Wallace titling his major book on evolution *Darwinism*.

Wallace was born January 8, 1823, near Usk, in southern Wales, into a large middle-class family in economic



free fall. His father had a facility for losing money—they were only in Usk because, as Wallace related, it was “a place where living was as cheap as possible”—and Wallace’s childhood was a tale of indignities imposed by poverty. He left school at the age of fourteen and soon after went to work as an assistant to his brother William, a land surveyor. It was tramping across the British countryside on these surveying missions that first introduced Wallace to the natural world, as he became curious, in a naive, amateurish way, about the plants he encountered. His interest in natural history was put on an altogether more serious footing, however, when, in Leicester in 1844, he met another young self-taught naturalist, Henry Walter Bates (who would later find fame as the discoverer of “Batesian mimicry,” in which harmless species evolve to look like toxic ones to gain protection from predators). Bates

quickly converted Wallace to his own passion, beetles, and both were soon “ardent beetle-hunters,” as Wallace put it.

Before long, however, the limitations of the relatively depauperate British fauna made Wallace and Bates think about going farther afield. They were also inspired both by a desire to explore the heretical proto-evolutionary theories of the time and by contemporary scientific travelogues, including Darwin’s *Voyage of the Beagle*. But how could they fund an overseas expedition? They contracted with a London natural history agent to sell the specimens—exotic bird skins, fantastic gaudy butterflies—they would ship home. In 1848, the pair arrived in Brazil, where they split up to maximize their effectiveness as collectors, with Wallace exploring the upper reaches of the Rio Negro.

Alone, often sick, dealing daily with the flies, and with the mildew and pests that conspired to destroy his precious specimens, Wallace experienced a brutal introduction to tropical biology. In 1849 his younger brother Herbert came out to assist and contracted yellow fever, from which he died. In 1852, his own health broken, Wallace decided to head home. The prospect of a triumphant return must have sustained him through his darkest hours, as he imagined the impact of his arrival in scientific London. Those hard-won specimens would be his passport to the scientific big time. Even better, he was bringing home a small menagerie of living animals: think of walking into a London scientific salon with a rainbow-billed toucan on your arm!

But the triumphant return was not to be. Poorly stowed cargo caused his ship to catch fire in the middle of the Atlantic, and the captain gave the order to abandon ship as the tinder-dry wooden hull went

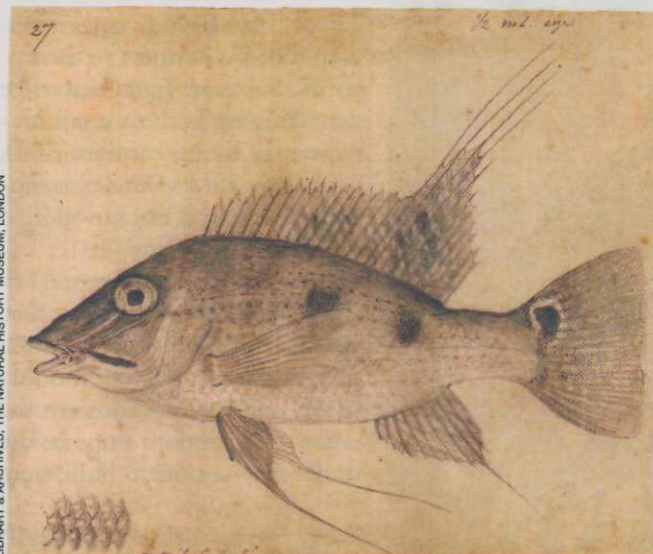
Wallace (center, wearing hat) negotiates for natural history specimens in the Aru Islands off New Guinea. Titled *Dobbo in the Trading Season*, this illustration from *The Malay Archipelago* was based on Wallace’s own sketch.





