DAVID CECCARELLI

HISTORICAL NARRATIVES IN SCIENTIFIC RESEARCH: THE CASE OF EVOLUTIONARY BIOLOGY

ABSTRACT: ***HISTORICAL NARRATIVES IN SCIENTIFIC RESEARCH: THE CASE OF EVOLUTIONARY BIOLOGY***

Evolutionary biology provides some hints to analyse the articulations and possible issues which arise from the integration between scientific practise and historical-philosophical reflection. Indeed, the study of organic change has been carried out by scientists poised to play on more than one table, becoming the major players in the dialogue among science, epistemology and history of science. In particular, during the XX century a number of biologists made the historical-epistemological reflection a work tool. This, however, poses a number of questions: which role do historical narratives play for the scientist? What drives his choices of authors and issues to tackle? Can we consider scientists' historical narratives as rhetorical devices to legitimise their own scientific agenda? By framing such issues in the field of evolutionary biology, the present article aims at reconsidering the use of historical narratives in science. The paper will consist of three sections. In the first part, I will retrace the main steps of the debate on the role of history of science in scientific practise and education. In the second paragraph, I will examine how the classical historical narratives provided by twentieth-century biologists have come under considerable criticism over time. A third and last section will examine the interplay between the latest evolutionists' narratives and the current approaches in the historiography of evolutionary biology.

1. *Introduction*

The modern-day call for interdisciplinarity is largely a response to the institutionalization of knowledge and disciplinary specialisation that have increased since the twentieth century. Undoubtedly, the 2020 health crisis has made it even more desirable to develop new strategies to achieve a cross-disciplinary dialogue on science and prevent the risks of overspecialisation. In particular, the call for a historical-philosophical informed approach in scientific practise, education and communication has been a pivotal subject of debate[1]. Yet it is necessary to think about how to balance the styles of different disciplines without running into exploitations, trivialities or "pitch invasions".

Scholars have increasingly focused their attention on the making of cross-disciplinary studies on science and constantly monitored the state-of-art of specific fields within national and international education systems[2]. Among the several conclusions drawn from such surveys, some are of major concern in the contemporary reflection on science. Interdisciplinary discourses involve semantic bargaining, critical analysis and numerous epistemological issues. Their price, as it has been pointed out, is «eternal vigilance»[3], thus scholars are compelled to monitor the interplay of languages, boundaries and necessities respecting the peculiarities of each field. Furthermore, to better understand the drawbacks as well as the potentialities of interdisciplinarity

[1] A. Briscuso, *Il Ministro Boccia ignora cosa sia la scienza. Parola di Karl Popper*, in «Strade», 15, 2020; S. Pollo, *Parlare del virus in democrazia*, in «La Rivista il Mulino», 25, 2020; Id., *Comunicare la scienza nella fase 2*, in «La Rivista il Mulino», 21, 2020; M. McKinnon *et al.*, *Effective Communication in a Pandemic Requires More than "the Science"*, in «International Network for Government Science Advice», International Science Council, 24, 2020.

[2] J.T. Klein, *Creating Interdisciplinarity Campus Cultures. A Model for Strenght and Sustainability*, Jossey-Bass, San Francisco 2010; R. Frodeman (a cura di), *The Oxford Handbook of Interdisciplinarity*, 2a edizione, Oxford University Press, Oxford 2017.

[3] T. Augsburg, S. Henry (a cura di), *The Politics of Interdisciplinary Studies: Essays on Transformations in American Undergraduate Programs*, MacFarland, Jefferson 2009, p. 246.

in science, it may be useful to study how it manifested in the contexts in which particular projects emerge and evolve[4].

In this regard, evolutionary biology provides some hints to analyse the articulations and problems that arise from the integration between scientific practise and the historical-philosophical reflection. Indeed, the study of organic change has been carried out by scientists poised to play on more than one table, which became the major actors in the dialogue among science, epistemology and history of science. Especially since the mid-twentieth century, many biologists have made the historical-epistemological reflection a structural element of scientific research. In this regard, the present article aims at reconsidering scientists' use of historical narratives. In the first section, I will retrace the main steps of the debate on the role of history of science in scientific practise and education. In the second paragraph, I will examine how the classical historical narratives provided by twentieth-century biologists have come under considerable criticism and revision in the last years. A third and last section will be devoted to examine the interplay between the latest evolutionists' narratives and the current approaches in the historiography of evolutionary biology.

