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DARWIN, DARWINISM, AND PSYCHOLOGY

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ABSTRACT: Charles Darwin's contributions were celebrated worldwide during 2009, the bicentennial anniversary of his birth. A household word, "Darwinism," has become synonymous with the doctrine of evolution, which has exerted immense influence in the biological sciences, philosophy, political science, psychology, and the other social sciences. But the concept of evolution existed long before Darwin published in 1859. Furthermore, Darwinism was developed and promoted by others, while Darwin himself remained in the background, doing almost no public promoting and holding some views, including those concerning selective breeding and the interpretation of Lamarck's work, that he should have known were mistaken. While he had the leisure to spend a life observing nature, countless others born without the luxury of an inheritance, like Wallace, Huxley, Lloyd-Morgan, and Romanes played a far greater role in developing and establishing evolutionary thought. Darwin collected the facts that brought victory for the doctrine of evolution, but its development owed more to others, and even during his lifetime had far surpassed his specific contributions. We trace the history of evolutionary thought and consider questions concerning Darwin's delay in publishing, the cause of his illness, the Huxley/Wilberforce "Debate," and "*Organic Selection,"* with extra attention paid to the political work of Malthus, the experimental work of Spalding, and the philosophical works of Huxley and Romanes.

Keywords: Darwin, evolution, Darwinism, psychology

> *A professor showed a visitor around his department. "And how do you examine the students," asked the visitor. "That's easy," said the professor. "We ask them the same questions each year." "But doesn't that make it too easy for the students?" "No," said the professor. "We change the answers."* (Birch, 2008)

> *And referring to U.S.-based evangelist, Ray Comfort, who argues that the universe and life is the result of an intelligent creator, Dawkins said: "There is no refutation of Darwinian evolution in existence. If a refutation ever were to come about, it would come from a scientist, and not an idiot."* (Wilkinson, 2009)

In 2009, the 200th anniversary of Charles Darwin's birth, it seemed that everyone was writing a piece on some aspect of his work and trying to outdo one another lavishing praise and insinuating his influence on every imaginable topic. The website ***darwin-***

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*online.org.uk/**2009**.html* listed page after page of symposia, festivals, and celebratory lectures occurring all over the world and all through the year. His specific effect on psychology was examined in nine articles in the *American Psychologist* in 2009, as authors discussed Darwin's influence on American Functionalism, on Galton and Baldwin, and on comparative psychology. They noted his views on race, gender, culture, emotional expression, and psychological disorders. It seemed to the reader that, if not for Darwin, we would have been left with the medievalists, relying only on religion and imaginative literature for answers to important questions about nature.

Since Darwin's influence on everything, including psychology, has been discussed so fully, what is left to say? Actually, there is quite a lot. Here we consider influences on him that appropriately moderate his contribution toward the acceptance of the concept of evolution. The doctrine of evolution has taken many forms; its general form preceded Darwin by millennia, and it occupied a prime position in "pop" science through his lifetime, as it does today. It is certain that the overuses and subsequent ridicule of the notion of evolution and of the origin of species during the first half of the Nineteenth Century contributed to Darwin's two-decade delay in publishing his landmark work. In any event, despite his undeniable contributions to science, "Darwinism" was also the product of the work of others, who have been celebrated far less than has Charles Darwin, a man who never gave a promotional lecture, participated in public debate, or provided a scholarly public presentation. His voluminous correspondence and many books seem an insufficient substitute for facing critics and answering their concerns.

We also find it impossible to judge the originality of Darwin's contribution apart from the context of knowledge in which he worked. For one example, the concepts of malleable species and evolution owing to variation and selection of physical and behavioral characteristics were described in detail by his grandfather, Erasmus Darwin, and by the French genius, Jean Lamarck, though both lacked the confirming data that were later available. And Thomas "Bob" Malthus detailed the selection pressures on populations attending competition for sustenance, which, like Lamarck's work, was common knowledge a decade before Darwin's birth in 1809. Perhaps the most direct influence on Darwin was John Henslow, Regius Professor of Botany and a polymath at Cambridge, who put Darwin on HMS Beagle and supported him in many ways,

Evolution Is a Very Old Concept

Many ancients are known to have held evolution-like beliefs (see Malone, 2009, Russell, 1945). Anaximander in ancient Elea, a Greek colony in Italy, wondered that human infants were so helpless — how could they have survived when mankind was more primitive than was the case in his time, the Sixth Century BC? He proposed a fish-like ancestor, perhaps because he had seen fetal gills or noticed that newborns otherwise resemble aquatic creatures. Two centuries later, Empedocles proposed a bizarre selection process acting on an original assortment of infinitely varied stock — isolated organs and limbs, oxen with human heads, and so on. Over time the "unfit" were selected against and modern humans remained.

Other Presocratics and even Aristocles (Plato), who summarized his predecessors as he plagiarized them (Malone, 1997), had little influence on later speculation in biology. It was *Aristotle's* opinions and data that dominated and were even revered for two thousand

years. But Aristotle did not propose anything like evolution; in fact, his views were quite contrary and consonant with his belief in different "natures" or "essences." He proposed a *scala naturae* of fixed species arranged from low to high. This was eventually adopted by very different theologians, Augustine and Aquinas, and fixed as doctrine of the Church. The Scale of Nature became a matter of universal belief, as expressed by John Locke in the Seventeenth Century:

> All quite down from us the descent is by easy steps, and a continued series that in each remove differ very little one from the other. There are fishes that have wings and are not strangers to the airy region, and there are some birds that are inhabitants of the water, whose blood is as cold as fishes ... When we consider the infinite power and wisdom of the Maker, we have reason to think that it is suitable to the magnificent harmony of the universe, and the great design and infinite goodness of the architect, that the species of creatures should also, by gentle degrees, ascend upwards from us towards his infinite perfection, as we see they gradually descend from us downward. (Locke, 1690, Part 3, Ch. 6, Para. 12)

When evidence of extinction — "missing links" — was found, as in the remains of woolly mammoths and plants never seen living, *catastrophism* was often used to explain it. Just as God had sent the Flood, gigantic geological changes had changed climates, flooded regions, and wiped out whole species instantly. Many of these catastrophes were believed to be possible only when the earth was young and therefore, they can no longer occur.

The Background for Modern Evolutionary Doctrine

Lyell more than hinted.

A Scottish geologist, Charles Lyell, proposed an alternative to catastrophism, which he viewed as "indolent dogma" (Malone, 2009, p. 218). He proposed *uniformitarianism*, which holds that nature, both inanimate and animate, changed gradually due to natural causes that are the same today as when life began. Species become extinct due to the same causes that erodes stones and created canyons as water flowed over the same paths for thousands of years.

Lyell spent his life traveling and making notes on the constantly-changing earth that he saw. He showed how gradual change caused by natural forces alone could affect life forms:

> As to the dry land ... it is exposed almost everywhere to waste away. Forests may be as dense and lofty as those of Brazil, and may swarm with quadrupeds, birds, and insects, yet at the end of ten thousand years one layer of black mould, a few inches thick, may be the sole representative of those myriads of trees, leaves, flowers, and fruits, those innumerable bones and skeletons of birds, quadrupeds, and reptiles, which tenanted the fertile region. Should this land be at length submerged, the waves of the sea may wash away in a few hours the scanty covering of mould, and it may merely impart a darker shade of color to the next stratum of marl, or other matter thrown down. (Lyell, 1854, p. 188)

The first volume of Lyell's book was packed by Charles Darwin for his famous voyage around the world from 1831 to 1836 on HMS Beagle.

Darwin had been unsuccessful in Edinburgh's medical school and was doing poorly in the less-demanding theological studies at Cambridge to which he had then been consigned. His family hoped that if he couldn't be a physician like his father, perhaps he could be a parson. His position on the Beagle owed to contacts at Cambridge and a congenial interview with the *Beagle* captain, Robert FitzRoy, who would be a years-long companion. He hoped it would be a chance for him to exploit his youthful energy and unusual powers of observation and collecting. Darwin described himself as seeing through the eyes of Lyell, writing that "I always feel as if my books came half out of Lyell's brain ... & therefore that when seeing a thing never seen by Lyell, one yet saw it partially through his eyes" (Letter to Leonard Horner, 29 August, 1844). Throughout his travels he saw evidence for Lyell's thesis - an old world, changing now as it has changed for countless millennia.

As the earth changed, so did living things. Darwin left England a creationist, like almost everyone else, and returned in five years a creationist with some doubts. And he should have had doubts! His paternal grandfather, Erasmus, had published *Zoonomia*, in the 1790s, a bizarre book, partly because of his writing style, in which he proposed one primal organism from which all others, of all species, evolved – the first cause and parent of parents.

Grandfather Erasmus: Evolution, but no Process

Erasmus Darwin argued that changes in species over the course of time occur because of environmental forces and that such changes are passed on to offspring. This belief in an evolutionary process and in the inheritance of acquired characteristics was endorsed also by his grandson and was expressed by Erasmus as follows:

> From thus meditating on the great similarity of the structure of the warm-blooded animals, and at the same time of the great changes they undergo both before and after their nativity; and by considering in how minute a proportion of time many of the changes of animals above described have been produced; would it be too bold to imagine, that in the great length of time, since the earth began to exist, perhaps millions of years ... that all warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality ... and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end? (*Zoonomia*, 1794, Vol. 1, Sect. 39.4.8)

The belief in the inheritance of acquired characteristics was widespread through the 19th Century for good reasons, which is why Charles Darwin was compelled to assume its truth throughout his life. Besides, in the popular mind, it was comforting to believe that your efforts in life, whether through healthful living, or intellectual, artistic, or professional accomplishment, will be passed on in some degree to your children. The authoritative

treatment of, and case for, such inheritance was published by Jean de Lamarck in 1809, the first to argue persuasively for evolution.

Lamarck was the first…

In 1859 geologist Charles Lyell wrote this about Lamarck's priority as evolutionist: *"I conceive that Lamarck was the first to bring it forward systematically & to 'go the whole orang' … Yet evolutionists 'cannot be pooh-poohed & ought not to be so"* (Lyell, 1859). When Lyell referred to going "the whole orang'" he meant that Lamarck proposed that evolution accounts not only for the creation of other species, like orangutans, but for humans as well, including all 'particularly human' powers, such as reason, emotion, and will. This extreme position was promoted by Darwin more than half a century after Lamarck, but not adopted by most other evolutionists for at least a century after Lamarck's work.

Charles Darwin was very familiar with the thesis of Jean Baptiste de Monet, the impoverished Chevalier de Lamarck, the scientist most closely associated with the doctrine of the inheritance of acquired characteristics, a principle that Erasmus Darwin took for granted. Though much of Lamarck's work in fields beyond his expertise in biology was fraught with folly in presentation and interpretation (see below), his *biology* (a term he coined) correctly emphasized three important things. First, that species vary under changing environmental influences, though unchanging conditions may produce what appear to be static life forms, leading one to suppose a stable scale of nature. Second, that there is a unity underlying species diversity. And third, that species are subject to progressive development. He viewed development as "improvement owing to effort" and that made Lamarckianism attractive to many, though what he meant by effort was invariably misinterpreted by critics, who imagined the giraffe consciously "trying" to lengthen its neck, perhaps for the species' good. Lamarck's view of effort was more an innate tendency toward change and not a conscious desire to do so.

