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BOOK REVIEW

A new grammar of science

Kevin McCain: Understanding how science explains the world. Cambridge: Cambridge University Press, 2022, 140 pp, £11.99 PB

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In 1892, Karl Pearson (1857–1936), a leading founder of the modern field of statistics and very influential interpreter of the philosophy of science, published his famous book *The Grammar of Science*. The dominant attitude expressed in this book was a personal fascination with an idea of science in possession of infallible methods of inquiry. This amazing reliability of scientific methods, according to Pearson, stems from the fact that "all science is description and not explanation" (Pearson 1911, viii). Science is not an explanation of anything, since it does not seek after a plan which lies in phenomena themselves (Pearson 1911, 232). On the contrary, it is a conceptual description and classification of our perceptions. It makes our thought economical, enabling us to find out what we want, but gives no account for the particular content of the phenomena. Analysis of a variety of sciences from the very limited perspective of psychological associationism enabled Pearson to claim that:

(1) The Ptolemaic system was just an insufficient attempt to describe certain phenomena (Pearson 1911, 98).
(2) The use of terms like "mechanism" or "cause" is an example of "muddy speculation" (Pearson 1911, 117).
(3) The classifications of life and lifeless are merely class names for sense impressions (Pearson 1911, 392).
(4) The Darwinian theory of evolution is truly scientific since it does not attempt to explain anything (Pearson 1911, 416).

It is a very interesting take off point to have the above-mentioned claims in mind when one starts to read Kevin McCains' book. The author points out already in the preface that the crucial point which he is arguing for is that "explanation is a key aim of science" (McCain, xvii). Not only this, but also that scientific explanations lead us to understanding the world around us. If this is so, we have a

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contradiction to what Pearson suggested. In fact, the picture of science provided by McCain is very different from Pearson's. This becomes clear when we compare Pearson's claims and McCain's point of view on the aforementioned issues. McCain points out that:

(1) The Copernican model was a scientific advance, "because it yielded a deeper understanding" of the universe than the Ptolemaic one (83).
(2) The use of terms like "cause" within scientific explanations means that there is a reference to one thing being dependent on another. One of the most common sorts of dependence relation studied by sciences is the causal one (23).
(3) If one looks for a scientific explanation of a life phenomenon X, the goal is met when one has "the information about how or why X depends upon some other things, such as Y" (5). This "dependence," according to the author, allows for various sorts of relations. Apart from causal ones, there can also be constitutive, mereological ones, etc.
(4) The theory of evolution is the classic example of the explanation of certain phenomena such as variation among the finches of the Galapagos Islands or the homologous structures in anatomy. The new knowledge is the recognition of the result of adaption by natural selection in the first case and the common descent in the second (6–7, 90–91).

Each of the above four points deserves careful study in order to determine what is meant by causal relations (e.g., Salmon 1998) or how the theory of evolution (e.g., Mayr 1970) has explanatory import and to what extent. In this context, McCain's book does not offer very detailed answers to such questions. However, its aim is different. The author points out that it is broader in scope as it focuses on features that one finds in all scientific domains (xviii). As a basic introductory book to the problems of contemporary philosophy of science, it does its job. What are its particular advantages?

First, McCain not only argues in a skillful way that an "explanation is a set of statements that account for why or how something occurred" (15) but also tries to answer the question "why" we ask such questions. This would definitely be considered "muddy speculation" for Pearson. McCain, in contrast to Person's associationist view, and referring to contemporary studies in psychology, shows that explanation has a central role in our cognitive lives from childhood. It is ubiquitous and fundamental to our sense of understanding. Stepping from the field of psychology, McCain rightly emphasizes that today the majority of philosophers of science (and scientists?) hold that science seeks to explain the world (de Regt 2017; Salmon and Kitcher 1989; Schaffner 1993; Potochnik 2017; Psillos 2002). Moreover, he points out that what makes explanation so important to science is that scientific explanation gives us an understanding of phenomena, that is, "it involves really grasping how the world is" (6). It should be strongly emphasized that the understanding that McCain is arguing for is not the mere "aha" feeling of having an insight into the workings of the world. Understanding, in the scientific sense, involves the knowledge of the basic "dependencies" according to which the

world operates. Hence, the realm of science is confined not only to the description, systematization, and prediction of phenomena, but fundamentally has to do with explanation and understanding.

Secondly, the author delves into detail about different kinds of explanations specific to the life sciences. To explain "why" by explaining "how" has a long-lasting tradition in European philosophy, going back at least to Aristotle, who conceived of explanations as answers to "why" questions. McCain, in contrast to Aristotle, not only focuses on causal why–explanations but also depicts various types of explanations (e.g., actual–sequence, robust–process, experimental, and historical) as they are employed in contemporary science, especially in biology (29–42). The choice of life sciences is partially due to the fact that, according to McCain, "what we have seen about how science works … can help us navigate difficult situations such as the COVID-19 pandemic" (102). In other words, the time of the pandemic has shaped or even changed the personal and collective imagination about science, for better or worse. During this time, it was not only possible to observe how and why science seeks to explain the world, but also, unfortunately, how misunderstandings about this process have led to poor decisions (103). Discussions among experts have often been vehement. As a consequence, the sense of frustration or even hostility toward science has spread among people. However, at the same time, a diversity of views or explanations is inherent in the dynamics of science. As McCain tries to point out, well before the COVID-19 pandemic, science had already shown itself to be a realm of competing explanations. Scientific theories are not "epistemically certain" (40–41), in the sense of being the "right one" to explain the reality. Scientific explanation is not impartial or extraneous to the world that it models. Science deals with the complex world and is comprehensible only within the architecture of limited human knowledge.

What is the main moral of this book? I would say that McCain's focus on explanatory commitments of life sciences shows that the variety of scientific disciplines, explanatory frameworks and their proper evaluation, are vital to the advancement of scientific understanding. We have moved beyond applying Pearson's criterion to evaluate the scientific character of life sciences, i.e., whether "the conceptual shorthand of the physicist, his ideal world of ether, atom, and molecule, will, or will not also suffice to describe the biologist's perceptions of life" (Pearson, 392). The contemporary plurality of explanations, however, should neither misrepresent nor undermine the credibility of science. The plurality does not imply that science does not provide guarantees. On the contrary, formal and quantitative methods have been exported outside of strictly mathematical and physical disciplines and have proven to be necessary, but at the same time not sufficient, in branches of the Life Sciences, Humanities, and Social Sciences.

If the key aim of science is explanation and giving understanding, we are rather viewing science as a whole, as a coordinated mosaic. Hence, from the title *Understanding How Science Explains the World* emerges the general account of science, or sciences, as neither isolated nor put into the sort of hierarchical order where some sciences are more important (whatever that would mean) than others, but rather entails a complex knowledge system of interacting scientific disciplines. The failure or insufficiency of very general theories in dealing with complex phenomena

has brought about the change within scientific explanation resulting in a plurality of explanatory elements and the need for local responses in order to explain and understand global problems. In such a context, I consider *Understanding How Science Explains the World* to be a highly interesting book on understanding explanation, which does not undermine the scientific character of explanations as such, but sheds light on their multifaceted way of giving us understanding of still unexplained phenomena.

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