Wallace's watercolor of a female rhinoceros hornbill from Borneo, ca. 1855

up in flames. In the hope that the conflagration would attract other shipping in the area, the ship's two lifeboats circled the burning wreck, giving Wallace a ringside seat to what is surely one of the most poignant episodes in the history of science. The birds and monkeys he had cared for as he traveled downriver across the continent were sprung from their cages by the fire and went out to the



Wallace made this pencil sketch of a three-spotted eartheater (*Satanoperca daemon*) he caught in the Rio Negro, a tributary of the Amazon. It is one of more than 200 fish drawings that he rescued as his ship burned and sank on the way back to England.

bowsprit, the last part of the ship to be enveloped by the flames. There, confronted with an infinite ocean on one hand and with the flames on the other, they panicked, flinging themselves back into the fire.

Wallace and the crew spent the next ten days adrift in open boats before being picked up. Throughout, his Victorian stiff upper lip never quivered: "During the night I saw several meteors, and in fact could not be in a better position for observing them, than lying on my back in a small boat in the middle of the Atlantic."

Not surprisingly, when he finally made it back to Britain, Wallace's first response was to declare himself unwilling ever again to put to sea. But it quickly became apparent that he had no choice if he were to realize his dream of becoming a bona fide member of the Vic-

torian science elite: he would have to do it all over again. Within eighteen months of his return from Brazil, then, Wallace was aboard a ship bound for Singapore.

The eight years that Wallace spent in what was then called the Malay Archipelago—all the way from the Malay Peninsula to the western reaches of New Guinea—were, he recognized, the "central and controlling incident" of his life. Here, the skills he had learned in the Amazon finally paid dividends. Among them was his most successful book, *The Malay Archipelago* (1869), which rates as the most readable and exciting of all the great early scientific travelogues. But the real dividends were scientific. First, there was the collecting. Wallace's achievements here were extraordinary: for example, by his own reckoning, he discovered some 200 new species of birds—that's about 2 percent of all bird species. His naturalist's eye coupled with an awareness of geography acquired during his early years as a surveyor resulted in his identifying the discontinuity between the Australasian biota (where, for example, there are no monkeys) and the Asian one (no marsupials). He noted that the boundary—later called (not by Wallace) "Wallace's Line" or "the Wallace Line"—ran

between two contiguous islands, Bali and Lombok, and he was inevitably puzzled about how such differences could arise between geographically close locations.

As he thought through these problems, he came to recognize that two factors governed the geographic distribution of species. First was what his religious contemporaries called “design”—that is, “adaptation” in the language of evolutionary biology—whereby a species is fitted, or suited, to its environment. A desert-dwelling plant, for instance, has an array of adaptations to minimize water loss. But Wallace saw that locations with similar climates—he gave the example of two heavily forested tropical islands, Borneo and New Guinea—were home to very different species. If design were the only factor in play, surely Borneo and New Guinea should have similar species.

Wallace recognized that the second factor was history: the composition of an ecosystem is determined in part by a whole set of

past contingencies—for example, there typically are no monkeys present in locations that have never been connected to regions in which monkeys are prevalent. How Wallace would have loved our modern plate tectonic understanding of the geological evolution of Indonesia! We now

A frog from Borneo that Wallace painted in 1855, *Rhacophorus nigropalmatus*, is commonly known as Wallace’s flying frog. The extensive webbing between its digits enables it to glide from tree to tree.