This line of argument will allow us to show that a) historical narratives are still widely used in evolutionary biology; b) the scientific developments influence to a large extent the work of historians and epistemologists; c) the increasing international debate within the HPS (Integrated History and Philosophy of Science), together with the interdisciplinary dialogue among scholars, has increased awareness of the historical complexity of evolutionary biology.

[4] J. Vickers, *Diversity, Globalization, and "Growing Up Digital": Navigating Interdisciplinarity in the Twenty-First Century*, in «History of Intellectual Culture», 3, 1, 2003, pp. 1-19.

2. *History of science in scientific practise and education: an overview*

Who is the historian of science? When considering such question, we ought to bear in mind that the attention towards history was an essential feature of nineteenth-century scientific discourse. Early accounts of the progress within astronomy, physics, medicine and natural history were quite often written by scientists as a way to introduce their own contribution to the cause. Just as important is that, despite their almost hagiographic approach, early histories of sciences were frequently understood as a work tool to direct scientists' efforts effectively and improve their research agenda[5].

This view of history of science (HS) poses many questions as to the significance of scientists' historiographical narratives. In 1968, epistemologist George Canguilhem affirmed that scientists' use of history aimed at making up forerunners to legitimise hypothesis not yet recognised by the scientific community[6]. The issue of utilization goes along with that of valorisation. The historian, by the very fact of selecting its materials, inherently gives values, which makes historical narratives the result of a choice[7]. In this regard, the question arises as to what drives scientists' choices of authors and theoretical issues to tackle.

The fact that present scientific puzzles may affect scientists' historical analysis, and virtually lead to biased narratives, has been matter of debate in historiography since the 1960s. Concurrent with the professionalization of HS, historians have often charged scientists' historical reconstructions with "Whiggism" and "presentism", namely the general tendency to interpret and assess the past on the basis of the present

[5] W. Whewell, *History of Inductive Sciences*, I, John W. Parker, London 1837, pp. 41-42.
[6] G. Canguilhem, *L'objet de l'histoire des sciences*, in *Etudes d'histoire et de Philosophie des Sciences*, J. Vrin, Paris 1968, pp. 9-23.
[7] S. Bachelard, *Epistémologie et Historie des Sciences*, in «Revue de Synthèse», III, 49/52, 1968; A. Koyré, *Perspectives sur l'histoire des sciences*, in *Etudes d'histoire de la pensée scientifique*, Gallimard, Paris 1973, pp. 390-399.

knowledge[8]. Yet opinions on scientists' "distorted" history are anything but unanimous, especially as far as its significance in scientific practice and education is concerned. In his milestone book *The Structure of Scientific Revolutions* (1962), Thomas S. Kuhn regarded scientists' historical narratives as comparatively functional to the perpetuation of normal science. In this regard, he emphasised, non-functional HS might even prove to be detrimental for science students. In a science classroom, it is indeed a vantage to see science «developing linearly toward its present». Not only does HS hardly help solve scientific puzzles, but «more historical detail, whether of science's present or of its past, or more responsibility to the historical details that are presented, could only give artificial status to human idiosyncrasy, error, and confusion»[9]. Since scientists' HS is likely to be subservient to science, historian Martin J. Klein took a similar position in criticising the implementation of HS in science courses. According to him, history courses designed for scientists cannot but mirror scientists' pedagogical needs, and thus resulted in selecting, organizing, and presenting historical materials «on decidedly nonhistorical» and even «antihistorical grounds»[10].

