Preface

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There has always been interest in inconsistency in science, not least within science itself as scientists strive to devise a consistent picture of the universe. Some important early landmarks in this history are Copernicus's criticism of the Ptolemaic picture of the heavens, Galileo's claim that Aristotle's theory of motion was inconsistent, and Berkeley's claim that the early calculus was inconsistent. More recent landmarks include the classical theory of the electron, Bohr's theory of the atom, and the on-going difficulty of reconciling Einstein's general relativity and quantum theory. But over the past few decades philosophers have taken a particular and increasing interest in inconsistency in science. In 2002 this culminated in the first collection of articles specifically dedicated to the topic: *Inconsistency in Science*, edited by Joke Meheus, published by Kluwer, and featuring twelve articles on a range of topics in the philosophy of science and mathematics.

Since then philosophical interest in inconsistency in science has gained still further momentum. In particular, there has been a debate as to whether classical electrodynamics is an inconsistent theory (Frisch 2004, 2005, 2008; Belot 2007; Muller 2007; Vickers 2008). In addition one can point to important new developments in our understanding of how inconsistencies infiltrate scientific practice. Mark Wilson's work *Wandering Significance* (2006) is an increasingly important reference point here. One can also point to developments in our understanding of inconsistent mathematics (e.g. Colyvan 2008a, 2009), paraconsistent logic (e.g. Meheus 2003; Brown and Priest 2004; da Costa et al. 2007), inconsistency in the metaphysics of science (e.g. Verelst 2008; Colyvan 2008b) and inconsistencies in language (Azzouni 2005, 2007).

Several major questions remain in the philosophy of inconsistency in science, on which some not insignificant headway is made by the papers in the current volume. In particular the primary question of the collection is the title question: 'Is Science Inconsistent?' When one looks to case studies such as those noted above it may seem obvious that the answer to this question is simply 'yes'. However, as the recent debate over the consistency of classical electrodynamics has shown, things are not so simple. Philosophers cannot simply comment on 'science itself', as it actually is in its 'pure' form; instead they represent and reconstruct that science. The inconsistency of a theory such as classical electrodynamics depends upon how this representation/reconstruction is performed. Since there is no unique way to reconstruct scientific theories, it turns out that there is no straightforward yes/no answer to the question 'Is Science Inconsistent?'

Thus the proposed volume starts by addressing what we mean by 'scientific theory', and the different ways in which different elements of science can be represented and reconstructed by philosophers of science. Peter Vickers' contribution 'Theory Flexibility and Inconsistency in Science' suggests that theories are 'flexible' in a certain sense, so that a given theory might be consistent or inconsistent depending on how it is (re)constructed. Karin Verelst's contribution 'Newton vs. Leibniz: Intransparency vs. Inconsistency' gives a discussion of a strategy by which scientists have reconstructed apparently inconsistent science as consistent. Juha Saatsi's contribution 'Inconsistency and Scientific Realism' shows how apparently inconsistent theories can be represented in a way compatible with scientific realism. And finally Christopher Pincock's contribution 'How to Avoid Inconsistent Idealizations', argues that even within idealized science inconsistencies can be eliminated if one alters one's perspective on the role played by the mathematics.

But despite these ways in which the existence of inconsistency in science can be and has been played down, there are apparently circumstances in which it should be emphasised and utilised. For example, Robert Batterman's contribution 'The Inconsistency of Physics (With a Capital "P")' shows how conflicts can arise when one applies mathematical representations for different scientific purposes. Jody Azzouni's contribution 'A New Characterization of Scientific Theories' shows how it can be beneficial to represent scientific theories inconsistently for certain explanatory purposes. Kevin Davey's contribution 'Can Good Science be Logically Inconsistent?', and Mathias Frisch's contribution 'Models and Scientific Representations or: Who is Afraid of Inconsistency?' then back up this thesis, arguing for situations in which inconsistency can be scientifically useful.