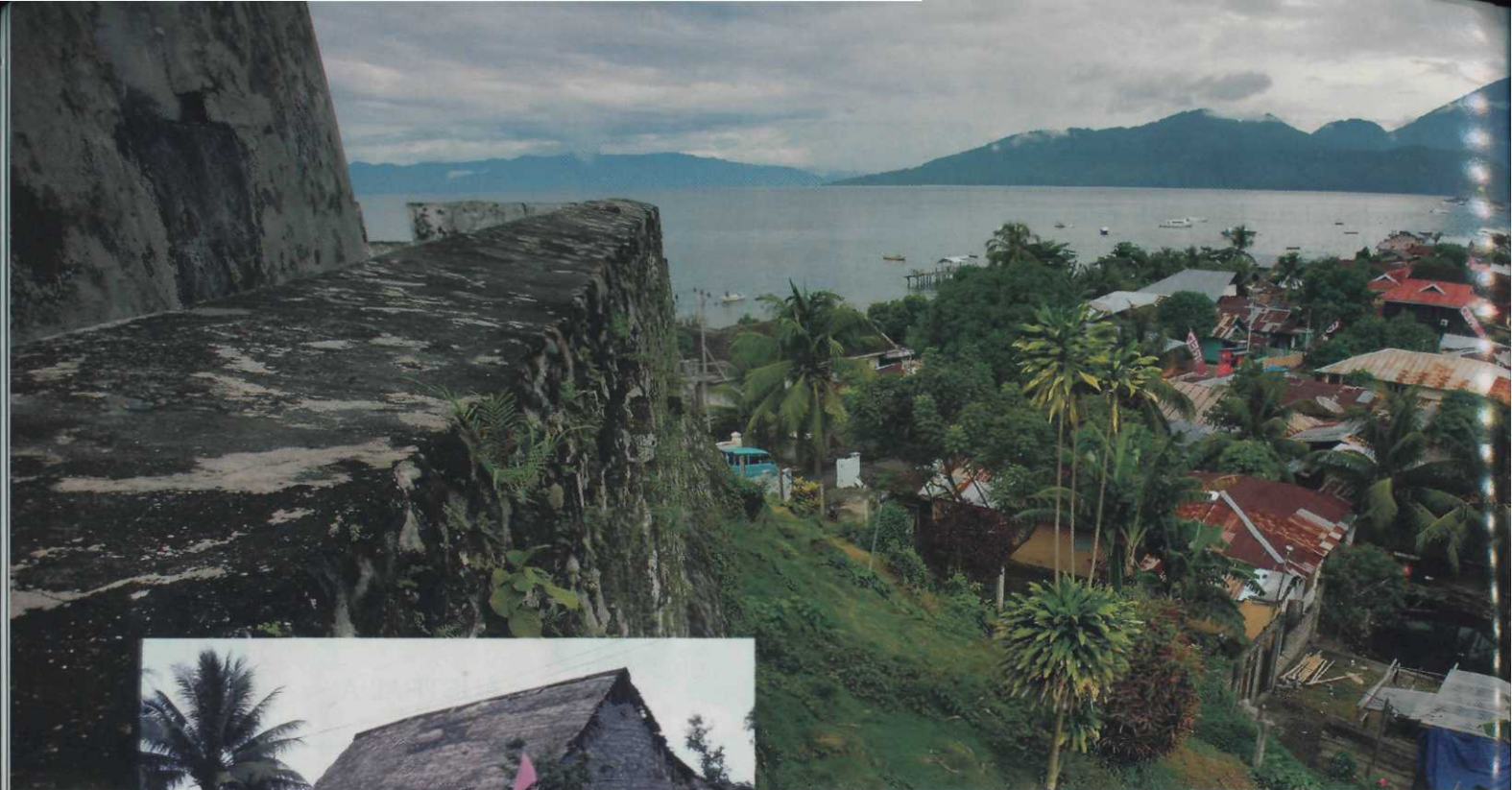
appreciate that the current proximity of Bali and Lombok is a recent phenomenon (by geological standards) and that the Australasian and Asian regions have converged via continental drift.



Wallace was the first to identify the geographical boundary between the Asian and Australian biotas. Although the faunal boundary is more permeable than a single line suggests, Wallace’s observations have been borne out by studies of continental drift. Islands that today are neighbors, such as Bali and Lombok, were once widely separated, and thus followed distinct evolutionary trajectories.

But the scientific discovery for which Wallace’s journeys are most remembered was evolution by natural selection. This in fact was a two-step process. He had already published several scientific papers on natural history, but, in 1855, while in Sarawak, a kingdom in northern Borneo, he produced his first grand, big-picture paper, “On the Law which Has Regulated the Introduction of New Species.” It became known as the Sarawak Law, and it represents a stunning scientific debut. He italicized the paper’s take-home message: “*Every species has come into existence coincident both in space and time with a pre-existing closely allied species.*” In other words, living species that resemble each other (that is, are closely related) tend to be found in the same geographical area and, similarly, fossil species that resemble each other tend to be found close to each other in geological strata. We now know that all kangaroos live in Australasia, for instance, because they are all descended from an ancestral kangaroo. The origin of species was, Wallace had recognized, a genealogical process. But a complete understanding of the process of evolution required a mechanism whereby that genealogical generation-to-generation change could be entrained to produce useful traits—adaptations.

