The world after Charles R. Darwin

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On the occasion of the bicentennial of Charles Darwin's birth, 12 February 2009, the Accademia Nazionale dei Lincei, the oldest scientific academy worldwide, offered the public a widely participated international conference which represented the national opening of Darwin Year and one of the most important events organized in Italy and Europe for the celebrations. The 2-day conference—promoted in collaboration with the Accademia delle Scienze of Turin, the Accademia di Scienze Lettere ed Arti of Modena, the Accademia Nazionale delle Scienze called “dei XL”, the Accademia Pontoniana, the Istituto Lombardo Accademia di Scienze e Lettere of Milan, the Istituto Veneto di Scienze Lettere ed Arti in Venice—coincided also with the official opening ceremony of the international exhibition “Darwin 1809–2009”, which reached the astonishing amount of 120,000 visitors in Rome in the following 2.5 months. Thanks to the contributions of some of the major experts in Darwin's work and current evolutionary biology, the meeting at the Accademia Nazionale dei Lincei explored Darwin's cultural heritage from three integrated points of view: historical, philosophical, and scientific.

The neo-Darwinian structure of evolutionary theory could be described today as a progressive and updated “scientific research programme”. In opposition to the confusing idea that we have now more “theories of evolution” or a new “theory” with post-Darwinian or no longer Darwinian features, what we actually see in the forefront of researches in evolutionary biology is quite different: An extended and strongly corroborated neo-Darwinian core—with its four main factors: multiple sources of variation and inheritance, selective processes, genetic drift, migration and macro-evolutionary effects—surrounded by a protective belt of auxiliary assumptions in progress, controversies and open problems.

As Stanford Emeritus Professor of Genetics, Luigi Luca Cavalli Sforza, clearly stated, this “evolutionary core” made by variation, selection, drift and migration is strongly supported by the most advanced discoveries concerning the functioning and regulation of genomes, with growing applications in the understanding of human evolution and human

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diversity as well. This coherent framework of biological evolutionary patterns could be now fruitfully compared also with the mechanisms of cultural evolution, identifying analogies, differences, reciprocal influences and relationships. As we have seen in the lecture of Padua Emeritus Professor of General Pathology and Lincei Fellow Giovanni Felice Azzone, we could figure out a kind of “double birth” or double evolution of human species: a biological one, strictly Darwinian, and a cultural one, where the evolution of mind, moral sense and free will seem to follow a more complex dynamics of chance, plasticity and self-organization as from genes and neural nets.

But the evolutionary research programme is still evolving, and this is the mark of its scientific health. A protective belt of auxiliary assumptions and hypotheses, observative theories, domains of relevance, controversial issues surrounds the core, debating, i.e., multiple patterns about modes and rhythms of speciation, levels of selection (between genes, individuals and groups), the effective agency of natural selection in the genomes with respect to neutral phenomena, the relationships between evolution and development (so, between selection and structural or developmental constraints), the diffusion of epigenetic inheritance, the phenotypic plasticity, the active role of organisms in the “niche construction”, the growing empirical relevance of processes of functional cooptation (or “exaptation”) in evolution. In this perspective, what is happening is not a radical “paradigm shift”, but a continuous transformation in the structure of the neo-Darwinian research programme: not a period of “revolutionary science”, but a process of empirical integration, theoretical incorporation, extension and revision defined as “Darwinian pluralism” in Stephen J. Gould’s latest work of 2002 (“The Structure of Evolutionary Theory”).

Two examples of such renovation and extension of the scientific Darwinian heritage have been given by the contribution of the University of Costa Rica biologist Mary-Jane West-Eberhard, about the social biology and evolution of social wasps and the role of developmental plasticity in evolution, and by the contribution of Padua professor of zoology Alessandro Minelli, concerning “Evo-Devo”, the evolutionary biology of development. Darwin’s “irregularly branched” tree of life and other forerunning intuitions such as functional cooptation and pre-adaptation are up to now, a century and a half later, basic tools for a right reconstruction of the human family tree (or “bush”) according to the latest paleoanthropological evidences, as suggested by the lecture of Ian Tattersall, curator of the Division of Anthropology at the American Museum of Natural History in New York. An updated interpretation of the theory of evolution, between gene-centred “kin selection” and cooperative “group selection”, seems also necessary in order to explain better the evolutionary puzzle of altruistic behaviours in nature, as discussed by the University of Catania biologist and historian of biology Emanuele Coco.