Over the years, a considerable amount of research has been carried out to assess the impact of HS modules in science courses, which however has left numerous questions so far open[11]. According to historian Stephen G. Brush, the use of history may help students understand that a) scientific and philosophical issues are often intertwined and thus the «tendency to judge science primarily on

[8] C. Russell, *Whigs and Professionals*, in «Nature», 308, 1984, pp. 777-778.
[9] T.S. Kuhn, *The Structure of Scientific Revolutions* (1962), University of Chicago, Chicago 1970, pp. 137-138; see also T.S. Kuhn, *The History of Science*, in *International Encyclopedia of Social Sciences*, Growell, Collier &Macmillan, New York 1968.
[10] M.J. Klein, *Use and Abuse of Historical Teaching in Physics*, in *History in the Teaching of Physics*, a cura di S.G. Brush, A.L. King, University Press of New England, Hanover 1972, pp. 12-18.
[11] M.R. Matthews, *History, Philosophy, and Science Teaching: the Present Rapprochement*, in «Science & Education», 1, 1992, pp. 11-47.

the basis of its practical applications» might be simplistic; b) «science can acquire valid and useful knowledge» which is however «a product of human thought, subject to change in the light of new evidence and reasoning»; c) scientific contributions made by minorities undergone discrimination and negative social factors that have kept their numbers small[12]. In spite of this, the idea that coursework in HS necessarily enhances early scientists' knowledge of the "nature of science", though being an intuitively appealing assumption, still lacks of empirical demonstration[13].

In parallel, the debate between professional historians and scientists/historicists has somehow softened. Both historians and scientists have increasingly debunked the claim for "anti-Whiggism" and rather advocated the desirability of a sophisticated "presentist" and scientifically-informed HS[14].

Twentieth-century evolutionary biology proved to be an ideal arena for such confrontations. Since the time of Darwin, the evolutionists have seized the history of evolutionism[15]. At least in the second half of the nineteenth century, this was outcome of the process of professional self-definition by which scientists countered amateurs and science popularisers in the contention for scientific narrative. However, in the twentieth century some biologists made the historical-epistemological reflection a refined work tool. Far from being an end-of career whim, to such evolutionists as Ernst Mayr and Stephen Jay Gould the history of ideas and the epistemological reflection represented a structural

[12] S.G. Brush, *History of Science and Science Education*, in «Interchange», 20, 2, 1989, pp. 60-70.

[13] F. Abd-El-Khalick, N.G. Lederman, *The Influence of History of Science Courses on Students' Views of Nature of Science*, in «Journal of Research in Science Teaching», 37, 10, 2000, pp. 1057-1095; N.G. Lederman, J.S. Lederman, *Teaching and Learning Nature of Scientific Knowledge: Is It Déjà Vu All Over Again?*, in «Disciplinary and Interdisciplinary Science Education Research», 1, 6, 2019, doi: 10.1186/s43031-019-0002-0

[14] D.L. Hull, *In Defence of Presentism*, in «History and Theory», 18, 1979, pp. 1-15.

[15] See for instance H.F. Osborn, *From Greeks to Darwin: an Outline of the Development of the Evolution Idea*, Macmillan and Company, New York 1894.

element of research methodology. This, however, elicited a complex controversy among scholars as to evolutionists' use of HS.

3. *Evolutionary biologists and the use of history: the "modern historiography" and its criticisms*

In the introduction of *The Growth of Biological Thought* (1982), the famous evolutionary biologist Ernst Mayr (1904-2005) regarded history of science as a tool for concept analysis and clarification[16]. As the architect of the so-called "Modern Synthesis" whose main purpose was to integrate systematics, genetics and the Darwinian theory of evolution, Mayr highlighted that the modern evolutionary thought had emerged through emancipation from the physicalist approach of hard sciences, as well as from the refusal of typological and teleological thinking. To Mayr, not only were such conceptual transformations noteworthy from a historical point of view, but also had a concrete significance in the contemporary debate on the epistemological and methodological nature of life sciences[17].

Reviews of Mayr's *Growth of Biological Thought* were numerous and often praised his view of HS as a tool to clarify longstanding issues in biology. Ornithologist Donald S. Farner considered it «a landmark volume» that would hardly have been «superseded». Philosopher Michael Ruse praised the book and regarded it as «a magnificent overview of important themes and aspects in the history of biology». Contrary to those scientists who «made history their hobby» and turned out to write nonsensical histories of glorious progress, historian Jacques Roger and philosopher Michael T. Ghiselin claimed that Mayr had managed to make the

[16] E. Mayr, *The Growth of Biological Thought*, the Belknap Press of Harvard University, Cambridge 1982, p. 17.