Lamarck was a distinguished botanist and only turned to zoology after three decades of work with plants, which clearly *can* pass on acquired characters, as botanists have known for centuries. Sano (2010) commented on this issue:

> In his book, Lamarck proposed the law of use and disuse of organs, and the law of inheritance of acquired traits. Although the theory was discredited by most geneticists after the 1930s, botanists have long been aware of phenomena implying inheritance of acquired traits: branching and body weight by nutrient condition, spontaneous variegation in ornamental plants, new traits after grafting, and others. Since appropriate explanation on molecular basis was not available, these observations have not drawn much attention until the 1990s. (Sano, 2010, p. 348)

Like Erasmus Darwin, Lamarck believed that acquired traits could be passed on through a "law of use and disuse," such that animals that live in darkness, like moles, lose vision and eventually eyes. When he argued against fixed species in the organic world of plants and animals, he was a prophet of science to come. The quotation below was written several decades before Darwin's famous insight:

> In the same climate, very different habitats and conditions at first merely cause variations in the individuals exposed to them; but in course of time the continued change of habitat in the individuals of which I speak, living and reproducing in these new conditions, induces alterations in them which become more or less essential to their being; thus, after a long succession of generations these individuals, originally belonging to one species, become at length transformed into a new species distinct from the first. (*Zoological Philosophy,* 1809/1963, pp 39)

So, a deer-like animal that feeds on tree leaves may stretch its neck over time as it tries to reach higher and more attractive leaves. Perhaps part of the lengthening is passed on to its offspring and, over generations, giraffes result, and we call that creation of a new species. But when Lamarck extended that malleability of "species" to inorganic things, like rocks and metals, which may change identity as the alchemists claimed, he was viewed as a crank and became an object of scorn and ridicule as physical science began its rapid progress after 1800 (see Malone, 2009. Ch. 9).

Decades later, Lamarck's belief in the inheritance of acquired characteristics was shared by Charles Darwin himself and by many others. This was because evolution based only on selection of chance variations seemed too slow to account for all Creation and something was needed to speed up evolutionary processes. Of course, this was before it was realized that the earth was much older than had been believed and that there was no real shortage of available time. As it was, Lamarck's view persisted into the Twentieth Century, but eventually fell from favor, since its speeding up of evolutionary changes was unnecessary (Singer,1959, p. 297).

However, his "law of use and disuse" has returned, so to speak, in the form of genetic assimilation (see Waddington, 1953, Changeux, 2009) and in more recent discoveries in the general study of *epigenesis*, the switching on and off of genes as the result of individual experiences (see Carey, 2012). The environment may create heritable changes without affecting the composition of the genome. Over half a century ago Waddington reported such findings induced in the vein patterns of the wing of the fruit fly, *Drosophila*:

> ... if an animal is subjected to unusual circumstances to which it can react in an adaptive manner, the development of the adaptive character might itself become so far canalised that it continued to appear even when the conditions returned to the previous norm ... This mechanism would provide a means by which an "acquired character" in the conventional sense could be "assimilated" by the genotype, and eventually appear comparatively independent of any specific environmental influence. (1953, p. 118)

In successive generations, up to 23 in the initial study, the induced changes in wing vein patterning reliably appeared and, after a dozen or so generations, the period of increased temperature for the pupae that was the shock that caused the pattern change was no longer required. The specific epigenetic change responsible was left unknown and he suggested that it probably involved changes in more than one gene. Identification of specific genes participating in epigenesis has occurred recently (see Carey, 2012); details are irrelevant to and beyond the scope of this essay.

Malthus was clear: Competition and Selection!

A third influence on Darwin and on countless others was the work of the Rev. Thomas Robert Malthus, mathematician and economist, known to his friends as "Bob," whose 1798 *Essay on Population* was an argument for the importance and inevitability of struggle and survival as economic principles. The Essay was revised over the years to keep pace with critics and powerfully influenced public attitudes, government policy, and evolutionary thought. Oddly, it was Erasmus Darwin's *Zoonomia* that inspired Malthus, who in turn inspired both Alfred Russel Wallace and Charles Darwin. Malthus warned that unchecked increases in population must lead to strife and famine and a forced reduction in population, since food production cannot match the inevitable geometrical increase in populations.

This was published anonymously at a time when the utilitarian philosophers, including Joseph Priestley and Jeremy Bentham, were promoting the idea of universal peace, liberty, and equality, allowing unlimited increase in population. Malthus' thesis did not make the utilitarian paradise as attractive as it had seemed; rather, it conjured visions of struggles among people for scarce resources, with survivors living to reproduce. Nature eliminates the weak, sick, and otherwise unfit and the efforts to promote health through hygiene and healthy living conditions only dilute the process of winnowing out the weak and less fit.

His argument first appeared in 1798 as *An Essay on the Principle of Population*, written when Malthus was a 32-year-old pastor living with his parents. With that in mind, his strong arguments against government aid for the needy, exemplified in England's *Poor Laws,* seem at least ironic and perhaps even hypocritical. His reasoning was persuasive, and Darwin noted, "But nobody conveys 'the warring of the species' so strongly as Malthus" (*Notebooks* D134). For humans, this battle affects the lower classes most and "The sons and daughters of peasants will not be found such rosy cherubs in real life as they are described to be in romances" (Malthus, 1798, p. 20).

If population doubles every 25 years, it far outstrips the increase in food available through cultivation of land and inevitably results in starvation and misery unless population growth is limited. Of course, there are some limitations built into society. For example, families are expensive, so a single workman may earn enough to live tolerably well, but if he marries and has children, those earnings will have to be shared among all and all will suffer. If a gentleman marries, the same applies with the added factor of a step downward in society which may place him and his similarly-stationed wife "... two or three steps of descent in society ... where education ends and ignorance begins ... a real and essential evil" (1798, p. 28).

The poor will always be with us and there is no point in attempting to alleviate their misery through charity; that only makes matters worse. Experience has shown that government spending to support the very needy, through the establishment of Poor Houses by central government or even by local parishes is actually harmful for everyone. Malthus offered several arguments to justify what seems cruel treatment, reasons that are still given by politicians today.

First, a man who earns enough through his labor to just get by may be tempted to marry if he knows that charity exists to care for his family if he cannot. Thus, he may produce children that "... increase population without increasing the means for its support, and thus to depress the condition of those that are not supported by parishes, and, consequently, to create more poor" (1798, pp. 29-30).

Second, the poor seldom save money, even when a windfall leads to a transient increase in income. So when hard times come they are unprepared, partly because they know that they can rely on public assistance. As Malthus wrote,

> A man who might not be deterred from going to the ale-house from the consideration that on his death, or sickness, he should leave his wife and family upon the parish might yet hesitate in thus dissipating his earnings if he were assured that, in either of these cases, his family must starve or be left to the support of casual bounty. (1798, p. 28)

Third, maintaining the indigent in poorhouses requires that they be fed, as well as sheltered, thus diminishing the total amount of food available to all, including "more worthy and industrious" people. This is a shame and may force others to become dependent. This effect is greater when poorhouse conditions are made better, so the poorhouses should be unpleasant, underlining the impression that "dependent poverty is disgraceful."

Malthus had studied mathematics at Cambridge and supplied tables of births and deaths in various areas in England and elsewhere to support his argument that population increases geometrically, as in examples of cat populations, where one cat may produce four female kittens, leading to a subsequent generation of 16, leading to 64, and so on until the world is covered with cats. Of course, this expansion is limited by many factors, chief of which is food availability. In human societies, food production is limited to an arithmetic series of increase, which can never match the geometric increases in unfettered population. Shortages arise and competition for now-scarce resources forces a winnowing out of the weak and the creation of a class of the permanently poor. A program that raised the poor from poverty without a corresponding increase in food production would be of little help – at best it would change the membership of the poor class, but it could not eliminate it.

The social implications of the essay are debatable, especially regarding the place of society in dealing with the poor. What is not debatable is the fact that all organisms are in a struggle for survival, and in the competition between and within species only some will survive to reproduce and pass on their kind. This was clear to the young Charles Darwin and to the countless readers of Malthus's essay in the original and in later editions during the early 1800s.

John S. Henslow: Darwin's Tutor, Supporter, and Model

"I fully believe a better man never walked this earth." That was Darwin's opinion expressed in a letter to J. D. Hooker on May 18, 1861, upon news of the death of John Stevens Henslow, Regius Professor of Botany and Mineralogy at Cambridge University. Decades earlier, as a Cambridge student nominally studying classics and theology preparing for a life in the clergy, Darwin could not help but be attracted to Henslow, who seemed to know everything about nature, as revealed in the walks he took with students and the meetings at his house. Henslow trained Darwin in the collecting and cataloging of specimens, from mineral to vegetable to animal. He was an acute observer of everything around him and an expert in botany, geology, chemistry, and entomology. Darwin became his almost constant companion and probably was influenced more by him than by anyone through his life – even more than by Lyell.

Henslow provided 22-year-old Darwin with the opportunity of a lifetime when he recommended him as gentleman companion for Captain Fitzroy's five-and-a-half-year survey of South America on HMS Beagle, after he had been offered the post himself. Throughout the five years that Darwin sent multitudes of samples of plants and animals, Henslow educated him in their preparation and shipping. Further, Henslow passed them on to experts when necessary, and read reports from Darwin to the Cambridge Philosophical Society, thus providing him some publicity. Hence, Darwin's reputation as a naturalist began to be established by 1836 when he returned. And all this though Henslow disagreed with Darwin's (actually conservative) applications of evolutionary explanations to nature (see Darwin Project/Henslow, Walters & Stowe, 2001)!

John Henslow actually acted as a pastor in Cambridge while holding the chair in botany and spent the last twenty years of his life as a vicar of a church in Suffolk until his death at age 65 in 1861. By that time, Darwin felt in no condition to attend the funeral, though he was considerably younger than Henslow and knew that if their positions were reversed, Henslow would have made the trip for *him* (Walters & Stowe, 2001).

Darwin's Priority and Hesitation to Publish

Thanks largely to Henslow's heroic efforts as stand-in for him during the Beagle's voyage, by 1837 Darwin was recognized as a painstaking naturalist who had worked on barnacles and mammalian fossil forms and had written on geology and reefs. He was thought to be patient, reflective, and in no hurry to publish. He described in autobiography what he did next:

> In October 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement Malthus on *Population*, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had at last got a theory by which to work; but I was so anxious to avoid prejudice, that I determined not for some time to write even the briefest sketch of it. In June 1842, I first allowed myself the satisfaction of writing a very brief abstract of my theory in pencil in 35 pages; and this was enlarged during the summer of 1844 into one of 230 pages, which I had fairly copied out and still possess. (Barlow, p. 120)

The *Origin of Species* was published in 1859 and eventually revolutionized biology and other disciplines. Asa Gray, Fisher Professor of Botany at Harvard, reviewed it at once and contrasted Darwin's "orthodox" naturalistic view with idealist views of Agassiz and Dana.

