

Report on
Points of Contact between the Philosophy of Physics and the Philosophy of Biology
European Science Foundation Research Networking Program
"The Philosophy of Science in a European Perspective"
Workshop, LSE, London, 13-15 December 2010

Summary:

Teams B and D jointly held a workshop on themes of common interest at the London School of Economics on 13-15 December 2010. The workshop consisted of 4 sessions and one evening lecture, the latter was delivered by Steven French (University of Leeds). Each session consisted of three papers of one hour each (30' presentations followed by 10' commentaries and 20' of discussion). The talk by Alexander Bird had to be cancelled on a short notice due to an urgent matter. As it was too late to find a replacement, we just started an hour later on the 14th. Co-organizer and team leader of Team D Dennis Dieks (Utrecht, Professor) had to cancel on a short notice due to illness. Thus, in total 23 active participants attended the workshop and 23 presentations and commentaries were delivered. 15 participants were junior scientists (i.e., not in a permanent academic position during the full last 5 years).

The main idea of this workshop was to bring together philosophers of physics and philosophers of biology. Even though these academic disciplines have a common origin in modern empiricist philosophy of science and share many topics of common interest, venues for discussing these issues jointly have become rare in recent years. The big conferences in philosophy of science are usually organized into different sections, such that philosophy of physics and biology are usually separated. Another difficulty is that much recent work in both fields relies quite heavily on highly technical discussions of physical and biological theories and/or experiments, respectively. It was therefore an important goal of this workshop to facilitate overcoming such barriers. With this goal in mind, we have established a system of "physics/biology cross-commenting", which means that most of the talk in philosophy of physics were commented on by a respondent from the philosophy of biology, and vice versa. On the whole, this system worked nicely, as the respondents were usually able to open perspectives from the other side. The evening lecture by Steven French also bridged the gap between these disciplines, as Steven French (a well-known philosopher of physics) presented some ideas of his that concerned biology, basically applying a view that was developed largely in the philosophy of physics to biology (structural realism).

Detailed Report:

One problem for this workshop was the fact that the two main topics for the third year of activities for this ESF Networking Programme, namely probability and statistics, have not enjoyed quite the same attention in these two disciplines. As probability is clearly a fundamental concept in physics, in particular in statistical mechanics and quantum mechanics, this is not quite the case in biology. Probabilities may be used quite regularly, but not in fundamental theories, for the simple reason that there is no such thing in biology. Thus, the concept probability is more like a modeling tool that is more or less useful in various contexts. This may help to explain why the debate on probability in physics is far more developed than the corresponding debate in biology. The same is true, to some extent, about statistics. Nonetheless, we were able to discuss these two central issues. Bengt Autzen (LSE, Graduate Student) provided an excellent analysis of the use of Bayesian statistics in phylogenetic inference in **Session 4**. The paper was commented by Eric Raidl (Paris / Konstanz,

Graduate Student) who normally works on statistical mechanics. Furthermore, the workshop inspired Charlotte Werndl (LSE, Lecturer) to write an original paper on the interpretation of probability in evolutionary theory, providing a new deterministic ontic interpretation (most extant accounts are either epistemic or indeterministic). This paper will be included in volume 3 of the proceedings in the Springer series that accompanies this program.

For the other papers, we decided to broaden the scope of topics for this workshop in order to realize the full potential of this rare encounter between philosophy of physics and philosophy of biology. Clearly, the most hotly debated themes of common interest between these two fields have to do with laws, causation, natural kinds, structures, reduction, realism, and experimentation. Thus, we decided to invite papers on all these topics from both sides.

Session 1 dealt with laws and causation. Mauro Dorato (Rome 3, Professor) provided a systematic comparison of *ceteris paribus* laws in physics and biology (i.e., laws that are only valid under certain conditions). The paper was commented by Christian Sachse (Lausanne, Lecturer), who is an expert on causation and reduction in biology. Michael Esfeld (Lausanne, Professor) defended a form of structural realism about fundamental physical theories. This was commented by Michael Baumgartner (Konstanz, Postdoc), who is an expert on theories of causation. Finally, Federica Russo (Kent, Research Fellow) provided a critical assessment of Jim Woodward's well-known account of causal regularities, while Sebastian Matesescu (Bucharest / Utrecht, Graduate Student) defended Woodward against this critique.

