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Causality in the Biological Sciences, 17 January

In January this year C. Kenneth Waters (Center for Philosophy of Science, University of Minnesota) came to Cologne as a visiting professor of our DFG-research group "*Causation and Explanation*". One highlight of the fruitful interactions between Ken and our group was the workshop on "*Causality in the Biological Sciences*" that took place at the University of Cologne on January 17th, 2014. Besides Ken Waters, the invited speakers were Lorenzo Casini (LMU München/Université de Genève), Kolja Ehrenstein (Universität zu Köln), Lena Kästner (Ruhr-Universität Bochum), and Raphael Scholl (Universität Bern).

The aim of this workshop was to bring together researchers that work on various aspects of causal reasoning in the life sciences. Some of the talks focused more on general philosophical issues, such as the problem of omissions/absences, the locality of causation (Ehrenstein), and the question of how to model mechanisms by means of Bayesian networks (Casini). Other speakers discussed how causal reasoning and explaining works in specific scientific fields, such as classical and contemporary genetics (Waters), neuroscience (Kästner), and biochemistry (Scholl). The workshop also brought together work on the history of causal reasoning in the biological sciences (Scholl, Waters) and more systematically-oriented work on causality (all).

Ken Waters opened up the workshop with a talk about "*Causes that Matter in Scientific Practice*". The central question of his talk was: What makes DNA so valuable for biological research? Ken argued that in many contexts DNA is important because it is the *actual difference maker* of nucleotide sequence differences in RNA and polypeptides. However, he also pointed out that the process from DNA to a functioning protein is complex, which is why there are various limitations of the explanatory significance of DNA as an actual difference maker. Furthermore, Ken used an example of the investigate practice from genetics to show that the value of DNA consist not so much in its explanatory significance, but rather in its utility as a means for manipulation. In these contexts DNA is, in Ken's terms, a *practical potential difference maker*.

Raphael Scholl presented a project on "*Discovery from a Causal Point of View: Oxidative Phosphorylation*", which he pursues together with Kärin Nickelsen (LMU München). He used a historical case study (namely Peter Mitchell's discovery of the chemiosmotic theory of oxidative phosphorylation) to point out how a handful of simple causal heuristics suffice to explain the genesis of even very original, Nobel-prize-worthy hypotheses. Another major result of Raphael's analysis was that only such causal structures were investigated (or mentioned) for which the underlying mechanisms were known, but that coarse-grained causal level developed much more continuously than the fine-grained mechanistic level.

In the afternoon Lorenzo Casini presented recent developments of his project "*How to Model Mechanisms: In Defense of Recursive Bayesian Networks*". He works on this project together with Jon Williamson (University of Kent). The central goal of Lorenzo's project is to show how Bayesian nets can be used to model biological mechanisms (as the mechanism of apoptosis) and how putative problems can be solved. One challenge that formal models of mechanisms encounter is how to account for causal reasoning across levels. Lorenzo's solution is to use recursive Bayesian nets (RBNs) to represent hierarchies of mechanisms. In his talk he responded to objections and revealed the advantages that RBNs have over other accounts.

Lena Kästner's talk on "*Materials & Methods*" addressed the question of how scientists develop causal explanations. Her main aim was to point out the limited role that interventions (of the Woodward style) play in finding causal explanations. On basis of various examples Lena showed that non-intervention strategies like mere interactions, pseudo-interventions, and data analyses are crucial to causal inference in neuroscience.

The last talk of this workshop was given by Kolja Ehrenstein. He discussed "*How* to *and* not to *break locality*". Kolja examined whether and which understanding of locality may help to qualify absences, such as the absence of lactose (which is supposed to causes the absence of β-galactosidase in the *lac* operon), as causes (or as effects). He argued that locality, understood as spatiotemporally continuous sequences of causal intermediates, fails. Instead, he defended the view that negative causes should be understood as disconnections of dispositional overlap and negative effects as inhibitions of the manifestation of a disposition.

I would like to thank all the speakers and participants of this workshop, in particular Ken Waters, for their stimulating contributions. Information about future events of our research group can be found on our website: http://www.clde.uni-koeln.de/.

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