> Mr. Darwin, on the other hand, holds the orthodox view of the descent of all the individuals of a species not only from a local birthplace, but from a single ancestor or pair ... the species we recognize have not been independently created, as such, but have descended, like varieties, from other species. Varieties, on this view, are incipient or possible species: species are varieties of a larger growth

> and a wider and earlier divergence from the parent stock; the difference is one of degree, not of kind. (Gray, 1860, P. 7)

Gray's succinct description of Darwin's contribution reminds us that Lamarck had proposed exactly that theory and supplied detailed supporting evidence fifty years earlier; perhaps he was too early and writing in the wrong language (Lamarck, 1809). And we have seen that he had muddied his reputation through his speculative forays into physics and chemistry.

Did Wallace deserve priority?

Darwin was stunned when he received Alfred Russel Wallace's paper on June 3, 1858. Wallace wanted Darwin's opinion of his report titled, "On the Tendency of Varieties to Depart Indefinitely from the Original Type." Wallace was also a collector of plants and insects, and, like Darwin, began by collecting beetles. Unlike Darwin, he had no independent means and so made a living as a collector, first in South America, later in Indonesia.

Wallace had read Lyell and Malthus and while recovering from malaria in Ternate, a part of Indonesia, he hit on the notion of competition and natural selection (he even used the same terms as Darwin) — that "the fittest would survive," to use his words (Browne, 2003). Darwin was inclined to let Wallace take the credit, but he was persuaded by friends to make a joint announcement of his and Wallace's conclusions and to speedily write a brief account for publication. The "abstract," as he called it, was two hundred thousand words long and finished within a year. That was *On The Origin of Species by Means of Natural Selection*

That book is so detailed as to tire feeble readers and Darwin indeed threatened to later give "a long catalogue of dry facts" (1859, Ch 2, p. 33). If not for the rush to publish enforced by Wallace's letter, he would have included many more facts than he did. (They appeared later in a succession of books, the largest of which is *The Variation of Animals and Plants Under Domestication* (1868, in two volumes.)) Was he merely a "kind of machine for grinding general laws out of large collections of facts," as he asked himself? A. N. Whitehead (not himself a riveting writer), echoing earlier critics, commented — "he is the dullest great man I can think of" (Price, *et. al.*, 2001, p. 279). But this is more a comment on the critics than on Darwin, much of whose writing still engages some readers and has dated much less than (for example) the younger T. H. Huxley's reputedly more vivid prose.

Was Wallace cheated out of publication priority by the older and more influential Darwin, as some have contended? No: (a) because Wallace himself didn't think so — he even titled one of his books *Darwinism* (b) because Darwin did in fact discover natural selection first; and (c) because it would be wrong to penalize someone like Darwin who refrained from publishing a controversial theory until he had accumulated overwhelming evidence for it. Without that kind of restraint, we invite many of the worst aspects of modern hyper-competitive science: publishing prematurely being one. As Darwin wrote in his autobiography:

> I gained much by my delay in publishing from about 1839, when the theory was clearly conceived, to 1859; and I lost nothing by it, for I cared very little whether

> men attributed most originality to me or Wallace; and his essay no doubt aided in reception of the theory. I was forestalled in only one important point, which my vanity has always made me regret, namely, the explanation by means of the Glacial period of the presence of the same species of plants and of some few animals on distant mountain summits and in the arctic regions. (Barlow, p. 124)

Darwin did not originate the concept of evolution and he was mistaken on many counts, even on simple matters of fact, where observation should have informed him. For example, he wrote that selective breeding depends on the trained eye choosing individuals showing slight individual variations in characteristics, just as he saw operating in nature. But most selective breeding of domestic animals relies (and always has relied) on large deviations, not small ones (*E.g*., Singer, 1959, p. 304). Nonetheless, by identifying the *process* behind evolution — variation and, most vitally, natural selection — he sealed the fate of the catastrophists and other promoters of the belief in the fixed scale of nature.

Why Did Darwin Delay — Or Did He?

Darwin wasn't the only naturalist to be questioned about an apparent delay in publishing his findings — Alfred Wallace began *his* eagerly-awaited book with this apology, "My readers will naturally ask why I have delayed writing this book for six years after my return; and I feel bound to give them full satisfaction on this point" (Wallace, 1869, p. 1).

Darwin, after formulating his theory by 1839 and outlining it by 1844 in a 230-page essay, made no attempt to publish it for fifteen years — that's twenty years after his voyage on HMS Beagle — while he settled in the country and fathered ten children. He wrote books on his voyage, on coral reefs, on volcanoes, and on seven years' work with barnacles. But he did not write the *Origin* until (it seemed) he realized that Alfred Russel Wallace was going to beat him to it. Many writers have tried to account for the 20-year gap between 1839 and 1859. But did he really "delay" and was he really concerned with priority — did he feel any need to be the first to introduce the first workable theory of evolution?

In a thoroughly-researched article appearing in *The Notes and Record of the Royal Society* (2007), van Wyhe showed that there really was no intentional delay and countered claims of the many writers who argued that there was. It appears that speculation over the reason for the supposed delay actually began only in the 1940s, after which it was a favored topic of many scholarly writers and of documentary movie makers. Did Darwin fear ridicule, persecution, or loss of reputation? Did he want to avoid shocking the religious sensibilities of readers, including his wife or the Beagle's Captain Fitzroy? Did he, as many writers suggest, keep his discovery secret for all those years? Van Wyhe himself proposed in 2002 that Darwin "kept the secret" for some of these reasons. And it is known that Darwin greatly feared disrepute and ridicule.

Darwin unfairly criticized Lamarck's work, though he agreed that one must assume inheritance of acquired characteristics if evolutionary theory was to work. But Lamarck had been *ridiculed* and Darwin wanted no connection with ridiculed science! The great, though impoverished, Chevalier de Lamarck, who coined the term "biology," had proposed a theory of evolution of species through variation and selection but he *seemed* to attribute purpose to adaptations and, along with similarly-thinking writers, had given a bad name to theories of evolution. Darwin wrote, "Heaven defend me from Lamarck nonsense of a

tendency to progression ... adaptations from the slow willing of animals ec." (Letter to Hooker, January 11, 1844), thus carelessly misinterpreting Lamarck's notion of "purpose" to safeguard his own reputation! Did Darwin simply fear ridicule and therefore delay publishing?

Was it Darwin's Illnesses?

If there really was an overlong delay in publishing his main contribution, we might attribute it to his seemingly constant illness. He suffered from intense headaches, vomiting, and heart palpitations along with a plethora of other maladies and he consulted dozens of the best physicians in England looking for a cure (de Beer, 1983 and many other sources). He also had himself hypnotized, and underwent hydrotherapy, spending winter days wrapped in a cold, wet sheet. His son Francis wrote, "For nearly 40 years he never knew one day of the health of ordinary men, and his life was one long struggle against the weariness of strain and sickness" (F. Darwin, 1887, p. 160). In his autobiography he referred to a forced retired life, since social interaction always led to "violent shivering and vomiting attacks being thus brought on." Social affairs" may well have included the consumption of milk products, such as cakes and puddings, of course. Campbell & Matthews (2005) reviewed Darwin's medical record derived from his many letters describing his suffering and from his diary where he recorded his medical woes over two decades. They concluded that his problems largely lay in what he ate and drank.

As practicing clinicians, they recognized that his seeming widespread and unrelated symptoms probably all derived from a systemic lactose intolerance, a problem common to approximately a quarter of Caucasians. They showed convincingly that during periods when Darwin was prevented from drinking milk or eating milk products, common in the sweets that he favored, his symptoms eased and recurred within hours of his consumption of milk products. During his five years at sea on the Beagle, though he was ill several times, he had no access to milk products and remained free of the symptoms that made his remaining half century so painful.

Was He Keeping a Secret?

Van Wyhe gathered an impressive amount of evidence to support his arguments that Darwin was not keeping a "secret," in fact, he told at least 33 people about his specific views on speciation, and he paid copyists on two occasions to copy the long 1844 essay. Darwin's two-decade pause owed to his concern with gathering sufficient evidence to make his case; it was not his health, or because of fear of religious, social, or personal consequences.

In fact, van Wyhe pointed out, Darwin had "put off" the publication of many projects. His notes on the psychological development of his son William were delayed for 37 years; his discussion of pangenesis was shelved for 27 years and the treatise on orchids waited 32 years for publication. Finally, the piece on cross fertilization was delayed for 37 years and the book on the effects of earthworms on landscapes sat for 42 years. Darwin didn't always publish in haste.

Yet during the period 1839-1846, he published ten books and twenty periodical pieces, all while gathering the evidence to make the case for the arguments that would

appear in the *Origin* so that he would not "... make a fool of myself on the subject of species" (van Wyhe, 2007, p. 192). He engaged in other activities as well and even took up pigeon breeding in 1854. By June 1858, when he received a letter from Wallace, he had written more than ten chapters of what would be topics in the *Origin of Species* – roughly 2/3 of the book.

Darwin did have cause to fear publication

Making the case for the *Origin of Species* was bound to involve heated arguments with the best scientists in the world and Darwin never sought debate, especially if it was public. His son Francis wrote, "He used to say of himself that he was not quick enough to hold an argument with anyone, and I think this was true." (Francis Darwin, Life, vol 1, p. 140). Others agreed, with assessments like Bradford's (1926, p. 74), "*It is very evident that he was not a quick and natural arguer, as was Huxley."*

Therefore, however bad his health, it did not prevent his work on subjects other than *The Origin*, so the delay must have been due to something else: fear of the consequences of publishing evidence for evolution. This seems true, notwithstanding van Wyhe's arguments. On becoming convinced of the mutability of species, Darwin famously wrote to his friend Hooker: "it is like confessing a murder" (11 January, 1844, Darwin Project Letter 729*).* So, he surely felt it essential to buttress overwhelmingly the case for what he realized was a momentous and potentially controversial discovery. Aside from the dogmatic opposition of the church, there was scientific opposition to such views and a disdain for the concept of evolution, "which had long been an enthusiasm of ecstatics and occultists devoted to seances and tales of fairies flitting across the moors at dawn." To propose "so amateurish a theory was to invite learned ridicule" (Ferris, 1988, p. 241) and for Darwin, who felt he was too slow to do well in acrimonious debate, ridicule was to be avoided at all cost.

Finally, my colleague Gordon Burghardt reminded me that Darwin worried a lot about salient problems that seemed to refute his theory. It is likely that worry over one of these, concerning sterile insect castes, caused him great anguish and contributed to his delay in publishing.

The problem of the insect neuter castes

Darwin spent considerable time worrying about the complex, unlearned skills of sterile insects, since they posed a seemingly unanswerable problem for him. As he wrote, the danger was real and "At first appeared to me insupportable and actually fatal to my whole theory" (1859, p. 236)

For example, honeybee colonies organize as a queen, a few dozen drones (males), and many infertile, "neuter" females who do not reproduce, yet play essential, specialized roles in the life of the hive, including caring for the young, building the myriad hexagonal cells comprising the hive, and other tasks that they could not possibly learn to do during one lifetime. Specific forms of organization also appear among the many species of ants, in which the sterile caste members may be specialized as various kinds of workers, including soldiers, which are large and feature heavier jaws and behaviors that make them fit for combat. The neuter workers, soldiers, and other sterile creatures cannot pass on any learned behavior to progeny, yet they are capable of behavior that appears highly skilled

and seemed to Darwin (1859, Ch. 7) to mimic results of long histories of small variations in instinctive behavior that eventually became the product that he observed.