Another option for the reconstruction of science is to make use of an inconsistent set of assumptions but to manage the inconsistency with one or another non-classical logic. Although this isn't something seen in actual science, as a reconstruction it may be extremely revealing. The third part of the volume explores such a possibility, starting with Otávio Bueno's contribution 'Inconsistent Scientific Theories: A Framework' which sets the scene and assesses the strengths and limitations of an approach that draws on paraconsistency. Newton da Costa and Décio Krause's contribution 'Physics, Inconsistency, and Quasi-Truth' then takes this further, applying a paraconsistent approach to the foundations of quantum theory. Richard Benham, Chris Mortensen, and Graham Priest's contribution 'Chunk and Permeate III: The Dirac Delta Function' draws on recent developments to discuss another possible application of paraconsistency. Finally in this section, Jean Paul van Bendegem extends the debate about inconsistency-tolerant systems of *logic* to a discussion of possible inconsistency tolerant systems of *mathematics* in his contribution 'Inconsistency in Mathematics and the Mathematics of Inconsistency'.

In the final section of the volume a new question is asked: what role, if any, should we expect inconsistency to play as science advances? Some have suggested that inconsistency should be left behind as scientists achieve greater unification, but Bryson Brown questions this in his contribution 'The Shape of Science'. Similarly Dunja Seselja and Christian Straßer's contribution 'Epistemic Justification in the Context of Pursuit: A Coherentist Approach' suggests that in certain circumstances consistency should be sacrificed in the interests of progress. Finally James McAllister's contribution 'Methodological Dilemmas and Emotion in Science' discusses how inconsistency can infiltrate science at a different level entirely—that of scientific method.

References

Azzouni, J. (2005): ‘The strengthened liar, the expressive strength of natural languages, and regimentation’, *The Philosophical Forum* 34:3&4, 329-350.
Azzouni, J. (2007): ‘The inconsistency of natural languages: How we live with it’, *Inquiry* 50: 590-605.
Belot, G. (2007): ‘Is Classical Electrodynamics an Inconsistent Theory?’, *Canadian Journal of Philosophy* 37: 263-282.
Brown, B and Priest, G. (2004): ‘Chunk and Permeate: A Paraconsistent Inference Strategy. Part I: The Infinitesimal Calculus’, *Journal of Philosophical Logic*, vol. 33, no. 4, pp.379-388.
Colyvan, M. (2008a): ‘Who’s afraid of inconsistent mathematics?’, *ProtoSociology* 25: 24-35.
Colyvan, M. (2008b): ‘The Ontological Commitments of Inconsistent Theories’, *Philosophical Studies* 141: 115-123.
Colyvan, M. (2009): ‘Applying Inconsistent Mathematics’, in Ø. Linneo & O. Bueno (eds.), *New Waves in the Philosophy of Mathematics*, Palgrave MacMillan.
Da Costa, N. C. A., Krause, D. and Bueno, O. (2007): ‘Paraconsistent logics and paraconsistency’, in Jacquette (ed.) (2007), pp. 791-911.
Frisch, M. (2004): ‘Inconsistency in Classical Electrodynamics’, *Philosophy of Science*, **71**, pp. 525-549.
Frisch, M. (2005): *Inconsistency, Asymmetry, and Non-Locality: A Philosophical Investigation of Classical Electrodynamics*. Oxford: Oxford University Press.
Frisch, M. (2008): ‘Conceptual Problems in Classical Electrodynamics’, *Philosophy of Science*, **75**, pp.93-105.
Meheus, J. (ed.) (2002): *Inconsistency in Science*, Dordrecht, The Netherlands: Kluwer Academic Publishers.
Meheus, J. (2003): ‘Inconsistencies and the dynamics of science’, *Logic and Logical Philosophy*, 11, pp.129–148.
Muller, F. A. (2007): ‘Inconsistency in Classical Electrodynamics?’, *Philosophy of Science*, **74**, pp. 253-77.
Vickers, P. (2008): ‘Frisch, Muller and Belot on an Inconsistency in Classical Electrodynamics’, *British Journal for the Philosophy of Science* **59**, no.4, pp.1-26.
Wilson, Mark (2006): *Wandering Significance: An Essay on Conceptual Behavior*. Oxford: Oxford University Press.