[17] T. Junker, *Factors Shaping Ernst Mayr's Concepts in the History of Biology*, in «The Journal of the History of Biology», 29, 1, 1996, pp. 29-77; B. Continenza, *Ernst Mayr e la "Essentialism Story"*, in «Medicina & Storia», XII, 2012, pp. 7-58.

historico-philosophical reflection a necessary component of scientific inquiry[18].

However, there was no shortage of criticism of *The Growth of Biological Thought*. In a pivotal paper published on the *Journal of the History of Ideas* in 1990, Mayr responded to several charges of "Whiggism"[19]. Here, he reiterated that scientists could use HS as a mean of conceptual elucidation. By relying on philosophers Michael Ruse and David Hull's similar views[20], Mayr maintained that it was «by no means wrong to look at the past on the basis of an understanding of the present»[21], and further proposed the idea of «developmental historiography», which aimed at reconstructing the phylogeny of scientific concepts by accurate selection, comparison and assessment.

A similar attitude characterised the work of the well-known American palaeontologist Stephen Jay Gould (1941-2002). Along the lines of David Hull's evolutionary epistemology, Gould saw HS as the processing of conceptual genealogies. According to this view, scientific ideas are historically situated objects that belong to specific phyletic lines and must be examined by analysing the degree of similitude of their essential propositions. As in evolutionary biology, the historical inquiry must recognise the difference between homologous genealogies, which result from the transfer of information from master to disciple, and conceptual analogies, i.e. the occurrence of similar scientific ideas in non-

[18] D.S. Farner, *Reviewed Work: The Growth of Biological Thought. Diversity, Evolution, and Inheritance by Ernst Mayr*, in «The Auk», 100, 2, 1983, pp. 507-509; M. Ruse, *Book Review: Ernst Mayr. The Growth of Biological Thought. Diversity, Evolution, and Inheritance*, in «Journal of The History of the Behavioural Sciences», 20, 3, 1984, pp. 220-224; J. Roger, M.T. Ghiselin, *More Maiorum (A Review Symposium). The Growth of Biological Thought. Diversity, Evolution, and Inheritance. Ernst Mayr*, in «Isis», 74, 3, 1983, pp. 405-413.

[19] E. Mayr, *When is Historiography Whiggish?*, in «Journal of the History of Ideas», 51, 2, 1990, pp. 301-309.

[20] M. Ruse, *Booknotes*, in «Biology & Philosophy», 2, 1987, pp. 377-381; D.L. Hull, *In Defence of Presentism*, cit.

[21] Mayr, *When is Historiography Whiggish?*, cit., p. 309.

related authors. Understood in this way, science and history converge on a homogenous totality[22].

No doubt Gould's scientific interests fostered and oriented his attention towards history. As a palaeontologist and morphologist, throughout his production Gould attempted to reassess theoretical issues that, in his view, had long been marginalized by the architects of the Modern Synthesis, i.e. the importance of developmental constraints in orienting evolution, the limits of pan-adaptationist interpretations of organic change, and non-gradual explanations of phyletic progress. Not surprisingly, Gould's main historical surveys dealt with biological theories that had traditionally been considered unorthodox and non-Darwinian: i.e. neo-Lamarckism, orthogenesis, saltationism. This was meant to elicit a form of self-criticism in scientific practise, as well as to provide useful tools to contemporary research by critically reviewing long forgotten insights[23].

As for Mayr, historians' responses to Gould's forays into the history of biology were manifold. When *Ontogeny and Phylogeny* (1977) was published, reviews of the first half of the book, which explored the rise and fall of the recapitulation theory, showed both enthusiasm and complaint. Historian Frederick B. Churchill praised the historical section of the book for having elucidated some important differences in Von Baer's and Haeckel's views of development, which helped readers understand the making of the modern conception of the ontogeny process. Gould was «extraordinary successful at binding science and history» adding considerably to the history of biology, although the selection of authors and topics mirrored «his own immediate purposes»[24]. Gould's scientifically informed historical survey, historian

[22] S.J. Gould, *Ontogeny and Phylogeny*, Belknap Press of Harvard University Press, Cambridge, 1977.
[23] D. Ceccarelli, *Per un'analisi di Gould: storico e teorico della struttura in biologia*, in S. Caianiello (a cura di), *Da Gould a evo-devo. Percorsi storici e teorici*, CNR Edizioni, Roma 2014, pp. 39-55.
[24] F.B. Churchill, *Reviewed Work: Ontogeny and Phylogeny by Stephen Jay Gould*, in «Journal of Paleontology», 52, 6, 1978, pp. 1395-1399, p. 1399.