But how could that be? Neuters cannot pass on products of variation and selection, since they produce no offspring, but the worker castes of bees, ants, and other social insects needed no training to perform, acting as if they had inherited all the knowledge they needed! The problem seemed indeed fatal to his whole theory until he realized that it remains a problem only when attention is restricted to *individuals.* But variation and selection may apply to "*the family*," as well (p. 237). Viewed in that light, with the group treated as the individual, we see that "... the difficulty is lessened ..." In fact, the phenomenon of infertile individuals may also explain the value of grandmothers in human societies, though Darwin did not suggest that, but others did.

Of course, Darwin did write up his views prior to 1859 — in pencil — in 1842. The 230-page manuscript was only found in 1896, fourteen years after his death. With his wife's death in that year, the family house was vacated, and this earliest formulation of Darwin's theory was found in a cupboard under the stairs. That cramped area had always been used solely as a storage space and the manuscript had evidently been placed there since there was no intention to publish (Freeman, 1977).

Darwin's Defender: Huxley the Bulldog

Thomas Huxley was a largely self-taught polymath and a feisty and articulate debater who was temperamentally very different from Darwin. Boakes referred to the effect that he had on others, "Though Darwin later claimed to feel quite infantile in intellect compared with Huxley, who also gave Wallace a feeling of awe and inferiority not gotten from Darwin or Lyell" (1984, p. 7).

Huxley gained an appointment as assistant surgeon on HMS Rattlesnake and spent 1846-1850 in the South Pacific, where he studied marine anatomy and sent the results back to England. During several more years, he made his reputation with papers on that subject and was appointed to the Government School of Mines, later to become the Imperial College of Science and Technology. He spent 35 years there but was famous by 1858, at age 33, both as a comparative anatomist and as a popular speaker. His success was especially remarkable since he had only two years of formal education and was sent off to a series of apprenticeships at age ten. His further education came almost entirely as self-taught through solitary reading (Huxley, 1890).

Huxley and Animal Mind

While Darwin was far too cautious to speculate on the nature of mind and consciousness in the style of the philosophers of his time, Huxley felt no such restraint. Like Descartes, Huxley viewed animals as automata, but like the French philosopher La Mettrie who preceded him, he saw them as *sensitive* automata. In an invited address at the 1874 meeting of the British Association in Belfast, Huxley expressed the opinion that consciousness in animals can be no more than a collateral product, and conscious volition can only be "indicative of physical changes, not a cause of such changes" (Huxley, 1874). Listeners knew that Huxley was a great believer in human/animal continuity and must have

concluded that he meant the argument to apply to humans as well. He finished by saying that the application is proper and that,

> We are conscious automata, endowed with free will in the only intelligible sense of that much abused term — inasmuch as in many respects we are able to do as we like – but nonetheless parts of the great series of causes and effects which, in unbroken continuity composes that which is, and has been and shall be — the sum of existence." (Huxley, 1874)

Huxley elaborated on this approach in his treatment of David Hume, leading light in Empiricist philosophy since the middle of the previous century. And he followed Hume in assuring us that animals have minds, in the sense that they have much of the same subjective experiences that humans have, though they and we are, nonetheless, automata.

Human Instinct and Animal Mind

In 1871 Darwin published *The Descent of Man*, devoted to showing that the differences between man and beast were not so great as to warrant "suprahuman intervention" to account for the human mind. Two chapters aimed to show that reason and higher mental powers exist in animals other than humans and that our status is therefore not unique. Other chapters pointed to the instinct in human behavior, a topic that was popular in the late Nineteenth Century and, following a period of disrepute, resurfaced in the latter decades of the Twentieth (see Burghardt, 1973).

Porphyry and Animal Mind

It was Porphyry who, in the Third and Fourth Centuries, was a disciple of Plotinus and who wrote commentaries on his mentor, on Aristotle, and on others. As a Neoplatonist, he was an opponent of the Christian sects of his time and he criticized their eating of flesh, though the animals whose flesh they consumed had souls like their own. Like Darwin many centuries later, Porphyry diminished the distinction between human and animal psyches.

As proof that animals have souls, Porphyry pointed to the same sorts of evidence that Darwin used in his arguments for the existence of animal minds. First, animals have reason, which in ancient times was divided into "outgoing" or "indwelling." Evidence for outgoing reason lies in the communication among animals, who seem to understand one another, at least at some level. The counterargument that we cannot understand them is moot, wrote Porphyry, since we do not understand humans of other nationalities and languages, but we do not deny them souls on that ground (Brett/Peters, 1912/1965).

And, in fact, we do understand them to an extent, since we can tell when they are hungry, angry, or fearful. As far as indwelling reason, is it not obvious that animals seem to feel envy and that they have virtues such as courage and industriousness? They have no written laws, but neither did humans at one time, yet humans are supposed to have souls. Finally, like humans, animals are liable to go mad. Is it only prejudice that denies them souls? Though he was almost certainly unfamiliar with Porphyry's arguments, Darwin agreed and pointed to scores of examples supporting the presence of intelligence in animals — examples suggesting emotional experience, reasoning power, and proto-language. Everyone is familiar with the playful puppy, and Darwin referred to playful ants,

pretending to bite and exhibiting clear signs of jolliness. We know also the courageous dog, the faithful horse, and the curious cat — example after example can be brought to show that animals feel happy, sad, dejected, proud, brave, jealous, and so on. Animals show emotion much as we do. Several of Darwin's detailed examples were included in James's *Principles of Psychology* (1890).

Huxley and Wilberforce

Darwin saw in Huxley a valuable ally for the promotion of the doctrine of natural selection, should he agree with it. In 1859, upon reading *The Origin*, Huxley saw the power of the theory and then remarked "How extremely stupid not to have thought of that!" (Huxley, 1887, p. 197). He told Darwin that he would supply the "combativeness" that "may stand you in good stead."

> And as to the curs which will bark and yelp – you must recollect that some of your friends at any rate are endowed with an amount of combativeness which (though you have often and justly rebuked it) may stand you in good stead – I am sharpening up my beak and claws in readiness. (Huxley, 1859, para. 5)

In 1860 Huxley did just that, in a highly-publicized interchange with Bishop Wilberforce of Oxford at the meeting of the British Association for the Advancement of Science at Oxford on June 30. Wilberforce, called "Soapy Sam," after his habit of rubbing his hands together as he spoke, condemned Darwin's theory as "a dishonoring view of nature," and asked Huxley through which of his grandparents he was related to a monkey. "The Lord hath delivered him into my hands," whispered Huxley to a friend, Benjamin Brodie (Lucas, 2003).

Then he rose and gave his famous reply, accusing Wilberforce of using religious prejudice and his oratorical skills to enforce his opinion on matters in which he had no authority. No record was made of the actual interchange and many versions exist of what has become a legendary encounter. Decades later, a witness wrote an account of the "debate," as she recalled it:

> ... a species of oratory which could deem it an argument to ask a professor if he should object to discover that he had been developed out of an ape. The professor aptly replied to his assailant by remarking, that man's remote descent from an ape was not so degrading to his dignity as the employment of oratorical powers to misguide the multitude by throwing ridicule upon a scientific discussion. The retort was so justly deserved, and so inimitable in its manner, that no one who was present can ever forget the impression it made. (Sidgwick, 1898, pp. 433-434)

England (2017) provided an exhaustively-researched account of the censoring of the report of the actual interchange that appeared in the leading scientific journal of the time, apparently to shield readers from the raucousness (shouting down, cheering) that can go on at such a meeting. In fact, HMS Beagle's Captain-now-Admiral Fitzroy, long a friend of Darwin, seems to have been shouted down when he rose to criticize the evolutionist view.

England showed that a less prudish but still reliable local newsletter seems to provide a more believable account, corresponding to the reports of those witnessing the event.

Huxley as Hume, a Century After

In 1876 Huxley was asked to write an introduction to a book on the philosophy of David Hume. The result was a 319-page tutorial on Hume's 1748 *Inquiry,* with the last 78 pages titled "Helps to the study of Berkeley" (Huxley, 1878)! This work revealed Huxley as a genuine philosopher, as well as marine biologist and promoter of Darwin's theory. It is worth noting a few instances of his interpretation of, and admiration for, Hume.

One of the most obvious implications of evolutionary doctrine is the continuity among species, meaning that when we attribute reasoning to ourselves and other people, we must also admit it to animals, as he quoted Hume on page 122:

> No truth appears to me more evident, than that the beasts are endowed with thought and reason as well as men. The arguments are in this case so obvious that they never escape the most stupid and ignorant. (Hume p. 232)

Huxley followed that by noting that this "is one of the few cases in which the conviction that forces itself upon the stupid and ignorant, is fortified by the reasons of the intelligent ..." He went on to argue further for that view, in that we are but the "last term of a long series of forms ... from the highest mammal to the almost formless speck of living protoplasm" (Huxley, 1878, p. 123). In fact, Huxley wrote that we might look for consciousness in any organism in which we find a distinct nervous system. Lower animals are also capable of learning, of course, as Huxley quoted Hume:

> First ... animals, as well as men, learn many things from experience, and infer that the same events will always follow from the same causes. By this principle they become acquainted with the more obvious properties of external objects, and gradually, from their birth, treasure up a knowledge of the nature of fire, water, earth, stones, heights, depths, & c. and of the effects which result from their operation. (Huxley, 1878, p. 126)

Hume proposed that learning could account for only part of the behavior of animals, and he accepted "instinct" to explain much animal behavior that seems wondrous to us, from nest building to migration. Of course, instinct also forms the basis for human activity, including our reasoning ability. He quoted Hume again:

> But though animals learn many parts of their knowledge from observation, there are also many parts of it which they derive from the original hand of Nature ... But our wonder will perhaps come to diminish when we consider that the experimental reasoning itself, which we possess in common with beast, and on which the whole conduct of life depends, is nothing but a species of instinct or mechanical power, that acts in us unknown to ourselves. (Huxley, 1878, p. 129)

Do beasts show evidence of conscious will? For that matter, do we? Huxley discussed the question of volition, which he interpreted quoting Hume — "the impression which arises when the idea of a bodily or mental action is accompanied by the desire that the action

should be accomplished" (Huxley, 1878, p. 129). So, we do what we like? As far as "doing as we like," Huxley proposed that our likes and dislikes are products of our past, including our species past, and hence also determined. I feel free to do whatever I want, but what I want is itself the product of a vast web of causes, some originating long before my birth.

Darwin and Animal Mind

Sled dogs scatter on thin ice, "reasoning" that distribution of their weight will prevent a dunking. Travelers in the Andes ask for the mule that is "la mas racional," and Darwin's dog remembered him after five years' absence. Other examples of amazing feats of animal intelligence were given, all to diminish the apparent human/animal chasm, so that natural selection had some hope of producing a human brain as a variation on already high-quality animal brains.

