Darwin Died at a Most Propitious Time

The most official of all the year's centennial celebrations heard why Darwinism is more alive and more vigorous than ever

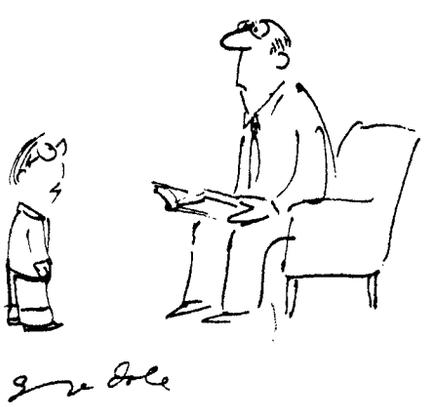
"Charles Darwin died at a most propitious time," said Sydney Brenner, director of the Medical Research Council's Laboratory of Molecular Biology, Cambridge, England. Brenner was not being callous in his opening remarks at the year's most official of the multiplicity of conferences to commemorate the centenary of Darwin's death. He was referring to the revolution in molecular biology of recent years that is producing "a tremendous flood of important and exciting data that undoubtedly will lead to a deep understanding of the process of evolution."

Stephen Jay Gould, of Harvard University at the other Cambridge, agrees that the centenary year is a particularly special time for evolutionary biology. "Evolutionary theory . . . is bursting with new life and excitement," he declared. Gould also took the opportunity to rebut the curiously popular charge that evolutionary biology is a fragile facade in imminent danger of collapse. "The healthy turmoil currently experienced by Darwinian theory is sometimes misrepresented as death-throes by an uncomprehending (or irresponsible) press, searching to intensify conflict."

The conference, which processed at a stately pace in the gentile surroundings of Darwin and Queen's Colleges, was more of an historic event than a scientific symposium. It was an occasion for reflection on the status and ramifications of biology's most pervasive and persuasive theory. It was also an opportunity for acolytes and colleagues alike to seek dedications from famous authors whose many works, which form the most visible part of the vigorous Darwin industry, conveniently were on sale near the conference hall. And it was a time at which the great majority of participants felt moved, as committed evolutionists, to sign a petition urging governments to take a long-term view on the global destructive power being developed in nuclear arsenals.

For the record, no one challenged the value of the intellectual tradition initiated by the Darwinian revolution. Indeed, in a masterly summary John Passmore of the Australian National University expressed himself confident that the passage of another 100 years would witness a bicentennial as firmly dedicated to the name and as intimately associated with the ideas of the man whom Ernst Mayr terms "the greatest biologist of all time."

The admixture of disciplines on display, from geology and paleontology through molecular biology, behavioral ecology, history and philosophy of science, and even moral philosophy, produced something of an unreal ambiance, a feeling of Alice in Scienceland. So wide-ranging were the papers presented that, in the manner of the Red Queen, many participants found they had to run faster and faster just to keep pace. But the great breadth of topics covered served to emphasize in a way no other meeting has ever done the tremendous scope of evolutionary theory—of Darwinism.



"... but how can you reconcile the stork theory with Darwinism?"

Passmore asked rhetorically why it was that the intellectual tradition started by Darwin is dubbed an "-ism." "We don't refer to Einsteinism or Newtonism, so why is it Darwin*ism*? Is there something unusual or odd about evolutionary theory that it is so termed?" Yes, he answered himself, in addition to being so all-encompassing, evolutionary theory is an historical theory. He was referring to the old argument, recently aired afresh in an Arkansas federal court but now mercifully slipping into retirement in academic circles, that an historical theory is not a truly scientific theory. Biologists are not happy with the idea that evolutionary theory is nothing but a research program, said Passmore. Nor should they be, as that notion was based on the physical sciences model of what is science and what is not. "This narrow view of science has done a great deal of harm," argued Passmore.

But is this why evolutionary theory has come to be known as an "-ism?" No, says David Hull, a philosopher of science at the University of Wisconsin, Milwaukee. It is just an accident of history. "Some theories are so difficult to understand, such as the theory of relativity, that most people keep their mouths shut about it. Evolutionary theory appears to be simple and everyone feels free to comment on it." Loose usage encourages the attachment of "-ism." "In fact, it is a very difficult theory indeed, counter-intuitively so."

In the century and a quarter since the publication of *The Origin of Species*, Darwinism has experienced fluctuating fortunes, sometimes being virtually eclipsed by a blinkered rush to new insights on evolutionary theory, as happened in the 1920's. At the Cambridge meeting Darwinism was perceived as being as strong as it has ever been, perhaps stronger in some ways. For Mayr one of the principal messages of the meeting was that the contributions from the many different disciplines cogently confirmed the basic formula of Darwin's ideas.

Molecular biology and behavioral ecology, both relatively young disciplines, both unknown to Darwin (although, as Tim Clutton-Brock of Cambridge University said, Darwin would probably have recognized the latter as natural history), are producing information and ideas that, says Mayr, fit perfectly into the Darwinian framework. Moreover, says Mayr, the many controversies we have seen through the years, such as the issue of adaptation and the possible punctuational mode of evolutionary change, were known to Darwin. "There appears to have been no limit to Darwin's creative thinking."

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Although causing confusion among some onlookers, Gould too asserts the continued strength of Darwinism, but it is strength through growth and extension. The healthy turmoil he sees surrounding the centennial contains two proposals. First is "a widened role for non-adaptation and for chance as a source of evolutionary change." And second, "attempts to construct a hierarchical theory based on the interaction of selective (and other) forces at numerous levels (from genes to clades)—rather than almost exclusively upon selection among organisms."

