

How Organisms Represent

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Both philosophers and historians have long been interested in what drives scientific change, the development of fields and communities over time, and what it means to talk about ‘progress’ in research. Analysis of these issues leads to more specific questions relating to the practices of science, such as what makes a project, idea, method, or tool successful; why researchers choose certain types of models, technologies, and materials for their work; and how these choices and practices affect their outputs and the uptake of their contributions by the broader scientific community.

Limited integrated research has been devoted to the nature of epistemic communities themselves, and how the ways in which the material and social environments in which scientists work affect both the development of their research programs and the extent to which they acquire visibility and traction amongst their peers. This relative lack of attention is partly due to the strong emphasis in more traditional philosophy of science on theories and concepts as key units of analysis which are used to organize and understand the history of entire fields. Among historians, it may be due to past tendencies to focus on microhistories, as well as limited, broader-scale syntheses of detailed accounts of the various elements that contribute to scientific change and progress. It is also due to the sociological nature of these concerns, which require us to engage deeply with the social, institutional, and economic aspects of research, factors that oftentimes have been seen to be extraneous even to integrated historical and philosophical perspectives on science.

We contend that such factors are essential to the epistemology of science and how we identify and study historical trends, developments, and case studies in scientific practice. We therefore advocate a view of research developments as driven by the success or failure of repertoires, which are defined as specific assemblages of skills, behaviors, and material, social, and epistemic components that are repeatedly and effectively used by given scientific communities as ways to practice and manage research, attract funding, and train newcomers. The repertoires framework provides an approach for explorations of the dynamics of scientific change and how to account for research ‘progress’ which are both historically informed and philosophically robust.

In this paper, we explore how and why organisms come to be viewed as plausible representations in contemporary biological practice, using detailed case studies of arguably non-obvious uses of animal models. Examining modelling activities, rather than their products, is a particularly useful approach when trying to understand how experimental organisms help to create knowledge that can be projected beyond the immediate domain in which it was produced, and particularly what makes such projections more (or less) plausible. This question is especially significant given that organisms often are taken as models for phenomena that are arguably not directly observable in the organisms themselves (e.g., the use of mice to explore alcoholism in humans) or for organisms that are very dissimilar to them (e.g., the use of yeast as models for cancer in humans).

We argue that the plausibility of organisms as models relates to the ways in which they fit (or fail to fit) a given research repertoire, which in turn defines the expectations and constraints of the research community in question. We thus provide a framework to understand the epistemic grounds on which researchers endow models with representational power, the extent to which such endowment is viewed as fruitful and plausible—or problematic and unrealistic—by others, and the implications of such

assessments for what are perceived to be 'successful' research practices.

This analysis also illustrates one way in which adopting the repertoires framework can help to address long-standing questions within the philosophy of science while at the same providing historically-sensitive analysis of the factors that contribute to sustainable research practices. In particular, these examples from the life sciences help us to show how this framework can be used to address the crucial issues of how different ways not just of knowing but also of doing come to be aligned and integrated in certain scientific communities, how such specific assemblages of practices are stabilized over time, and how they are reproduced across different fields.