Nonetheless, the notion that animals are guided solely by instinct and only (some) humans by reason was popular in the 19th century and seemed beyond any dispute. How can a spider learn to spin a web and how can a pigeon build a nest unless nature has implanted wisdom in advance — as instinct? Doesn't intelligence replace instinct as we pass from lower to higher organisms? Darwin dismissed this view, pointing to the direct, not inverse, relation between instinct and reason. Organisms like the beaver, which learns quickly and is otherwise intelligent, have many instincts and simple, less reasonable organisms, such as insects, have correspondingly fewer instincts. Reason does not increasingly replace instinct as we pass up the phylogenetic scale. In fact, for Darwin, there was no scale, no "higher" or "lower" organisms.

Language is always brought up as a key difference between human and beast since nothing like human language seems to occur in other animals. But Darwin pointed to mimicry in birds, bird song, monkey calls, and other "elements" of language as evidence that the pieces were there, if the intelligence were added to use them. Even morality could be developed from animal "parts," given instincts of parental and filial affection. Humanity's comparatively great intelligence developed rapidly from this animal base with the help of Lamarckian inheritance. Human peculiarities, such as relative hairlessness, likely were the product of natural selection.

Critics at the time and since, were quick to point out that Darwin's case for reason and emotion in animals was not entirely persuasive. Even a century later, the question of mentality in animals remains, while the definition of and criteria for mentality remain murky. Mitchell, *et al.* (1996) edited a volume comprising 29 chapters written by philosophers, biologists, and psychologists, all dealing with the nature of private experience in nonhuman animals. Though data were collected during the Twentieth Century, the book is in part a Nineteenth-Century work, in the sense that some chapters merely present arguments for sketchily-defined human "faculties" such as "attention," "perception," and the like in the behavior of animals. In fairness, other chapters feature more updated and enlightened perspectives, as the reader will perceive.

In 1871 Darwin noted that there was no generally accepted categorization of human mental powers and, given that, *his* argument was restricted to showing that, superficially, humans and other animals do not differ *in kind* when it comes to mentality. Subsequent research supports his conclusions: The "human/beast" distinction is blurred regarding mind, partly since we have no clear definitions of mental "faculties" or of mind in humans.

But we can say that many abilities that have been attributed to human cognition have been demonstrated in animals, so that the instinct versus reason distinction is progressively harder to maintain.

Romanes Founds Comparative Psychology

In 1874 Darwin was impressed by a letter published in *Nature* and invited the author, George John Romanes, to visit him at home in Kent. Romanes had been a student of physiology and carried out careful work in Scotland on jellyfish and on the nature of reflexes. He was recognized for this work by election to the Royal Society at the age of thirty-one. But his interest in the evolution of mind was what earned him lasting fame and a bit of notoriety. He proposed, with Darwin's support and approval, to examine evidence for mentality in animals and to determine in what ways minds differ.

> First, I have thought it desirable that there should be something resembling a text-book of the facts of Comparative Psychology, to which men of science, and also metaphysicians, may turn whenever they may have occasion to acquaint themselves with the particular level of intelligence to which this or that species of animal attains. (Romanes, 1883, p. v)

Animal Intelligence?

Romanes had collected reports of intelligent animal activity from contacts all over the world and had received Darwin's notes on behavior. Darwin was pleased to see Romanes taking on a task that he viewed as important and many at the time saw Darwin passing on his mantle to the much younger Scot. Romanes planned to sort out his masses of material by first classifying the observations and then deducing the general principles of a theory of mental evolution. The presentation of the classified observations was published first by itself as *Animal Intelligence* in 1882, a few weeks after Darwin's death. Romanes was afraid that if this book were judged in isolation from the planned theoretical interpretation, it would be considered "but a small improvement upon the works of the anecdote mongers" (Romanes, 1882, p, vii). And that is exactly how it was interpreted, despite his efforts to avoid it.

Romanes tried to evaluate critically the cases he presented, so that his would not be just another "pop" book describing the wonderful world of animal minds. But he absolutely trusted sources that he judged competent, so he included stories of communication of complex information among snails. When a bishop and a major general reported the same story, Romanes included their account of a tribunal of rooks judging a miscreant jackdaw.

What exactly is the mind?

Aside from the unfortunate character of the first book, Romanes made a positive contribution to the defining of mind, not only in animals, but in humans as well. Only one's own mind is available as thoughts and feelings — to know the thoughts of others, I must rely on what Romanes called the "ambassadors of the mind." Those ambassadors are the behaviors of others, including their vocalizations. It is fair to say that when I infer conscious experience in others, I make an objective inference based upon their activities. The duck

flying through the air must feel something like what we would feel doing the same thing. The fact that I can make an inference of *any* kind owes to the fact that I can make a subjective inference about my own mental states. When I judge that certain of my behavior is accompanied by certain mental states, I am justified in making an objective inference and assuming that other organisms feel the same thing under the same circumstances (see Malone, 1982). Given that we can never know the mind of another, the only way that we can access other minds is indirectly. As is the case when closely questioning the transubstantiation of species, we must resist "the skeptical demand for impossible evidence" (Romanes, 1882, p. 201). Of course, it is debatable whether we can know our *own* mind so well, but that was not a question for Romanes and his fellows.

Romanes also defined mind, or set the criteria for the legitimate inferring of mind, in a way that was adopted by many during the late Nineteenth and early Twentieth centuries. The question is one that later puzzled Freud — when are we justified in interpreting an organism's action as evidence for mind, or conscious experience? When a dog fetches a stick, or a monkey cracks a nut, or a bird feeds its young, or a worm digs a burrow — are any of these activities evidence for mind? Both early and recent writers hopelessly confuse "mind," "conscious," "thinking," and other words that may each mean very different things. What *is* mind, or rather, what shall be the criteria for what we *call* mind?

Romanes proposed that mind and consciousness may be assumed when activity is purposeful — directed toward a goal — and when it improves with experience. In other words, mind requires the ability to learn to reach goals. This eliminates reflexive behavior, where goals are routinely achieved, but learning is not a conspicuous feature. Countless later writers were to adopt this criterion, including William James, Edward Thorndike, Edwin Guthrie, and Edward Tolman. Mind means purpose and ability to learn.

The Many-Branched Tree of Mind

When Romanes thought of "mind," it was not the conception of mind held by Huxley — an epiphenomenon accompanying the workings of the machine. It seems to be mind in the sense that Descartes thought of it, as an entity utterly separate from body and capable of influencing the activity of the body. His *Mental Evolution in Animals* (1884, two years after Darwin's death) proposed a scale representing the evolution of mind as a set of mental abilities ranged from lower to higher, as a tree with human mind at the top. Such a higher/lower arrangement was not what Darwin had envisioned and was more in keeping with the views of popular "evolutionists" like Herbert Spencer. A clear rendition of his model appears in Romanes (1884, p. 265).

The scales are so arranged that one may pick one of the "Products of Emotional Development" on the left, such as "jealousy, anger, and play." The next scale, or tree branches, show that those require a development of "preservation of species of self" and both "sensation and perception," along with a degree of "will" (the trunk of the tree). The next scale shows that the jealous or playful organism must be capable of association by similarity, and have memory and the other "products of emotional development" falling below step 21. The next column shows that fish and "higher" organisms can play, be angry, and be jealous and so can reptiles and octopi, but spiders cannot. This stage of development is reached by the human infant at 12 weeks.

Romanes and Recapitulation?

The infant recapitulates, or retraces, the history of mental evolution. The recapitulation hypothesis proposed that the developing fetus passes through the stages of subhuman evolution — hence showing gills at one stage. Ernst Haeckel (1866) promoted this view; that is, "Ontogeny is an epitome of Phylogeny" (Singer, 1959, pp. 474-475). Epitome as used here refers to 'summary,' so that the fetus summarizes its history. Romanes spoke of *mental* development, but the idea is similar.

At one week, the infant has memory, as do worms; at three weeks it adds primary instincts, showing surprise and fear, equivalent to the abilities of insect larvae. At ten weeks, the infant can show social feelings, pugnacity, curiosity, and industry, like insects and spiders, and at four months it reaches the level of reptiles, showing recognition of persons, and already having shown affection, jealousy, anger, and play. By the age of a year, the infant is at the level of monkeys and elephants, meaning that it is capable of revenge and rage. The "tree" of mental development may seem attractive, but its usefulness is severely limited since the abilities referred to are neither clearly distinct nor easily defined. This is a perennial problem in psychology, by no means unique to Romanes or to comparative psychology.

Romanes' unusual view of instinct

Romanes inferred conscious intent in interpreting the behavior of an animal, even when chance learning was an obvious alternative; further, his definition of instinct was unusual. Actions of animals that he deemed "instinctive" were those in which something like "inference" or "consciousness" was still present or could be present — instinct was teleologically defined, as was mind. Further, in the last years of a short life, Romanes often referred to 'the Deity,' reverently, as Huxley and other evolutionists never would, and suggested that Christianity exemplified the highest expression of human evolution (see McGrew, 2010). He viewed instinct differently from Herbert Spencer (e.g., 1855), who saw it as no more than compound reflexes that are inherited progressively over generations — in a Lamarckian process, habits in individuals become habits in the race. Many others tacitly accepted this definition.

For Romanes, natural selection and inheritance of acquired characteristics were both important, as they were for Darwin, so that instincts are operated upon by natural selection to produce non-intelligent habits, which are not modified during an individual's lifetime. However, learned behavior may become automatic habit and so becomes inheritable. These "secondary instincts" are capable of rapid change, so to again cite a familiar example, within a few generations, a family of English mastiffs can acquire the fear of butchers, if their parents and further ancestors witnessed the slaughter of animals (Malone, 2009, p. 232, Romanes, 1895).

Romanes' conception of psychology: Not by experiment

As a leading proponent of comparative psychology, Romanes' vision of "psychology" is worth considering. When considering research to confirm hypotheses

about the nature of animal mind, he concluded that only the methods of psychology could be used. And what were these methods in 1884? Romanes wrote, "In the science of psychology nearly all the considerable advances which have been made, have been made, not by experiment, but by observing mental phenomena and reasoning from these phenomena deductively" (Romanes, 1884, p.12).

Despite holding that opinion, the writer who defined mind as learning, evidenced in goal-directed activity that is flexible, did no notable research in comparative psychology. He did do simple experiments such as one carried out in the center of Wimbledon Common, where cats that had been gathered from the neighborhood were released to see how well they found their homes. In March of 1881 Romanes wrote to Darwin reporting the results (Duncan, 1902, pp. 112-113). There was no evidence for a homing ability or cognitive orienting as if a cognitive map was a guide. He coined the term 'comparative psychology,' but was not a noted researcher.

Darwin, and after Darwin: The Power of Steady Misrepresentation

Darwin, and after Darwin was the title of a book published in 1895 and partially finished by others posthumously, in which Romanes defended Darwin's version of evolution, which was losing favor by that time. When we think of Darwin's view, what comes to mind is the sufficiency of variation and selection in accounting for species, for innate behaviors, and for cognitive activities, such as perception, attention, and so on. Even religious beliefs are products of variations that are selected in one way or another and thus survive. But recall that Darwin never held that extreme "Darwinian" view that Alfred Russel Wallace continually promoted, and Darwin became irritated when it was attributed to him, as it frequently was and is still. He always believed in contributions by Lamarck's Laws of Use and Disuse.