It is interesting that this pluralistic approach—functional, structural and historical—to the evolutionary explanation could be traced back in the work of the founder himself, Charles Darwin, and particularly in his “Transmutation Notebooks” (1836–1844). His ideas appeared for the first time, during his early career as geologist, together with promising insights concerning the deep geological time of the Earth and the instability of Earth surface, as reminded by Bruno D’Argenio, geologist at the University of Naples “Federico II” and Lincei Fellow. In fact, one of the main consequences of Darwinian revolution is the idea that Earth and life co-evolved for more than 3.5 billion years, changing the ecological rules of the biosphere and setting the stage for the emergence of more complex forms of life, as showed by Harvard Professor of Earth and Planetary Sciences Andrew H. Knoll.

Specifically, as pointed out by Niles Eldredge—curator in the Division of Palaeontology of the American Museum of Natural History in New York and one of the scientists

updating the theory of evolution through the model of speciation by “Punctuated Equilibria”—in these private Notebooks of Darwin geologist (22 years before “The Origin”), we can find two early Darwinian hypotheses (concerning the role of geographical and reproductive isolation for relatively rapid speciation and the evolution of extremely complex organs by functional cooption) that showed their empiric relevance more than a century later. The role of chance in evolution and the tinkering of natural selection are probably at the base of the cognitive difficulties we have in accepting the theory of evolution even 150 years later: Our teleological mind seems not truly adapted to the counter-intuitive Darwinian idea of the contingency of natural history.

So, Darwin’s scientific heritage becomes more generally philosophical, and cultural. Though not involved in public debates after 1859, Darwin understood that his ideas were going to challenge a whole set of beliefs deeply rooted in Western traditional thought. For the first time, the unnecessary turn to finalistic plans and intentional designs in order to explain the diversity and adaptations of living beings, together with the central role of contingency in natural history, was supported by a corroborated explicative frame based on the mechanisms of mutation and natural selection. It was a radical turning point, experimentally extended to many new biological fields in XX century. But not only biological, the tangled and controversial history of the influences of Darwinian ideas on social theorists and social issues (calling for biased terms such as “social Darwinism” and “eugenics”) has been clarified in this meeting by the University of Modena-Reggio Emilia historian of philosophy Antonello La Vergata.

So, two centuries after his birth, not only does Darwin’s heritage concern the content of his scientific research programme, usefully updated today, but also his innovative method of inquiry, and the emancipated “grandeur” of his “view of life”. As comparative anatomist at the University of Rome “La Sapienza” and Lincei Fellow Ernesto Capanna reminded, Italian naturalists and scientific academies were so strongly aware of the wide significance of Darwinian revolution that they profitably exchanged correspondence with Darwin himself, and they introduced evolutionary ideas very rapidly into the country, through “popular lectures” open to public audiences and through popular books, even about human evolution before “The Descent of Man”. In other words, they immediately understood that Darwin’s theory was a crucial passage in the history of modern science, in our perception of “Man’s place in nature”, and an ultimate piece in the conquest of a real consciousness about the “deep time” of the planet, the life in it, and the human species in the “tree of life”, as Emeritus Professor of History of Science at the University of Florence and Lincei Fellow Paolo Rossi depicted in his lecture.

With such an extremely positive reception of Darwin’s results, though not equally followed in XX century Italian culture, it is particularly relevant that the highest Italian cultural institution celebrated the bicentennial of the great English naturalist with this successful, interdisciplinary, and authoritative international conference. These proceedings will be an excellent message to promote, in a country which really needs it, the value and freedom of scientific research and culture in a rich and exciting Darwin Year.