Phillip R. Sloan maintained, allowed to understand the epistemological complexity of nineteenth-century descriptive embryology, where, in accordance with the Duhem-Quine thesis, «no crucial observation could be made to decide between competing theories». Despite being well documented and comparatively useful, Gould's HS was unquestionably on the «whiggish side» and even downsized issues of deeper historiographical interest[25].

These charges of presentism pose a number of epistemological and methodological issues that deserves further historical reflection. Understood as the general tendency to subordinate the past to the present and deem the latter as a fairly inevitable outcome[26], whiggish histories may take many forms. Both Mayr's and Gould's selection of authors and subjects was functional and informed to present scientific concerns, which does not mean that their accounts of the history of evolutionism came down to merely teleological narratives. When used deliberately, conceptual anachronisms (i.e. falling back on new terminologies and concepts) may be auxiliary means to make the past accessible. As tools «on the edge of methodological correctness»[27], anachronisms demand attention and careful utilisation, yet, just like metaphors, represent devices that enable the interdisciplinary reflection on science. In a similar way, little «historical sins», such as focusing on those past ideas that proved to be scientifically fruitful over time, may enrich contemporary scientific debates[28]. On the other hand, removing whatsoever interest in contemporary research and using solely repertoire concepts which corresponds to

[25] P.R. Sloan, *Reviewed Work: Ontogeny and Phylogeny by Stephen Jay Gould*, in «The British Journal for the History of Science, 13, 1, 1980, pp. 50-55, p. 53.
[26] H. Butterfield, *The Whig Interpretation of History*, G. Bell and Sons, London 1931, p. 16.
[27] D. Špelda, *Anachronisms in the History of Science: An Attempt at a Typology*, in «Almagest», 3, 2, pp. 91-119, p. 113.
[28] S.J. Gould, *The Structure of Evolutionary Theory*, Harvard University Press, Cambridge 2002, p. 343.

the historical sources would make HS descriptive and barely intelligible[29].

In addition to this, when inflated, charges of whiggism are pernicious in so far as they convey the idea that historians can only write reliable and unbiased histories of science, which somehow contradicts the very assumptions that such historical epistemologists as Suzanne Bachelard and Alexander Koyré had long put forward, namely that historical narratives always result from a choice and, therefore, valorisation[30]. As historian Junker maintained: «the notion that a scientific study can be conducted by a completely detached observer from a neutral standpoint has been shown to be impossible in physics, and is also an illusion in historiography. The question is not whether, but which kind of interests are the underlying motivation for a historian»[31].

Perhaps, the analysis of evolutionists' use of history should leave aside the issue of presentism, and rather focus on other aspects that the most recent historiography has contributed to examine. By relying on Maurice Mandelbaum's taxonomy of historiographical approaches, historian Maurizio Esposito has recently posited that one major aspect of modern historiographies of evolutionary biology that post-modern historians phased out is the explanatory approach to historical reconstruction. Not only did Mayr's and Gould's narratives seek to trace a strand of events and research traditions, but also examined them *in order to* understand why and how some present options succeeded, tracing back the causes that brought about the current research agendas. In contrast, Esposito highlights, post-modern historians, most of which are frequently not biologist, rather try to understand how

[29] D. Špelda, *op. cit.*, p. 112.
[30] S. Bachelard, *op. cit.*; A. Koyré, *op. cit.*
[31] T. Junker, *op. cit.*, p. 68.