Changed habits produce an inherited effect, as in the period of the flowering of plants when transported from one climate to another. With animals the increased use or disuse of parts has had a more marked influence (*Origin,* 6th Ed., p. 8). He went on to give examples of Lamarckian inheritance in ducks, horses, rabbits, and dogs and, with regard to misappropriation of Wallace's views to him, testily wrote, "Great is the power of steady misrepresentation" (*Origin,* p. 176).

Romanes (1895) pointed out in his Chapter 1 that at the time of Darwin's death in 1882 only Alfred Russel Wallace held the view that variation and selection were entirely sufficient to account for organic evolution, while other authorities like Huxley, sided with Darwin. The situation changed over the next decade so that everyone came to agree with Wallace, but Romanes resisted, spending a good part of his time during the last years of his life boosting Darwin's view by seeking evidence for Lamarckian inheritance, to counter the "neo-Darwinism" that was gaining favor. August Weismann, a German biologist, had argued that heredity depends only on selection acting on the 'germplasm' and modifications occurring during an individual lifetime are not heritable. For example, practicing the piano has no effect on genes and so "musicality" is not heritable. Neither Spencer, Romanes, nor Darwin himself supported so exclusive a role for natural selection, and Romanes (1893) defended Darwin and fought neo-Darwinism in his *Examination of Weissmanism* and in his 1895 *Darwin, and after Darwin.*

Romanes Turns to Lloyd Morgan!

As Darwin had chosen Romanes to succeed him, Romanes chose Conwy Lloyd Morgan (1852 – 1936), whom he regarded as "the shrewdest, as well as the most logical critic that we have in the field of Darwinian speculation" (Romanes, 1895, p. 300). The relationship between the two began with a note to *Nature* in which Morgan corrected Romanes' interpretation of "scorpion suicide." Romanes had anecdotal evidence that stressed scorpions commit suicide by stinging themselves. Morgan argued that self-stings are reflexively produced and that the "suicide" interpretation would not be advanced by a skilled observer (Morgan, 1883, pp. 313-314).

Morgan did not hesitate to differ with other of Romanes' interpretations that inferred human mental characteristics in the special tricks of pet animals. Darwin had earlier advised Romanes to keep a pet monkey and observe it. Romanes did get a monkey, but left it to his sister to care for it and perform the drudgery associated with care of an obnoxious pet. Nonetheless, he interpreted the monkey's successful use of a screw as the discovery of "the principle of the screw," quite a different matter. Concerning Romanes' analysis of the emotions, Morgan wrote, "I feel myself forced at almost every turn to question the validity of his inferences" (1895, p. 403). Owing to his father's financial irresponsibility, Morgan was unable to follow the family practice and obtain a law degree at Oxford; after grammar school he was sent to what was then called the London School of Mines. Thomas Huxley was there at that time — 1869 — and Huxley's lectures maintained his interest in biology and evolution, interest that had begun with the reading of Herbert Spencer years before.

On graduation, Morgan hired on as a companion to a family touring America and during the several months that this took, he read Darwin. He spent a year as a research associate at the School of Mines but, unfortunately, it was the year that Huxley spent having his "breakdown." After many temporary jobs, Morgan was employed at a small college in South Africa, teaching science, English Literature, and history. In 1884 he was able to return to England to the new college at Bristol as Professor of Geology and Zoology and it was during the nine years there that he established his reputation. His story begins with the amazing Douglas Spalding.

Spalding: Instinct Versus Learning

Young Douglas Spalding was a largely self-educated mender of slate roofs who happened to hear the philosopher Alexander Bain speak at Aberdeen in 1862 and so became interested in the relative influence of instinct and experience in animal behavior. Bain was impressed with Spalding and let him attend lectures on literature and philosophy at Aberdeen University without paying fees and later Spalding even fulfilled the legal term requirements for barrister and, though admitted to the bar, he never practiced law. He later met the famous John Stuart Mill, who shared his interest in the innate/acquired question, at Avignon, and through Mill he met other famous people who were impressed by his paper in *Nature,* published in 1872, describing a series of experiments, which he also presented at a meeting at Brighton. Where and how Spalding's work was done remained unknown to the author (Anonymous) of Spalding's 1877 obituary (See Douglas A. Spalding. *Nature*,

17, 35–36). In fact, his methods had been well described in the same journal in 1872, 1873, and 1874.

Spalding found that deprivation of vision or audition a few days before hatching did not affect chicks' mobility or reactions to calls when they hatched, and sensation was restored. Hence, concluded Spalding, some reactions are completely instinctive, and this may include even the reaction to an arrival of a hawk or the buzzing of dangerous bees. Some "imperfect instincts" require experience, as in the case of the "following" reaction shown by chicks or ducklings who saw Spalding within a day or so of hatching. This effect was described by William James (1890) in his chapter XXIV, where Spalding was clearly identified as the discoverer of what was later called *imprinting*. Spalding also observed the peculiar way in which turkeys catch insects:

> ... a turkey, when it sees a fly settled on any object, steals on the unwary insect with slow and measured step, and, when sufficiently near, advances its head very slowly and steadily until within reach of its prey, which is then seized by a sudden dart (1872, p. 486).

A chicken, living with such a turkey for months, failed to adopt that prey-catching method, though other young turkeys also caught insects in that way. But chickens still received much credit. Always cautious, Spalding nevertheless suggested that his findings showed that "the chicken ... perceives the primary qualities of the external world" in advance of much experience with it (1872, p. 485). The methods used in these experiments showed care and ingenuity were described in 1872 and in equal detail in 1875 (pp. 507-508). Gray (1967) praised Spalding's experimental methods and contrasted them with the relatively crude attempts by later researchers to replicate them.

In more famous experiments (1873, p. 289), Spalding showed that swallows and other birds that were restrained in a small nest box, so that they could not move their wings from the day that they hatched, appeared to fly as well as other birds when the impediments were removed at the age when such birds ordinarily fly. He had shown that some coordinated behaviors are indeed instinctive, and that sensory experience or practice are unnecessary for their execution. This interpretation and conclusion was contested vigorously during the early 20th century, particularly by Z.Y. Kuo (1921).

After 1873 Spalding was employed by the radical Lord Amberley, whose wife Kate acted as Spalding's research assistant, as did Lord Amberley on occasion (Spalding, 1873, p. 489). The papers of the Amberleys were examined sixty years later by their second son, philosopher and Nobel Prize recipient Bertrand Russell (Russell & Russell, 1937). Among his findings was the fact that his mother regularly took Spalding to bed, out of concern by herself and her husband for Spalding's celibacy. Following the death of the Amberleys, Spalding moved to France, where he died at age 37 of tuberculosis contracted years earlier in London. Until that time, Bertrand (Lord) Russell, son of the Amberleys, supported Spalding with the same stipend that had been provided by his father, Lord Amberley (Anonymous, *Nature*, 1877, *17*, 35–36).

Morgan's Learning Research

Morgan had been invited to reexamine Spalding's findings by an American friend and, when he did so, he was more struck by the influences of early experience on later

behavior than by the instincts that so impressed Spalding. He found that a chick's accuracy of pecking improved a great deal with early experience and that there appeared to be no innate recognition of water. The so-called "instinctive" reaction to hawks was evidenced to other stimuli, such as "any loud, strange, and unusual sound ... or sight of an alarming object" (Morgan, 1896, p. 202). Hence, the instinctive reaction was not as specific as Spalding felt it to be; Spalding did write (1872, p. 486) that his observations of what he called "instinctive knowledge of their enemies may be taken for what they are worth." This question was revisited repeatedly in the 20th century, for example with Lorenz and Tinbergen playing the part of Spalding and Kuo and Schneirla playing Morgan.

Morgan's best-known experiment probably was that showing rapid learning by chicks of the foul taste of the caterpillar of the cinnabar moth (1896, p. 214). They quickly learned to avoid the such caterpillars, an accomplishment made easier by the distinctive blue and gold bands marking them. In Morgan's view, it was learning because of consequences — some responses give satisfaction, and those responses are repeated. Others provide displeasure or no satisfaction and are not repeated.

Morgan knew that such learning had been called trial and error by Alexander Bain and he studied other instances of it, beginning with the escape of a duckling from a pen made of newspaper walls. An escape through a hole made in the wall at one spot was followed on the next occasion by an attack on the same spot and another escape.

Tony and the interpretation of behavior

Another of Morgan's reports concerned his pet fox terrier, Tony, who learned to open a gate by placing his head between the vertical rails and under the horizontal latch (Morgan, 1896, 255-258, 289-290). The practice began by chance, as Tony often spent time with his head between the rails, looking out at the road. On one occasion, he happened to have his head under the latch, and he lifted his head in such a way as to open the gate. After a pause, he ran out through the open gate.

Over a period of three weeks, Tony placed his head between the rails enclosing the latch more and more often and less often between the other rails. After three weeks he could go straight to the latch, open the gate, and leave the yard. An observer like Romanes would be impressed with the apparent mentality thus displayed, but Morgan noticed something else. He pointed out that "even now he always lifts it with the back of his head and not with his muzzle which would be easier for him" (Morgan, 1896, p. 290). Morgan seems not to have been a master experimenter; however, unlike Romanes, the observations he made were usually repeated over an appreciable period, so that the course of development of an action could be studied. Such a strategy helps to avoid the overgenerous attribution of mentality that occurs so easily when only isolated observations are made.

The misinterpreted Canon

Morgan published his famous canon in *An Introduction to Comparative Psychology* (1894; 1896, pp. 120, Ch. 14) and previously introduced it publicly at the International Congress of Psychology in 1892. It has commonly been interpreted as an admonition against anthropomorphism, as practiced by Romanes, and an urging for parsimony, or simplicity in explanation (E.g., Boring, 1950, p. 474). However, Burghardt (1985), in an

authoritative review of implications for comparative psychology, showed that this was not true. Indeed, the reader of Morgan's *Introduction to Comparative Psychology* cannot avoid concluding that he saw consciousness everywhere in behavior; parsimony does not mean excluding it or anthropomorphism from our explanations. Consider one of the forms in which Morgan described his canon (1896, pp. 53, 120):

> In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of one which stands lower in the psychological scale.

Examples of cases to which Morgan referred were those in which a horse was said to understand the principle of the inclined plane when it took a zig-zag course up a steep hill or when a dog was believed to understand geometry when it cut off a rabbit running a predictable path. In both cases, simpler explanations are possible and quickly come to mind and attribution of the highest human faculties is unnecessary.

Morgan offered "process" as substitute for "faculty" and also offered a scale of faculties/processes, so that "higher" and "lower" have some meaning. Rather than assume a branching tree of functions representing "lower to higher," Morgan proposed a loose linear scale, similar to that of Herbert Spencer in 1855. That means that the only way to describe mentality is as a continuum with more or less of the same thing — whatever that might be called. (A great problem for comparative psychology has been reliance of workers in the field on deficient and/or ancient models of mind. Morgan relied on Spencer's (1855) model, though few others took it seriously). Morgan's defense for this method was that it would fulfill the goal of showing the development of processes from sensation to "reflective introspection and perception of relations and retrospection" that would decisively win the case for the evolutionists (1896, p. 243). That sequence goes as follows.