Richard Lewontin, a population geneticist at Harvard, expects to see the continuation of Darwinism, provided the currently rigid separation between internal (genetic) and external (environmental) forces is modified to allow for subtle and important interactions. "If the hundredth anniversary of Darwin's death is not to mark the death of Darwinism, we need to struggle for its transfiguration," he urged.

The apparently paradoxical process in which established ideas in evolutionary biology are occasionally challenged, modified, and developed, yielding a product that is still termed Darwinism, causes Hull some amusement and frustration. "I don't think there is a permanent core to Darwinism," he says. "Ideas change through time, legitimately so. And yet there is an obvious need to accept change while giving the semblance of no change."

Hull sees this process as a phenomenon general to all science, even to the most radical groups. It is an expression of a need for continuity, he suggests. The application of the term Darwinism to modern evolutionary biology is legitimate, he says, if it simply means that the intellectual origin's are to be traced back to Darwin's seminal ideas, but not if it is meant to imply an all-enveloping canopy of substance. "No one should expect any great scientist to set out all truth for all time."

Philosophizing aside, the Cambridge meeting was imbued with an enthusiastic, "we are all Darwinians now."

In a generally harmonious meeting, albeit interrupted at intervals by British paleontologist Beverly Halstead's repeated but unsuccessful attempts to tackle Gould on punctuated equilibrium, Robert Sokal caused considerable consternation toward the end of the proceedings by suggesting that although the molecular biologists clearly had something new and interesting to present, the more traditional evolutionary biologists were raking over the same old boring arguments, with nothing new to contribute. Once again, the molecular biologists had stolen the show.

Who can fail to be impressed by the brilliant glistening jewels currently on display in the world of the new molecular biology? Split genes, pseudogenes, processed genes, families of repeated sequences shifting and changing—all combine to impart an image of a dynamic genome. "This truly amazing array of discoveries gives us an insight into many important sources of variation of which we were previously unaware," responded Mayr. And yet there is an important paradox, for in many instances at least the fossil record speaks of long periods of morphological stability within species. This stasis in the face of apparently constant change is a key issue in understanding evolutionary mechanisms.

François Jacob's metaphor of evolution as a tinkerer is as elegant and relevant as ever. "If an engineer were asked, starting from scratch, to manufacture a frog, it seems unlikely that he would first design such a swimming precursor as a tadpole and transform it later into a land animal," said Jacob of the Institut Pasteur, Paris. "One would have to say that this process resembles, not engineering, but tinkering, bricolage, as it is called in the French. While the engineer's work relies on his having the raw materials and tools that exactly fit his project, the tinkerer manages with odds and ends."

Until recently, the mechanisms of genetic tinkering were difficult to imagine, said Jacob. The new discoveries in molecular biology provide the missing material, the odds and ends. "Now we can see that it is at the molecular level that the tinkering aspect of evolution is most apparent."

No one failed to be impressed by what the molecular biologists had to say. In case molecular biologists should come to believe that they now guard the route to all the important answers in evolutionary biology, Ernst Mayr cautions that "these people must learn to think like evolutionists, to understand the importance of population effects."

Sokal's challenge inevitably provoked some sharp rejoinders. Lewontin readily acknowledges the great progress in molecular biology but retorts that unless molecular and whole animal biology come together in harmony the central problem of evolution—the relationship between microevolutionary change and the origin of species diversity (macroevolution)—will never be solved. While Gould declared whole animal biology to be much more difficult in many ways than molecular biology, British evolutionist John Maynard Smith pointed to the tremendous recent progress in theoretical and experimental research. "We now know a great deal about the evolution of behavior and the evolution of breeding systems, an area that was unexplored 20 years ago," he said. Edward O. Wilson, of Harvard, makes the point that if there is a disparity in achievements between these two major branches of biology then it is not as big as the disparity in funding. "Three billion dollars are spent on molecular biology each year, compared with just 30 million in evolutionary biology."

But this was an historical event, one which allowed only brief glimpses of an extensive range of subject areas. While not deprecating what was on display from the essentially two-dimensional world of the genome, it is surely unjust and naïve to imagine that here is represented an achievement greater or more promising than the huge amount of information and insight that has been gained from the essentially more complex, three-dimensional world of whole organisms and the communities in which they live. Many sharp exchanges could be heard around this proposition.

The separate worlds of whole organisms and the genome are linked by, to borrow a phrase of Darwin's, that mystery of mysteries, embryological development. "The differences between adult organisms merely reflect differences in the developmental processes that produce them," said Jacob. "To really understand how evolution proceeds, it is necessary to understand embryological development and its limitations."

The first Darwin centennial in 1909, celebrating the great man's birthday, was marked by a deep confusion in central ideas. The science of genetics had just been rediscovered and was somewhat boorishly holding center stage. Natural selection had yet to reemerge forcefully from its immediate post-Darwinian obscurity. And Neo-Lamarckism had a vigorous voice.

The second centennial in 1959, marking the publication of *The Origin*, came with the Modern Synthesis at its apogee. Agreement between evolutionary biologists was extensive, even smug.

The healthy turmoil of the third centennial is certainly a time of eager anticipation as well as reflection on the past. Gould cited William Bateson's 1909 statement, which remains true today: "We shall honor most in him not the rounded merit of finite accomplishment, but the creative power by which he inaugurated a line of discovery endless in variety and extension."—ROGER LEWIN