research traditions coexisted, mingled and declined, addressing the development of evolutionary thinking in all its complexity[32]. Modern historiographies turned out to hypostatize historical phases and research agendas (i.e. Darwinism, Eclipse of Darwinism, the Evolutionary Synthesis) by imposing temporal horizontal cuts and labels on what should be rather considered as «vertical intellectual movements and ideas evolving in parallel and interacting in complex ways»[33]. Historiographical labels are unquestionably powerful and useful from the scientist's perspective: they identify what is in and out of research programs and can be further used to make up historical traditions, schools of thought or, with the utmost efficiency, confine inconvenient ideas. Twentieth-century debates in evolutionary biology frequently saw scientists struggling for the right label and/or rejecting the problematic ones. When at the turn of the twentieth century the new studies on the mechanical basis of heredity drew a clear distinction between inheritance and development, i.e. the transmission of characters (genetics) and their expression (embryology), almost any study of environmental influences on development was pigeonholed as "Lamarckian". The parabola of the Austrian biologist Paul Kammerer is a case in point in this regard. The experimental work on midwife toads he carried out between 1905 and 1910 aimed to show that environmental effects could cause hereditable genetic changes. As is well-known, Kammerer committed suicide in 1926, following allegations of having counterfeited his experimental results, an event that many

[32] M. Esposito, *Cathedrals, Corals and Mycelia: Three Metaphors for the History of Evolutionary Biology*, in R.G. Delisle (a cura di), *Natural Selection: Revisiting its Explanatory Role in Evolutionary Biology*, Springer, Cham 2021, forthcoming.

[33] R.G. Delisle, *Introduction: Darwinism or a Kaleidoscope of Research Programs and Ideas?*, in *The Darwinian Tradition in Context. Research Programs in Evolutionary Biology*, Springer, Cham 2017, pp. 1-8, p. 4; see also J. Cain, *Rethinking the Synthesis Period in Evolutionary Studies*, in «Journal of the History of Biology», 42, 2009, pp. 621-648; G.S. Levit, U. Hossfeld, *Darwin without Borders? Looking at "Generalised Darwinism" through the Prism of the "Hourglass Model"*, in «Theoretical Biosciences», 130, 2011, pp. 299-312.

scholars considered as the evidence of how "Lamarckism" became a stigma for twentieth-century evolutionary biologists[34]. It was also for this reason that the British embryologist Conrad Hal Waddington, who, in 1942, had introduced the term "epigenetics" to designate the study of the interactions between the genes and their products that bring about the phenotype, struggled to be considered as a "Darwinian" and tried to reconcile genetics, development, and evolution in a renewed research program he later called "post-neo-Darwinism"[35]. To some extent, scientists' use of historiographical labels is a matter of sociology of science[36].

4. *Narratives in expansion*

The reconsideration of the modern historiographies of evolutionism materialised in parallel with the shifts towards a pluralist paradigm in evolutionary biology and the consequent rise of new historical narratives. While expanding the theoretical borders of the Modern Synthesis, many evolutionary biologists have contributed to revise the old historical reconstructions and proposed new – and sometimes controversial – ones. Perhaps, no such field as epigenetics has affected the history of evolutionism. Indeed, the findings in contemporary epigenetics rehashed the label "Lamarckism" and further fostered the quite catchy leitmotiv of Lamarck taking revenge on Darwin.

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[34] A. Koestler, *The Case of the Midwife Toad*, Hutchinson, London 1971; R.W. Burkhardt, *Lamarckism in Britain and the United States*, in *The Evolutionary Synthesis: Perspectives on the Unification of Biology* (1980), a cura di E. Mayr, W.B. Provine, Harvard University Press, Cambridge 1998, pp. 343-352; S. Gliboff, *The Case of Paul Kammerer: Evolution and Experimentation in the Early Twentieth Century*, in «Journal of the History of Biology», 39, 3, 2006, pp. 525-563; S. Gliboff, *The Golden Age of Lamarckism, 1866-1926*, in *Tranformations of Lamarckism. From Subtle Fluids to Molecular Biology*, a cura di S.B. Gissis, E. Jablonka, the MIT Press, Cambridge 2011, pp. 45-55; B. Continenza, *Waddington tra "neo-darwinismo" e "post-neo-darwinismo"*, in *Atti del del Convegno dei Lincei su Genetica, epigenetica ed evoluzione (XXXI Seminario sull'evoluzione biologica e i grandi problemi della biologia, Roma 26/28 febbraio 2004)*, Accademia Nazionale dei Lincei, 2005, pp. 143-173.