The lowest level of mentality is evidenced in simple associations, and Morgan proposed two basic kinds — associations among sense impressions and those among actions and outcomes. This corresponds to the learned taste aversions that he had studied and experiments such as rabbits' escapes through newspaper walls and Tony's escapes through the latched gate. The parallel with caricatured classical and instrumental learning, as S-S and S-R association, is obvious. Morgan referred to findings such as the learned aversion to the sight of the cinnabar caterpillar and escape learning by ducklings and by his dog Tony, as instances of the two kinds of association.

Morgan then described perception of relations, defining the separation between human and most animal capabilities. Tony was unable to return a nine-inch stick when he had to bring it through a six-inch space between fence posts, though that would have shown perception of relations, as long as it was clear that trial and error were not involved. Counting was also mentioned as a case of perceptual learning, and probably Morgan would have considered cases of relational learning later presented by the Gestaltists under the heading of "transposition."

Higher-level processes, found in no subhuman animal, appeared as perception of abstract relationships. "Counting," not dependent on particular objects, or "matching to sample," or choosing the object intermediate in size from a set of three objects. Such abstraction is required for the thought that is independent of its objects and so allows flashes of insight that he thought elude lower animals and other concrete thinkers. The

neurologist Kurt Goldstein used similar criteria to define concrete and abstract thought in humans (see Harlow, Gluck, & Suomi, 1972).

If an organism is capable of these functions, then it is a human and probably not a schoolchild or a peasant. Such a being may even be capable of the concept of self, though a child or peasant may well not be capable, and the animal surely is not. So wrote Morgan (1896, p. 318). Overlaying this scale were faculties such as communication, memory, and others that appeared in higher or lower forms depending on the species in question. Animals could communicate, Morgan felt, to the extent that they could indicate fear or draw attention to some object — simple associations that have nothing to do with relationships or abstractions. Animal memory was purely simple association. A dog may remember its food dish just as a student may remember the date of Locke's birth, with no knowledge of wider relations in either case. Systematic memory, on the other hand, includes meaning as knowledge of relationships among items remembered.

What the Canon really meant

Again, Lloyd Morgan was by no means opposed to *anthropomorphizing*, the inferring of human processes in animals. He explicitly proposed that comparative psychology must involve a "doubly inductive process," including the observer and the observed. By induction Morgan meant:

> ... the observation of facts, the framing of hypotheses to comprise the facts, and the verification of the hypotheses by the constant reversion to the touchstone of fact. Our conclusions concerning the mental processes of beings other than our own individual selves are, I repeat, based on a two-fold induction. (1896, p. 47)

It is easy to see Romanes' influence, as Morgan acknowledged, but he was "anxious to make the matter quite clear," and argued that the psychologist has been trained in introspective psychology and thus is able to describe his own conscious experience. He observes the activities of other organisms, human or animal, the interpretation of which is an objective induction. Finally, he makes a subjective interpretation of "the other's" mental state in terms of his own. The two inductions involved are actually the subjective induction concerning the observer's states of consciousness and the objective induction from observed behavior in others. Thus far, there seems little difference between Morgan and Romanes — both begin with subjective inference of one's own mentality and the observation of the "ambassadors of the mind" in the behavior of others that then allows objective inference of other mental states.

However, Morgan was far less charitable than was Romanes in assigning mentality to animals and his famous canon follows from a consideration of ways in which minds may vary. They could differ in what he called the *Method of Levels*, *Method of Uniform Reduction*, or the *Method of Variation* (1896, pp. 55-59) and only the third way seems plausible.

If the *method of levels* applied, we would find that snails, dogs, and humans differ in simple possession of faculties. Recall that Morgan's "levels of mind" ranged from simple association to knowledge of relations, to abstraction, to knowledge of self. But he also mentioned faculties such as memory and perception, as used in common conversation by common people. Assume that 1, 2, and 3 on a y-axis correspond to faculties such as

sensation, perception, and reason, respectively, and that a, b, and c on an x-axis refer to the three organisms being considered. It is conceivable that snails can only sense, that dogs can sense and perceive, and that humans can sense, perceive, and reason. In an ascending series of species, higher faculties are added onto lower ones. The most absurd aspect of this possibility is that it treats each mental power as a full-blown, present-or-absent entity, so that the sensing of the snail, dog, and human are identical and new faculties are simply added. But before dismissing it as utterly inane, note that many who have considered the topic have held that only humans are capable of reason, while other animals operate more simply. That is a case of the flawed method of levels.

If the *method of uniform reduction* were the case, all animate creatures would have all possible mental powers and faculties, but in differing degrees, according to their station. Humans would have a lot of abstractive power, while earthworms would be capable of less abstraction. Similarly, the memory of the baboon would exceed that of the butterfly, but even the butterfly would have the faculty of perception and a sense of self. This too, seems an unlikely mode by which minds might differ.

This leaves only the *method of variation*, the only reasonable possibility in Morgan's view. Faculties may vary non-uniformly, so that organism "b," the dog, for example, has more of the faculty of sensation ("1") than does the human or the snail (a and c, respectively), but less perception and abstraction (3 and 2) than the human has. Perhaps in visual acuity, olfaction, and audition the dog surpasses the human, who in turn excels in other ways.

Such a reasonable mechanism allows for superiority of animals, especially in sensory and simple association ways, and thus explains phenomena such as the wonderful horse of Herr von Osten, Clever Hans. Hans could answer all sorts of questions, as long as head bobs or hoof raises could express an answer. Investigations by noted philosophers and scientists pronounced him genuine, but psychologist Oskar Pfungst discovered his real genius. Hans's wonders lay not in reasoning ability, as first thought, but in sensitivity to subtle cues of breathing and movement inadvertently produced by human onlookers (Malone, 1990). The clear possibility of superior "lower faculties" in animals means that it is there that we should look for explanations of their behavior, before resorting to "higher psychical functions."

That is the point of Morgan's canon — he explicitly denied that he was invoking a law of parsimony, since simpler explanations are not always better. An example he gave is that of Lamarckian inheritance of acquired characteristics, a simpler explanation than that of August Weissman, a Lamarckian, as late as 1880, who destroyed that theory through the demonstration of the continuity of the germ plasm. Simpler does not mean better and Morgan did not mean that simpler explanations of animal behavior are always preferable (see Burghardt, 1985). Many authors who have misinterpreted Morgan have evidently failed to read his works.

But Was Morgan a Lamarckian?

Morgan had considered the inheritance of acquired behaviors; though oddly, he rejected the law of use and disuse as it applied to bodily organs and structures. But in 1894 he accepted the effects of natural selection as the only basis for evolution of both body structures and instincts. Instinct, for Morgan, was behavior that was entirely controlled by

the nervous system as organized at birth and which involved the activity of the whole organism. Further, instincts were elicited by more complex stimuli than is the case for reflexes.

To account for fine adaptations that seem hard to explain through natural selection, Morgan proposed rapid learning and imitation. Some environments provide situations where only one response can be correct and animals may learn through trial and error to behave as do their fellows and as did their parents, since that is the only way that works. The human use of language is at least partly due to this factor — the infant's learning of the rudiments of communication and language is shaped by a verbal environment that often accepts no substitutes.

Along the same lines, imitation is not only important in the learning of language by humans, but in the learning of songs by birds and in countless other cases. B. F. Skinner would agree a century later and emphasize imitation as "priming" in his last writings (Malone 1999). Instinctive imitation could appear as simple cases, such as eating when others eat or avoiding a cinnabar caterpillar that a fellow chick has learned to avoid. While these processes were important in human evolution, Morgan agreed with Wallace that human mental powers could not be fully viewed as products of evolution.

Organic Selection

Herbert Spencer noted that, "Now-a-days most naturalists are more Darwinian than Mr. Darwin himself" (Spencer, 1887, p. 19). Wallace, Romanes, and most other naturalists had become "Neo-Darwinians," while Darwin had remained a constant "Darwinist" to the day he died. This, again, was a dispute over the inheritance of acquired characteristics, as proposed by Lamarck and adopted by Darwin. Neo-Darwinists disagreed and gave rise to the needlessly confused topic of Organic Selection.

Alan Costall (1993) pointed out that Morgan has frequently been misinterpreted as fundamentally disagreeing with Romanes and as wholeheartedly embracing "neo-Darwinism," the post-Darwinian view that all evolution is explained by natural selection alone. Thus, the development of bodily structures, including the nervous system and brain structures that mediate instinct, as well as mental functions, are due to natural processes — the variation and selection that we now think of as "Darwinism." But recall that Darwin died a partial Lamarckian and that Romanes and Spencer, among others, also believed in the inheritance of acquired characteristics. That view has always held an appeal to evolutionary thinkers, since it seems to allow for something like directed adaptive effort, or 'bettering,' an alternative to what otherwise seems blind variation and selection. And, again, it appeals to our vain hopes that our progeny may benefit directly from our hours spent honing our skills and otherwise improving ourselves without having to duplicate our efforts entirely in doing so.

Baldwin was Clear Enough

Costall made the argument that both Morgan and James Mark Baldwin subscribed to a compromise between pure natural selection and Lamarckianism. This they called 'organic selection,' a point of view that is difficult to separate from natural selection but

which they felt, as does Costall, was importantly different. Baldwin gave the following illustration involving cooperation

> Animals may be kept alive let us say in a given environment by social cooperation only; these transmit this social type of variation to posterity; thus, social adaptation sets the direction of physical phylogeny and physical heredity is determined in part by this factor. (1896, p. 553)

In other words, The Baldwin Effect is an evolutionary mechanism, which transforms a culturally invented and acquired trait into an instinctive trait by the means of natural selection. Baldwin explained it more specifically in the following way, possibly to impress on the reader the usefulness of 'ontogenetic' and 'phylogenetic' adjectives:

> This principle secures by survival certain lines of determinate phylogenetic variation in the directions of the determinate ontogenetic adaptations of the earlier generation. The variations which were utilized for ontogenetic adaptation in the earlier generation, being thus kept in existence, are utilized more widely ... The mean of phylogenetic variation being thus made more determinate, further phylogenetic variations follow about this mean, and these variations are again utilized by Organic Selection for ontogenetic adaptation.
> So there is continual phylogenetic progress in the directions set by ontogenetic adaptation … And for adaptations generally, the most plastic individuals will be preserved to do the advantageous things for which their variations show them to be the most fit, and the next generation will show an emphasis of just this direction in its variations ... (1896, pp. 3-4)

Baldwin went on with a second simple and hypothetical example:

> We may imagine creatures, whose hands were used for holding only with the thumb and fingers on the same side of the object held, to have first discovered, under stress of circumstances and with variations which permitted the further adaptation, how to make use of the thumb for grasping opposite to the fingers, as we now do. Then let us suppose that this proved of such utility that all the young that did not do it were killed off; the next generation following would be plastic, intelligent, or imitative, enough to do it also. (p.4)

As Dennett more eloquently explained, "It shows how the "blind" process of the basic phenomenon of natural selection can be abetted by a limited amount of "look-ahead" in the activities of individual organisms, which create fitness differences that natural selection can then act upon" (Dennett 1995, p. 80).