In February 1858, while bedridden with fever (probably malaria) in the Moluccan (now Maluku) Islands, Wallace glimpsed the missing mechanism: natural selection, the process whereby competition for limited re-



IAN TATERSALL

The harbor at Ternate Island, above, became Wallace's base of operations, from which he mailed, to Charles Darwin, his paper on the theory of evolution by natural selection. Left: Despite locals' belief that this old house was Wallace's, historians say the original is long gone.

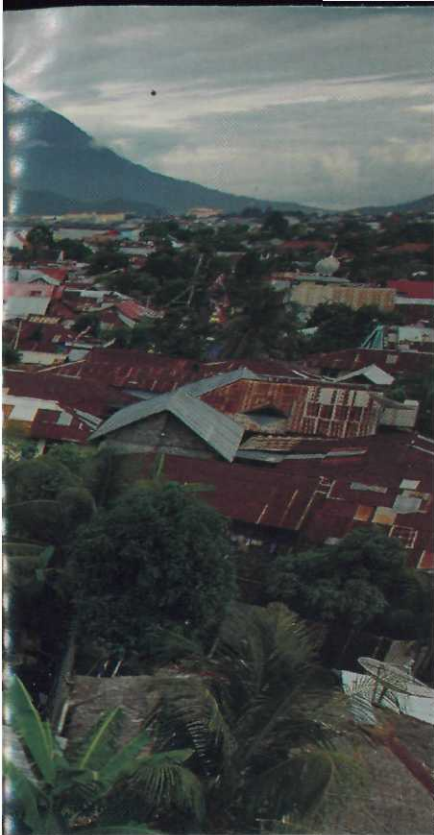
sources results in an enrichment in future generations of traits that allow their owners to compete more effectively. As soon as he was capable of writing down his idea, he did so. Then came the question of where to send the manuscript. Wallace had been sorely disappointed by the reception of the Sarawak Law paper, which he hoped would make waves in scientific London. Instead, it seemed to have been ignored; indeed, Wallace's agent wrote to tell him to stop "theorizing" and get back to collecting specimens (which could be sold). The one person who had been supportive of Wallace's ideas was Charles Darwin, so Wallace decided to send his new manuscript to him. This is the luckiest thing that ever happened to Darwin. How differently things might have turned out had Wallace instead sent the manuscript directly to a journal, meaning that Darwin would have woken up a few months hence to find that he had been scooped—that the idea he had been quietly gestating since shortly after his return from the *Beagle* voyage in 1836 had been published by the obscure Mr. Wallace.

Darwin received the manuscript on June 18, 1858, and, not surprisingly, freaked out: here was his idea written out in another man's hand. However, two of

Darwin's colleagues, botanist Joseph Hooker and geologist Charles Lyell, intervened with a solution that they hoped would both preserve Darwin's priority and do right by Wallace. At the July 1st meeting of the Linnean Society of London, they read both versions of the natural selection theory in a single presentation—separate expressions by the two "indefatigable naturalists." After that meeting, Darwin knuckled down to produce *On the Origin of Species* in little more than a year. What of Wallace, still half a world away, who was not consulted? Did he feel ill-used by this unorthodox arrangement to protect Darwin's priority? Not in the least. He was thrilled to have been suddenly elevated to Charles Darwin's coauthor. At last, he had made it.

Alfred Russel Wallace is flanked by his wife, Annie, and their daughter, Violet. The couple also had two sons, one of whom died in childhood.





TIM LAMAN

Wallace returned to England in 1862, this time without mishap, bringing two spectacular living birds of paradise that became a major attraction in London. He had made money from his collections and was now a highly regarded scientist. He managed in short order to compromise both those achievements.