Session 2 was about natural kinds. Holger Lyre (Magdeburg, Professor) connected this issue to the topic of structural realism, which loomed large over this workshop and gave rise to the most controversial and equally spirited discussions. He was commented by Paul Hoyningen-Huene (Hannover, Professor), who expressed a skeptical view with regards to structural realism (and realism in general). Michela Massimi (UCL, Senior Lecturer) addressed the topic more from the perspective of the philosophy of language, in particular the theory of reference. Hanne Andersen (Aarhus, Professor), an expert on Kuhn and incommensurability, expressed some critical thoughts about the theory of reference.

Session 3 dealt with essentialism, reduction and realism, three topics that are widely thought to be closely connected. Thomas Reydon (Hannover, Junior Professor) examined arguments that essentialism – widely assumed to be a dead issue in biology – should be resurrected, and argued for a modest essentialism. Roman Frigg (LSE, Senior Lecturer) provided a surprising defense of the traditional account of reduction due to Ernest Nagel, showing that the most popular arguments against this account are without merit. Marie I. Kaiser (Münster, Graduate Student) argued that reduction is something quite different in biology. John Dupré (Exeter, Professor) argued for thinking more in terms of processes than mechanisms in biology (mechanisms are one of the most extensively discussed topics in philosophy of biology these days).

Session 4 included the papers on probability and statistics already mentioned. Furthermore, the topics of inference and experimentation were addressed by Marcel Weber (Konstanz, Professor), who provided a social epistemological account of the dynamics of experimental knowledge and by Sabina Leonelli (Exeter, Lecturer) who focused on the impact of biological databases and "in silico methods" on experimental biology. Weber's paper was commented by philosopher of physics Meinard Kuhlmann who provided some interesting counter-examples from physics, while Leonelli's paper was commented by Miklos Redei (LSE, Lecturer), who also drew some interesting parallels to the use of computer simulations in physics.

13 participants have written a paper in response to this workshop, which are currently under review for inclusion in volume 3 of the ESF Springer Series.

Assessment of the results and impact of the event on the future direction of the field

The workshop clearly demonstrated that a fruitful debate is possible between the philosophy of physics and the philosophy of biology, and that there are even more overlaps between them than has been thought before. One major such area of overlap that emerged in this workshop is that the concept of structure as it is used in various forms of structural realism in physics may be a unifying concept for both areas (H. Lyre, M. Esfeld, S. French). This notion could replace concepts such as that of individual substance. It would be interesting to assess the implications of this for the theory of reference as traditionally conceived. As the paper by M. Massimi and the commentary by H. Andersen showed, this theory is in trouble in the first place. Furthermore, the concept of natural kind that also descends from the philosophical tradition is also being re-thought in a way that renders it almost beyond recognition (T. Reydon). Perhaps the structuralist approach could be extended in this direction. The same is true for the traditional concept of law of nature (M. Dorato). It is likely that a new kind of metaphysics is necessary to account for recent results both in fundamental physics and in biology. A special challenge for such a new metaphysics is the concept of process, which plays an important role in biology (J. Dupré). Recently, most discussions in philosophy of biology are centred around the concept of mechanism, which may not be really appropriate in biology (nor in physics), as it suggests too rigid a relation between the parts of a system.

In the more epistemological parts of the workshop, an important result was that the concept of reduction is fundamentally different in physics and in biology. It seems that the concept of derivational reduction remains important for physics and can be defended against standard philosophical objections (R. Frigg). By contrast, biology requires a completely different notion of reduction, which still remains to be developed (M. Kaiser). Concerning statistics, Bayesian methods have enjoyed much popularity in philosophy of science as well as in some scientific disciplines. However, fundamental problems remain (B. Autzen). This may be another instance for the problem of theory choice that besets biology just as do the traditional examples from physics (M. Weber). It could be that only a social epistemology can solve this problem. Indeed, the use of databases and "*in silico methods*" in contemporary science must also be seen in the context of social networks in science, because they represent collective achievements that also foster collective action in research (S. Leonelli).