[35] B. Continenza, *Waddington tra "neo-darwinismo" e "post-neo-darwinismo"*, cit.

[36] R.G. Delisle, *What was Really Synthesized during the Evolutionary Synthesis? A Historiographic Proposal*, in «Studies in History and Philosophy of Biological and Biomedical Sciences», 42, 2011, pp. 50-59.

The recent scientific literature shows plenty of examples of what, using historian Daniel Špelda's typology of anachronism, can be regarded as «conceptual anachronism»[37], i.e. associating transgenerational epigenetic inheritance with the classic doctrine of the inheritance of acquired characters. Whilst acknowledging the difference between Lamarck's original transformation theory and the modern concept of epigenetic inheritance, many biologists have proposed terms such as "quasi-Lamarckism" to designate organisms' epigenetic responses to environmental stress[38]. In addition to this, scientists have got into the substance of historical inquiry focusing on how "Lamarckian" ideas underwent rejection during the consolidation of the Modern Synthesis and exploring the works of "unorthodox" evolutionists[39]. Within this framework, Darwin himself is back to being revised in so far as his «long forgotten» plural view of the laws of evolution has ultimately been rehabilitated by contemporary research[40]. According to Eva Jablonka and Marion Lamb, the very concept of "Darwinian evolution" changed over time encompassing different views of the origin of variation. Although the gene-centred view of evolution became dominant through the evolutionary synthesis, this «does not mean» that «it is the final, correct, and complete interpretation of Darwin's theory». To the present day, they highlighted, Darwinism is due «for another transformation»[41].

[37] D. Špelda, *op. cit.*
[38] E.V. Koonin, Y.I. Wolf, *Is Evolution Darwinian or/and Lamarckian?*, in «Biology Direct», 4, 42, 2009, doi: 10.1186/1745-6150-4-42; see also S.B. Gissis, E. Jablonka (a cura di), *Transformations of Lamarckism, from Subtle Fluids to Molecular Biology*, the MIT Press, Cambridge 2011; Y. Wang, H. Liu, Z. Sun, *Lamarck Rises from his Grave: Parental Environment-Induced Epigenetic Inheritance in Model Organisms and Humans*. «Biology Review», 2017, 92, 4, doi: 10.1111/brv.12322.
[39] S.B. Gissis, E. Jablonka, *Introduction: The Exclusion of Soft ("Lamarckian") Inheritance from the Modern Synthesis*, in *Transformations of Lamarckism, from Subtle Fluids to Molecular Biology*, a cura di S.B. Gissis, E. Jablonka, the MIT Press, Cambridge, 2011, pp. 103-107.
[40] M. Buiatti, *Is Darwin Back? Towards and Expansion of Darwinian Thought*, in *Life and Time: the Evolution of Life and its History*, a cura di S. Casellato, P. Burughel, A. Minelli, Cleup, Padova 2009, pp. 219-238.
[41] E. Jablonka, M. Lamb, *Evolution in Four Dimensions* (2005), the MIT Press, Cambridge 2014, p. 40.

All this has triggered a profound reflection within the history and philosophy of biology, with scholars highlighting the misuses of the label "Lamarckism" when applied to contemporary epigenetic studies and, just as importantly, trying to overcome the assumed lasting opposition between "Darwinian" and "non-Darwinian" theories of evolution [42]. In spite of such criticisms, a common trajectory of inquiry can be detected. Indeed, both scientists' retrospective interest in the history of unorthodox evolutionary theories and historians' call for overcoming old-fashioned dichotomies have contributed to increase awareness of the historical complexity of evolutionary biology. This has started to materialise as early as the late 1970s, when such scholars as, for instance, palaeontologist Stephen Jay Gould and historian of science Peter Bowler, though going their separate ways, expanded the historiography of evolutionism shedding light on "non-Darwinian" ideas and their remarkable role in the shaping of evolutionary thought.

