Mechanisms, models and explanatory force

Tarik Issad*[1] and Christophe Malaterre*†[2]

[1]Institut National de Santé et de Recherche Médicale (INSERM) – Inserm – U1016, Institut Cochin, 22 rue Méchain, 75014 Paris, France

[2]Université du Québec à Montréal (UQAM) – Département de philosophie, Case postale 8888, succursale Centre-ville, Montréal, Québec, H3C 3P8, Canada

Abstract

Session: The explanatory role of mathematical and dynamical models in molecular and cell biology (BAETU, BRAILLARD, GROSS, ISSAD and MALATERRE) A major type of explanation in biology consists in mechanistic explanation. Mechanisms are generally defined as particular types of models that include entities performing certain sets of activities (e.g. Machamer et al. 2000, Kaplan and Craver 2011). The explanatory force of mechanisms is apparent in such typical cases as neuron firing or molecular receptor functioning. It is however much less clear how mechanisms explain in the case of the complex biomolecular networks that are increasingly being uncovered in biology, be they metabolic networks such as the regulation of glucose by insulin, or genetic regulatory networks. In this contribution, we argue that the very concept of mechanism faces a dilemma. Either it is defined in fairly broad terms so as to apply not just to elementary biological systems but also to more complex biological networks, and in this case it loses its specificity as a particular type of model. Or it is defined more strictly, and in that case it does not apply to an increasingly larger domain of complex biological models. The first option makes the concept of mechanism redundant with that of model, hence useless. The second preserves the relevance of the concept of mechanism in biological explanation, but can only do so at the cost of reducing its scope of application. In both cases, we argue that the explanatory force of models in biology does not come from their being mechanisms but simply from their empirical adequacy.

*Speaker

†Corresponding author: malaterre.christophe@uqam.ca