The appearance of lactose tolerance, the likely cause of Darwin's illnesses (i.e., lactase persistence), in human populations with a long tradition of raising domesticated animals for milk production has been suggested as another example. This argument holds that a feedback loop operates whereby a dairy culture increases the selective advantage to *individuals* from this genetic trait, while the average population genotype gradually changes to conform (Beauregard, 2000). That is, adults in such a culture may become able to drink milk and eat milk products, since the lactose tolerance historically present only in infants has undergone organic selection to become part of the culture's genotype.

James Angell Confuses the Issue

Baldwin's aim, made plain in his 1896 paper, was to eliminate the Lamarckian influence that Darwin accepted out of necessity. The way to do this was to show that variations and selection were enough and that the Baldwin Effect illustrates how that happened. James Rowland Angell, an influential functionalist psychologist at the University of Chicago, reviewed the issue and redefined organic selection in 1909, in the course of estimating the influence of Darwinian thought on later psychology. He reminded readers that Darwin had indeed proposed that instinct comes partly from natural selection and partly from Lamarckian causes.

> ... inheritance of useful habits consciously acquired ... (in bird mating), despite the impelling force of impulse, the female exercises a very definite choice in which to all appearances psychical impressions are potent ... It will be noted also that Darwin speaks quite explicitly of his belief that acquired habits are transmitted. The doubt which attaches to this doctrine in the minds of contemporary zoologists is well known ... Darwin refers to acquired fears in birds, mental training among dogs. (1909, p. 154)

He then went on to irretrievably muddle the issue, beginning with a mistaken summary of Darwin's thought! According to Angell, Darwin's contributions to psychology were three (italics added): (1) the doctrine of the evolution of instinct *and the part played by intelligence in the process*; (2) the *evolution of intelligence* from the lowest animal to the "highest" human, and (3) the expressions of emotion. Only the third is accurate.

The first, referring to the part played by intelligence, is a recasting of the question of the reality of Lamarckian use and disuse, versus the sufficiency of variation and natural selection. Costall in 1993 and Angell in 1909 wanted to make clear that Morgan and others did not subscribe to the "natural selection alone" position. Angell misinterpreted what these writers meant by organic selection as a *compromise* between Lamarckianism and natural selection in which *consciousness* is decisive. According to Angell, the doctrine of organic selection:

> ... maintains that consciously acquired habits, are probably not directly transmitted, but that consciousness plays an indispensable part in the drama by enabling successive generations of creatures to accommodate themselves to the vicissitudes of life while the slow changes are taking place which finally issue in the completed instinct. Not only is consciousness operative in this way, but in all the higher forms of animal life it is held that conscious imitative activities also play a part, and with man a dominant part, in setting the racial pattern. Natural selection serves to lop off the feeble and incompetent… but the successful issue is fundamentally dependent on conscious reactions during the critical formative stages. (1909, p. 156)

No wonder that Organic Selection was dismissed by so many critics! As the lead proponent of Functionalism in American psychology, Angell probably had more authority than was merited and his idiosyncratic and mistaken account received undeserved credence.

The reader may notice that Angel's addition of consciousness to variation and selection is unnecessary, even gratuitous and harmful, if one assumes that all behaviors are

subject to selection after arising solely as variants of already-present traits. Surely, organisms that are more plastic — apt to learn more quickly — should be more likely to survive and produce similarly smart progeny and so pass on that trait. Thus, an animal may learn to be attentive early in life *and/or* be born with a genetic variation that makes it more attentive than its parents. Whether this occurs consciously is relevant only if, like Angell, one feels it essential to show an adaptive function for consciousness.

Burghardt (2020) provided a clear and authoritative account of the Baldwin Effect, including references to related research, all of which correct previous misinterpretation. His example of instances of the effect in the feeding preferences of garter snakes will appeal to many readers.

Darwin's Enduring Contribution: Continuity of Mind?

> Some of my critics have said, "Oh, he is a good observer, but he has no power of reasoning!" I do not think that this can be true, for the 'Origin of Species' is one long argument from the beginning to the end, and it has convinced not a few able men. No one could have written it without having some power of reasoning. (Darwin, Autobiography, p. 27)

Darwin's *lack* of influence in biology during the Nineteenth Century is amazing. His lifelong friend, J. D. Hooker, died in 1911 at the age of 94 and was an eminent botanical taxonomist who saw the drafts of the *Origin of Species* long before 1859 and was an ardent Darwinist. According to Singer, 1959, his work spanned seventy-one years and was conducted as if Darwin had never lived and the doctrine of evolution never had existed! Though Darwinism showed that species were not fixed and static things, Hooker and others went on classifying as if Creationism was fact and Darwin had never written (in a letter to Huxley) that taxonomic relationships are "simply genealogical."

On the positive side, Darwin always argued for the continuity of mind, from animals to civilized human — differences in range and power, though great, were not differences in kind. In Darwin's time and for decades after, Alfred Wallace would argue that natural selection stopped with humanity and that an unfathomable gulf exists between man and beast. Wallace pointed to other natural discontinuities as evidence: organic/inorganic, organic/sentient and conscious, and sentient-conscious/rational. Further, he argued (see Angell, 1909) that music and mathematics represent activities that could have had no adaptive function and hence could not have arisen through selection.

Angell pointed out that musical and mathematical abilities are surely aspects of greater capabilities that would have adaptive significance. As for the general argument that man and beast are fundamentally different, Angell wrote, "In reading Wallace one feels the presence of a vein of mysticism and the impelling influence of religious pre-possessions ..." (1909, p. 161). Even in 1909 it was safe to say that most scientists accepted the continuity of mind.

Darwin was less successful in demonstrating mind in animals for the same reason that Romanes and Morgan were unsuccessful. One must have a reasonable model of mind to be inferred in animals and Darwin did not have one. In *The Descent of Man, and Selection in Relation to Sex* (1871) he naively categorized mind into the faculties of the day, so that animals were examined for evidence of sensation, pleasure, pain, imitation, emotion (pride, disgust, elation, etc.), attention, memory, imagination, and reason. He

argued for tool use in animals, as when elephants use branches to brush away flies. When Darwin proposed that a dog's reaction to the question, "Where is it?" shows that the animal is capable of abstract ideas, Angell suggested that, "The simple-mindedness of this conclusion must inevitably furnish amusement to the sophisticated animal psychologists of the present day" (1909, p. 322). *Who* was simple-minded?

Darwin saw rudimentary language in animals' calls and an aesthetic sense in colored plumages. For him, even conscience and belief in God were not inconceivable for the animal mind! Strong social instincts could well lead to conscience, which Darwin believed was already demonstrated in dogs. This was quaintly naive, "highly archaic and scientifically anachronistic," but should be forgiven in view of Darwin's extensive innocence of psychology ..." (Angell, 1909, p. 322). Angell's interpretations of Darwin's work have been largely forgotten – and deservedly!

Darwin's Strength as Psychologist: Observation and Description.

Darwin's "psychology" was that of the person in the street, but that is true of most scientists and his writings still have great value, as countless readers have found. His contribution lies in astute observation and clear description, rare items, so that he was frequently quoted by others. This is well illustrated in one of his best-known psychological contributions — his descriptions of emotional expressions (1872, Ch. 12). William James, perhaps greatest of all psychologists, quoted Darwin's characterization of fear, an excellent example of Darwin's observational skill:

> Fear is often preceded by astonishment, and it is so far akin to it that both lead to the senses of hearing and sight being instantly aroused. In both cases the eyes and mouth are widely opened and the eyebrows raised. The frightened man at first stands like a statue, motionless and breathless, or crouches down as if instinctively to escape observation. The heart beats quickly and violently, so that it palpitates or knocks against the ribs; but it is very doubtful that it then works more efficiently than usual ... for the skin instantly becomes pale as during incipient faintness ... That the skin is much affected under the sense of the great fear, we see in the marvelous manner in which perspiration immediately exudes from it. This ... is all the more remarkable, as the surface is then cold, and hence the term, a cold sweat ... The hairs also on the skin stand erect, and the superficial muscles shiver ... the breathing is hurried. The salivary glands act imperfectly; the mouth becomes dry and is often opened and shut. I have also noticed that under slight fear there is a strong tendency to yawn. One of the best marked symptoms is the trembling of all the muscles of the body; and this is often first seen in the lips. From this cause, and from the dryness of the mouth, the voice becomes husky or indistinct or may altogether fail ... (1890, p. 446)

Notice that this description is almost enough to make the reader fearful, yet, it is only a description of observable bodily reactions. As fear increases, the violence of the reactions increases as well:

> As fear increases into an agony of terror, we behold, as under all violent emotions, diversified results. The heart beats wildly or must fail to act and faintness ensue; there is a death-like pallor; the breathing is labored; the wings

> of the nostrils are widely dilated; there is a gasping and convulsive motion of the lips, a tremor on the hollow cheek, a gulping and catching of the throat; the uncovered and protruding eyeballs are fixed on the object of terror; or they may roll restlessly from side to side ... The pupils are said to be enormously dilated. All the muscles of the body may become rigid or may be thrown into convulsive movements. The hands are alternately clenched and opened, often with a twitching movement. The arms may be protruded as if to avert some dreadful danger, or may be thrown wildly over the head ... In other cases there is a sudden and uncontrollable tendency to headlong flight; and so strong is this that the boldest soldiers may be seized with a sudden panic. (1890, pp. 446-447)

Darwin interpreted emotional reactions as clear products of evolution and those of modern humans as vestiges of actions that were formerly useful. Thus, 'serviceable associated habits' survive so that we threaten by snarling and baring our canine teeth, as if preparing to attack and bite. We also prepare to work on an essay or a math problem as our ancestors did when they prepared for physical work, as in lifting a heavy object. In both cases, we take a breath of air, set our chest, and clench our jaw.

Some reactions are related by antithesis, so that we shrug our shoulders, look away, and stand with our "palms up" to indicate helpless impotence. "Taking command" is the reverse, so that we hold our palms down, establish eye contact, and stand erect. A threatening dog maintains eye contact, points its ears forward, bares its teeth, and holds its tail up. A submissive dog averts its gaze, holds its ears back, and "grins" foolishly. Modern dog trainers have shown that it is possible to train a vicious, obnoxious, or otherwise intractable dog to assume the submissive posture on command and to demonstrate corresponding behavior. A skilled observer may apply the same technique to human behavior.

Conclusion

Fame tends to be a winner-take-all game. Setting Lamarck and others aside, Darwin was number one in the scientific study of evolution, but just for that reason too much may be attributed to him. He was a man with the luxury of never having to earn a living who had enormous patience and an obsession with observation and recording — and tenacity in getting to the root of things. But he was not personally impressive. He didn't appear super-bright and strove to a fault to appear modest (although in some of his writings he was less so). His systematic, even shocking, conspiratorial discussions with friends and collaborators to advance the cause of Darwinism via appointments and publication (well documented in Janet Browne's excellent biography, especially in Book 2), also suggests that he became less modest with age. But he was often intimidated by others and overly credulous when he respected the source. It was Huxley, Romanes, Spalding, Morgan, Thorndike, Baldwin, and many others who lacked the leisure that Darwin enjoyed who really established what became "Darwinism" in psychology (Browne, 1996; Malone, 2009). He had the free time to fill the cartridge, but they fired the gun. It's time to moderate our adulation of one man and spread a bit of credit to others who deserve more than they have gotten for establishing modern evolutionary theory.

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