Never as today has the professional connection among scientists, historians and philosophers of biology been manifest. Progresses in scientific research largely influence the work of historians and epistemologists. New research findings, as well as scientists' own historical narratives, provide inspiration and subjects of inquiry for historians and philosophers, which, in turn, contribute to further analysing and challenging the epistemological structure and the narratives of contemporary research agendas. The international debate within the HPS and the increasing number of scientific projects in which scientists,

[42] D. Penny, *Epigenetics, Darwin, and Lamarck*, in «Genome Biology and Evolution», 7, 6, 2005, pp. 1758-1760; U. Deichmann, *Epigenetics: The Origins and Evolution of a Fashionable Topic*, in «Developmental Biology», 1, 416, 2016, pp. 249-254; U. Deichmann, *Why Epigenetics is not a Vindication of Lamarckism - and Why that Matters*, in «Studies in History and Philosophy of Biological and Biomedical Sciences», 57, 2016, pp. 80-82; L. Loison, *Lamarckism and Epigenetic Inheritance: A Clarification*, in «Biology & Philosophy», 33, 20, 2018, doi: 10.1007/s10539-018-9642-2.

historians and philosophers of biology interact each other has no doubt contributed to this scenario.

The marks of such a transition towards a more effective cooperation among scientists, historians of science and epistemologists was already recognised by David Hull between 1969 and 2002. In his pivotal paper *What Philosophy of Biology is not* (1969), Hull argued that, at that time, philosophers used to address topics in the evolutionary biology with no proper understanding of scientific concepts and further undermined any productive interaction[43]. After about thirty years, Hull noticed a considerable change in this regard. Both biologists and epistemologists had contributed to better understand scientific topics such as "function", "species", "systematics", "fitness", "selection", "reduction" and "development". In spite of this, there were other dangers to be avoided:

> Philosophers are attempting to join with biologists to improve our understanding of these biological phenomena. As such, they run the risk of being considered by biologists to be "intruders". In point of fact, biologists have been amazingly receptive to philosophers who have turned their hand to philosophy of biology with significant emphasis on "biology" [...]. But sometimes the tables are turned. Biologists take up traditional philosophical topics and attempt to treat them even if they are not professional philosophers[44].

How have things changed since 2002? In the conclusion of his article, Hull hoped for an «alternative» theory of evolution able to integrate the study of ontogenetic development with the rest of the evolutionary synthesis. To a large extent, this is what happened thanks to the studies in evolutionary developmental biology (Evo-Devo), the research on epigenetics and, finally, the establishment of the so-called "Extended Evolutionary Synthesis"[45].

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[43] D.L. Hull, *What Philosophy of Biology is not*, in «Synthese», 20, 2, 1969, pp. 157-184.

[44] D.L. Hull, *Recent Philosophy of Biology: a Review*, in «Acta Biotheoretica», 50, 2002, p. 123.

[45] M. Pigliucci, G.B. Müller (a cura di), *Evolution – The Extended Synthesis*, the MIT Press, Cambridge-London 2010. See also E. Serrelli, *La Multidisciplinarietà dell'evoluzione: filosofia, biologia e sintesi*, in «Reti, Saperi e Linguaggi», 4, 1, 2012, pp. 47-53.

Within this expanding theoretical framework, scientists, philosophers and historians, though not necessarily sharing the same objectives, are involved in a mutually shaping network of knowledge. Scientists' historical narratives are still widespread in evolutionary biology and largely contribute to this process. Considering them "intrusions", apart from substantiating a hardened view of disciplinary boundaries and perpetuating the never faded schema of "the two cultures"[46], appears inappropriate in light of the contributions scientists have made to the history of science. Undoubtedly, it is a hardly smooth dialogue among scholars who constantly struggle to develop a shared vocabulary and, most importantly, emphasize different aspects according to their epistemologies, methodologies and professional objectives. The broader is the dialogue, the more a scrutiny of languages and conceptual bargains is essential to make it effective.

DAVID CECCARELLI svolge attività di ricerca in Storia della scienza presso l'Università di Roma "Tor Vergata"

dave.ceccarelli@gmail.com

[46] C.P. Snow, *The Two Cultures and the Scientific Revolution*, Cambridge University Press, Cambridge 1959.