Workshop Programme:

Monday, 13 December

13:45 Opening of the Workshop

Session 1: Laws and Causation

14:00-15:00

Mauro Dorato (Rome 3): *Ceteris paribus* Laws in Physics and Biology

Commentary: Christian Sachse (Lausanne)

15:00-16:00

Michael Esfeld (Lausanne): Causal Realism

Commentary: Michael Baumgartner (Konstanz)

16:00-16:30 Coffee

16:30-17:30

Federica Russo (Kent): On Empirical Generalisations

Commentary: Sebastian Matesescu (Bucharest/Utrecht)

Tuesday, 14 December

Session 2: Natural Kinds

9:00-10:00

Alexander Bird (Bristol): Natural Kinds from Physics to Biology

Commentary: Sara Green (Århus)

10:00-11:00

Holger Lyre (Magdeburg): What Are Natural Kinds?

Commentary: Paul Hoyningen (LU Hannover)

11:00-11:30 Coffee

11:30-12:30

Michela Massimi (UCL): Natural Kinds and Conceptual Change: LaPorte on Incommensurability and Scientific Progress

Commentary: Hanne Andersen (Århus)

12:30-14:00 Lunch

Session 3: Essentialism, Reduction, and Realism

14:00-15:00

Thomas Reydon (LU Hannover): Essentialism About Kinds: An Undead Issue in the Philosophies of Physics and Biology?

Commentary: Dennis Dieks (Utrecht)

15:00-16:00

Roman Frigg (LSE): Who's Afraid of Nagelian Reduction?

Commentary: Marie Isabel Kaiser (Münster)

16:00-16:30 Coffee

16:30-17:30

John Dupré (Exeter): Retrieving Processes from their Reduction to Things. Or, is Realism Possible in Biology or Physics?

Commentary: Charlotte Werndl (LSE)

Evening Lecture

20:00-21:30

Steven French (Leeds): Shifting to Structures in Physics and Biology: A Prophylactic for Promiscuous Realism

Wednesday, 15 December

Session 4: Probability, Inference, and Experimentation

9:00-10:00

Bengt Autzen (LSE): Prior Probabilities in Bayesian Phylogenetics

Commentary: Eric Raidl (IHPST Paris)

10:00-11:00

Marcel Weber (Konstanz): Theory Choice, Social Choice and Experimentation

Commentary: Meinard Kuhlmann (Bremen)

11:00-11:30 Coffee

11:30-12:30

Sabina Leonelli (Exeter): Understanding Data in the Digital Age, Or: the Experimental Context in Silico

Commentary: Miklos Redei (LSE)

The workshop was preceded by the Steering Committee Meeting of the PSE Network on December 13, 2010. Note that the Team Leaders were also invited to the SC meeting and some Team Leaders

(but not all) did attend the SC meeting. Some members of the SC attended some parts of the workshop as well. Below is the complete list of participants of the **two** events.

List of participants

1. M.-C. Galavotti, Bologna
2. D. Batens, Ghent
3. C. Debru, Paris
4. J. Faye, Copenhagen
5. O. Gjelsvik, Oslo
6. T. Kuipers, Groningen
7. A. Miroiu, Bucharest
8. I. Niiniluoto, Helsinki
9. T. Placek, Cracow
10. W. Rabinowicz, Lund
11. M. Redei, London
12. F. Stadler, Vienna
13. W. Gonzalez, Coruna (13-17: Team Leaders)
14. S. Hartmann, Tilburg
15. M. Weber, Konstanz
16. T. Uebel, Manchester
17. G. Wheeler, Lisbon
18. C. Paoletti, Bologna
19. A. Ciula *end of SC meeting participants*
20. H. Andersen, Arhus
21. B. Autzen, London
22. M. Baumgartner, Konstanz
23. M. Dorato, Rome
24. J. Dupre, Exeter
25. M. Esfeld, Lausanne
26. S. French, Leeds
27. R. Frigg, London
28. S. Green, Arhus
29. P. Hoyningen-Huene, Hannover
30. M.I. Kaiser, Münster
31. M. Kuhlmann, Bremen
32. S. Leonelli, Exeter
33. H. Lyre, Magdeburg
34. M. Massimi, London
35. S. Mateiescu, Bucharest/Utrecht
36. E. Raidl, Paris
37. T. Reydon, Hannover
38. F. Russo, Kent
39. C. Sachse, Lausanne
40. C. Werndl, London