

### **Evolutionary approaches to understanding diseases**

Solving complex problems that consist of many interrelated questions usually requires expertise from different research fields or even different scientific disciplines, hence explanatory aims that are shared by two or more disciplines can motivate interdisciplinary research. Explaining and controlling human diseases can be seen as an example for a complex explanatory problem. While medical researchers and practitioners usually seek to explain medical conditions by studying mechanisms that cause diseases, recently the explanatory repertoire has been extended to include evolutionary hypotheses. Although evolutionary medicine is situated at the intersection of medicine and evolutionary biology, it still lacks the coherence and structure found in established interdisciplinary fields, but it can be characterized as a conceptual framework that provides novel approaches to studying and understanding diseases.

Some evolutionary approaches to understanding diseases employ a retrospective view of evolution which focusses on the adaptation (or maladaptation) of humans to modern environments. This backward-looking adaptationist perspective is also known as 'Darwinian medicine'. Other approaches are concerned with contemporary or "real-time" evolution and adopt a forward-looking perspective. These two perspectives are sometimes presented as different research traditions that apply different styles of evolutionary explanation. This view results from an epistemological approach that is focused on analyzing and comparing individual explanations. However, the two evolutionary approaches are unified through their common explanatory aim, namely understanding, preventing, and controlling human diseases. Thus, I suggest to shift the unit of epistemological analysis from individual explanations to the explanatory discourse that shapes the research community in question.

In my paper I examine the role of forward-looking and backward-looking approaches in evolutionary medicine by means of a case study. I will emphasize the processual character of scientific explaining by looking at the explanatory discourse revolving around the role of the microbiome in the pathogenesis and treatment of multiple sclerosis. My practice-oriented approach shows that forward-looking and backward-looking approaches complement and mutually inform each other. Thus, I argue, that it is misleading to interpret them as separate research traditions. Instead, I propose that forward-looking and backward-looking explanations should rather be understood as two different types of explanation in one explanatory discourse. My analysis of the case study suggests that the two types of explanation play different roles in the explanatory discourse. Darwinian medicine provides historical explanations that usually take the form of how-possibly adaptation explanations that have heuristic value, because they are useful tools for generating new hypotheses. These hypotheses can inform forward-looking research endeavors which, in turn, can lead to the revision or rejection of the adaptation hypotheses. Forward-looking approaches, e.g. experimental approaches to studying host-parasite coevolution, seek to understand mechanisms such as immunoregulation from an evolutionary perspective and generate evolutionary hypotheses of the mechanisms studied in medicine.

Despite its (heuristic) value, Darwinian medicine is often criticized by medical practitioners and researchers, because they view historical explanations as speculative or even unscientific. Forward-looking explanations, in turn, are accepted more easily, because they meet the standards of explanatory adequacy in medicine where researchers and practitioners are interested in mechanisms and often use causal-mechanistic explanations. I believe, that the different standards of explanatory adequacy in evolutionary biology and medicine are one reason why evolutionary medicine has not yet developed into a coherent interdisciplinary field.