The Origin

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The "Year of Darwin" continues. In February, we celebrated the 200th anniversary of Darwin's birth[1] and this month another significant anniversary arrives: it was 150 years ago, on November 24th, that *The Origin of Species* was published.[2] The initial printing of 1250 copies sold out on the same day; a testament not just to the work itself, its accessibility and its transformative nature, but to the intellectual vibrancy of Victorian England. It was a time and place when, at least for those who were not captive to the more brutal aspects of society so well chronicled by another Charles (Dickens), ideas about science and natural philosophy were devoured and debated by an interested public. Indeed, Robert Chambers had caused a sensation some years earlier with the publication of *Vestiges of the Natural History of Creation*, a hodge-podge of ideas, speculation and pseudoscience that attempted to explain the natural world. But Darwin's work was the real thing, explaining, simply, the natural world and how it arose in all its stunning complexity, beauty, and horror. In so doing, it has stood the test of time and to this day continues to have profound implications—not just for science but for philosophy and our very notion of what it means to be human.

At the time of *The Origin's* publication, biology was not really a science in the way we understand the word today. Rather, it was phenomenology, a collection of quite random observations and facts with no undergirding structure or coherence. This state of things was not unique to biology; in many ways, the field of chemistry, before the formulation of the periodic table by Mendeleev in 1869, was in a similar state. Melting points could be measured, densities calculated, but there was little that tied the field into a coherent whole. With Mendeleev's insight, though, the structure of the chemical world could be glimpsed, paving the way for a deep understanding of modern atomic theory.

Likewise, but in a more comprehensive and dramatic fashion, *The Origin of Species* brought order to biology and allowed its development into a true science. Suddenly, life's exquisite and unique adaptations were explained. And in explaining myriad differences, so too was the stunningly obvious (but previously inexplicable) commonality undergirding all of life explained. Why does the bat's wing look so similar to the human arm? Why does the mouse embryo look so similar to that of the dog? *The Origin* answered these questions. And in a breathtaking testament to its prescience, the principles elaborated in this 150-year-old book explain equally profound and marvelous observations of our own molecular era: for example, why the genetic code of the banana, moose, slime mold, and human are the same. That explanation is, of course, the simple notion that we are all related. As Thomas Huxley said, on hearing principles of Darwin's theory for the first time, "How stupid of me not to have thought of that." Or, as Homer Simpson might have said: "D'oh!"

But of course, it was precisely this simple but fecund observation that disturbed (and continues to disturb) some. For like all true milestones in the history of human thought, Darwin's magnum opus had important implications that extend far beyond science and inevitably touch on subjects that had previously been the exclusive domain of poetry, metaphysics, and theology. Victorian society was still in thrall to the supernatural as the only legitimate explanation for the marvels of biology. This is understandable since prior to the publication of *The Origin* there were no satisfactory natural explanations for the exquisite adaptations of life on earth. The implication (or rather demonstration, given the overwhelming data supplied by Darwin) of our common lineage with the rest of the natural world was disturbing to many. Indeed, the metaphysical implications of the theory were highly disturbing to Darwin himself (and his beloved wife, Emma). Darwin was a conflict-averse individual and sought his whole life not to upset others. It was thus torture to him that his theory was a source of pain to some and a source of mischief (in the guise of "social Darwinism") to others. His initial reluctance to publically explore the broader human implications of his theory are reflected in the fact that throughout the entire 490-page tome, he mentions humans only once, with the tantalizing but oblique comment that "Light will be thrown on the origin of man and his history."

However, Darwin showed a steely intellectual courage. Despite his hesitation to explore the human question directly in *The Origin*, he ultimately soldiered on, pursuing the uncomfortable but necessary implications of his theory, publishing *The Descent of Man*[3] in 1871. Even more courageously, the following year he published what may be his most revolutionary (and least-read) book, *The Expression of the Emotions in Man and Animals*.[4] In this volume, he applied evolutionary theory to understanding not just the origin of our own species and our structural traits but to our most revered qualities: our minds, sensibilities, and emotions. The prescience of this work is amply demonstrated by the vibrant field of evolutionary psychology and by burgeoning knowledge in neuroscience and the molecular underpinnings of human thought and emotion.

Darwin's insights surely have the power to create conflict, disturb us, and make us uncomfortable. At a fundamental sense, they can sometimes challenge our most comforting and sacred beliefs about ourselves. For some, whose ranks include fiercely intelligent scientists, a belief in the supernatural can be readily reconciled with the reality of Darwin's theories. For others, Darwin revealed a living world that, remarkably and wonderfully, could be explained without the need to invoke the supernatural.

My own view is that a close reading of his work and his life suggest that we are not forced to exchange comfort for a cold hard reality. Darwin may have removed the need for magic, but he did it in a kind and generous way, leaving no need to lament the loss, but rather, richer, for the possession of our new

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knowledge. Darwin's mechanistic theory—actually and literally explaining where we came from and why we "are"—leads to breathtaking beauty and awe that at the very least match mysticism or delivered creed. The concrete knowledge that I am literally—not metaphorically, but literally—related to the birds of the air and the lilies of the field is a source of never-ending astonishment and wonder. Darwin illuminated our kinship with all of life on this planet, from bacteria to the giant sequoia, from the laboratory mouse to our children. Surely, this is a recognition all the more relevant and valuable in a rapidly changing and interconnected world.

So, as we celebrate the 150th anniversary of perhaps the most revolutionary book ever written, let's give the author the last word. In the final passage of *The Origin of Species*, Darwin allows himself to wax poetic, expounding on the wonder, and awe that even a hard-headed and evidence-based view of the world can summon:

> It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. These laws, taken in the largest sense, being Growth with Reproduction; Inheritance which is almost implied by reproduction; Variability from the indirect and direct action of the external conditions of life, and from use and disuse; a Ratio of Increase so high as to lead to a Struggle for Life, and as a consequence to Natural Selection, entailing Divergence of Character and the Extinction of less-improved forms. Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, while this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

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