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Physics for neuroscience: the story of Huxley and Hodgkin before any interpretation

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In 1952 A.L. Hodgkin and A.F. Huxley published what has become known as the model of the action potential. It was subsequently considered as the cornerstone of electrophysiology and neuroscience, since concerning the ionic mechanisms involved in the nerve cell membrane. The history of the HH model on the one hand is an example of use of scientific experiment and laws of physics within life sciences, i.e., proposed the total current equation is derived from laws of electricity (Coulomb's and Ohm's laws) under specifiable conditions. On the other hand, the HH history has become the key point of reference for the contemporary philosophical debate on adequacy of scientific models, especially within the new mechanical philosophy. In his pivotal paper on explanatory models, C. Craver has interpreted HH model as the instrumentalist one which only "saves phenomena"via the application of mathematical formulas. The aim of this paper is twofold. First of all, we reconstruct the story of HH model counterarguing the claim that HH model does not explain. Secondly, our analysis will point out that the problem with Craver's reading of HH model stems from the unwarranted assumption that explanations and descriptions should always proceed hand in hand. We conclude that although HH model resulted to be incomplete in various respects, it does not follow that it was just inaccurate and non-explanatory. The requirements of unqualified understanding and completeness posed by Craver on HH model are never to be found in actual scientific practice. At best, they are ideal ones.

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