He seems to have inherited his father's lack of facility with money, and was reduced to grading exams for a living. It was not until many years later, when Darwin successfully sought a government pension

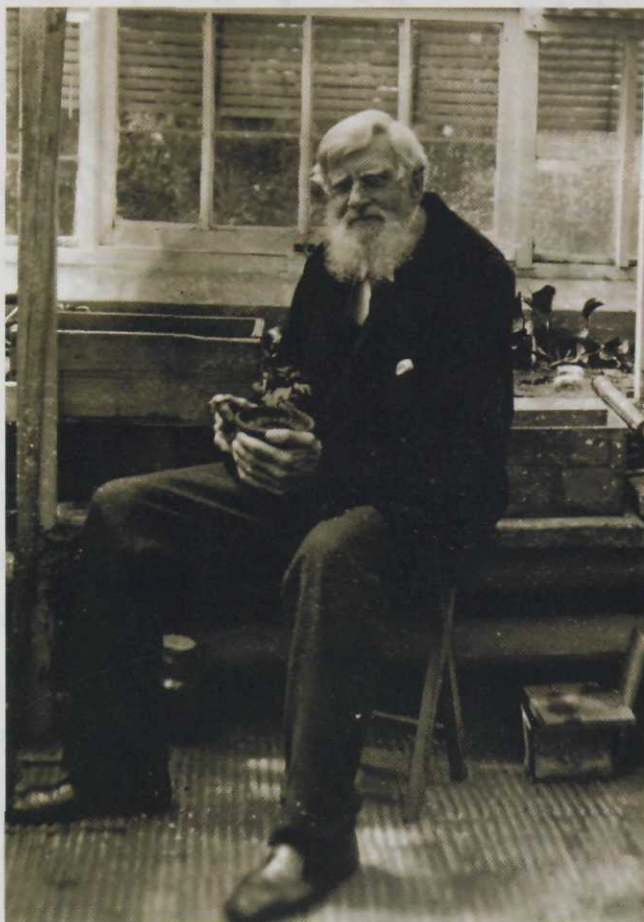
for Wallace, that his money concerns were to go away. Scientifically, Wallace was remarkably active after his return. Wallace being Wallace, we are only now beginning to appreciate the significance of some of his insights. In 1865, for example, he gave what is in effect the modern definition of "species": "Species are merely those strongly marked races or local forms which when in contact do not intermix, and when inhabiting distinct areas are generally believed to have had a separate origin, and to be incapable of producing a fertile hybrid offspring." Undergraduates today typically learn that this so-called "Biological Species Concept" was developed in the 1940s by ornithologist Ernst Mayr.

But Wallace also departed from the scientific straight and narrow in ways that sometimes irked his colleagues, gradually becoming ever more heterodox over the second half of his life, until his death on November 7, 1913. He became a spiritualist and even tried (unsuccessfully) to convince Darwin's famously sharp-witted "bulldog," Thomas Henry Huxley, to come with him to a séance. In part because of his spiritualism, Wallace declared in 1869 that natural selection could not account for human evolution. Darwin was horrified, writing, "I hope you have not murdered too completely your own and my child."

Wallace disagreed with Darwin on sexual selection, too. Despite these differences, Wallace and Darwin remained firm friends, and it is instructive to read their argumentative correspondence. The exchange is intense, but



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Wallace in the greenhouse of his home in Dorset: This photograph was presented to Quentin Keynes by Richard Wallace, with the dedication, "From the grandson of Wallace to the great-grandson of Darwin."

the mutual respect is palpable. Perhaps one of the greatest lessons Wallace can teach us is how to go about doing science. When Darwin was preparing to publish *The Descent of Man* (1871), he wrote apologetically to Wallace: "Fate has ordained that almost every point on which we differ should be crowded into this vol[ume]."

Wonderfully, Wallace was unfazed: "I look forward with fear & trembling to being crushed under a mountain of facts!"

Born in London, **Andrew Berry** studied zoology at the University of Oxford and received his doctorate in evolutionary genetics from Princeton University. He is now a lecturer in Organismic and Evolutionary Biology at Harvard University, Cambridge, Massachusetts. He is the editor of *Infinite Tropics: An Alfred Russel Wallace Anthology* (Verso, 2002) and of a new edition of Wallace's *The Malay Archipelago* (Penguin Classics, 2014).

