

## Introduction

# Beyond Toleration? Inconsistency and Pluralism in the Empirical Sciences

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Nowadays it is recognized that, at least for methodological purposes, entertaining pluralism in the study of science can offer a great number of benefits. One of them would be the opportunity of analyzing the role that some epistemic virtues –such as scope, fruitfulness, consistency, and simplicity, to name just a few– play in scientific activity. From the different pluralist positions, a lot has been said about empirical adequacy, refutability and explanatory power, yet consistency has not been equally dealt with. As a matter of fact, the lack of consistency and its philosophical implications have been studied from an angle that does not necessarily involve a pluralism of any kind. At the moment, it is commonly accepted that inconsistencies can be more frequent in scientific development than the traditional philosophy of science could have expected, and the idea that inconsistency is not always a synonym of logical anarchy, as it was suggested in the classical literature of logic and the philosophy of science, has been gaining support. All this has been possible mostly thanks to the emergence of paraconsistent logics and the availability of case studies that show how inconsistency is not an uncommon phenomenon in science.

But pluralism does not necessarily entail inconsistency toleration nor vice versa. Accordingly, the main motivation for this volume is to explore the links between pluralism and inconsistency toleration in science, in order to connect the reflections on inconsistency toleration with broader and major issues in

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philosophy of science. In order to do so, we will suggest two different lines of investigation: First, to focus on the implications of some pluralistic accounts in the philosophy of science for the study of inconsistency; second, to analyze the implications of some paraconsistent approaches regarding pluralism in science.

Joke Meheus' edited volume *Inconsistency in Science* from 2002 was the first book-length publication to isolate the topics in philosophy of science from the vast field of studies on inconsistency. That was a sign of maturity in the philosophical research program on inconsistency, as the volume showed how it began to confront itself systematically with some of the major topics in traditional or mainstream philosophy. Fifteen years later, we wanted to contribute to move forward the paraconsistent views in philosophy of science towards a more mature stage by moving from discussions of the possibility of cases of inconsistent science to the discussion of the implications of inconsistency-toleration for broader concerns in the philosophy of science. Thus, we aimed to show the current state of the art of, and motivate new research on, formal tools for the representation of inconsistency toleration in empirical sciences, different types of inconsistency toleration commitments, new historical cases of inconsistent science and reflections on integrated history and philosophy of science, inconsistent methodologies, methodologies for inconsistency and scientific pluralism; particular types of scientific pluralism and particular types of inconsistency toleration commitments; inconsistent science and varieties of scientific (anti-)realism, among other topics. The incentive for this especial issue was the organization of the workshop "The Place of Inconsistent Science in Scientific Pluralism", which took place at the National Autonomous University of Mexico (UNAM) in September, 2016. Most of the papers presented in that occasion were revised for this volume, and some others were added through the call for papers.

It is worth noting that even if the four major brands of paraconsistency –the so-called Brazilian, Australian, Belgian and Canadian schools, with their main techniques and motivations–, are still strong and recognizable, few of the papers in this volume adhere clearly, explicitly and uniquely to one of such schools. All of them are represented in one form or another –perhaps the only main position not represented here is a bold, fully dialetheist view of some inconsistencies in science– and, as in the case of Meheus' volume, there are the scholars more focused on the philosophy of science and less interested in taking part of the logical debate. Nonetheless, the stances are much more complex than ten or twenty years ago. What the volume shows for sure is that one should be ready to

expect new ways of tolerating inconsistencies as the relation between logic and philosophy of science ripens.

The volume opens with five papers that focus on the implications of some pluralistic accounts in the philosophy of science for the study of inconsistency. The first two of those contributions, “Scientific Pluralism and Inconsistency Toleration”, by Dunja Šešelja, and “Inconsistency in Mathematics and Inconsistency in Chemistry”, by Michèle Friend, aim at discussing different benefits of handling inconsistencies in science from a pluralistic framework. On the one hand, Šešelja presents a novel way to understand scientific pluralism about inconsistency toleration through the analysis of different types of pluralism and different degrees of epistemic commitments regarding inconsistencies in science. On the other hand, Friend compares the ways in which inconsistencies are often handled in mathematics and in chemistry, and stresses that both, mathematicians and chemists, can learn a lot from each other on how to deal with inconsistencies in general.

The following three contributions introduce three different analyses of inconsistencies in empirical sciences that are supported by original case studies: “Investigating Consistencies, Inconsistencies, and the Meaning of the *Ceteris Paribus* Clause in Chemistry”, by Jean-Pierre Llored; “Scientific Disagreement and Evidential Pluralism: Lessons from the Studies on Hypercholesterolemia”, by Veli-Pekka Parkkinen, Federica Russo and Christian Wallmann; and “Holism, Inconsistency Toleration and Inconsistencies between Theory and Observation”, by María del Rosario Martínez-Ordaz. Llored focuses on a methodological type of pluralism and analyzes in detail how chemists deal with inconsistencies using *ceteris paribus* clauses; to illustrate his point, he presents the common processes involved in the provisional definition of any chemical body, and argues that such processes are the ones that make inconsistency toleration possible in chemistry. Parkkinen, Russo and Wallmann discuss different ways in which scientists deal with one type of inconsistencies in empirical sciences, more in particular they present an analysis of ‘*loci* and reasons’ for disagreement and to support their claims, they introduce a case study from the health sciences. Martínez-Ordaz argues in favor of a particular way to approach to inconsistencies in empirical sciences and defends that some distinctions have to be drawn if one wants a more accurate analysis of inconsistencies between theory and observation; to support her main argument, she introduces two case studies from physics.

Next, the last four papers of the volume are devoted to analyze the implications of some paraconsistent approaches regarding pluralism in science: “Pluralism in Scientific Problem Solving. Why Inconsistency is no Big Deal”, by Diderik Batens; “Paraconsistency, Pluralistic Models and Reasoning in Climate Science”, by Bryson Brown; “Contradictions in Motion: Why They’re not Needed and Why They Wouldn’t Help”, by Emiliano Boccardi and Moisés Macías-Bustos; and “Scientific Pluralism, Consistency Preservation, and Inconsistency Toleration”, by Otávio Bueno. In his paper, Batens provides a neat discussion of the role that different types of paraconsistent logics play when dealing with contradictions in science and argues in favor of a logical pluralism inspired by the actual scientific enterprise. Brown presents a novel case study from climate science that illustrates how scientists combine inconsistent information in a highly sophisticated way. Inspired by this type of scenarios, he also develops a new application of the paraconsistent reasoning strategy Chunk-and-Permeate. Boccardi and Macías-Bustos present an original argument against the need for dialetheias in science, more in particular, they argue contra Priest that a Hegelian account of motion might not be the best choice when dealing with contradictions in physics. Finally, Bueno discusses the benefits of some formal and informal approaches to inconsistency in science, and suggests a refined class of logical pluralism regarding strategies for dealing with contradictions in scientific contexts.

We want to thank the reviewers for their help and service to the volume: Raymundo Morado-Estrada, Atocha Aliseda-Llera, Gabriel Ramos-García, Alejandro Vázquez-del Mercado, Michèle Friend, Bryson Brown, Francisco Hernández-Quiroz, and some others that still want to remain anonymous. We want to thank also UNAM’s generous financial support through the PAPIIT project IA401015 “After Consequences. A Universalist View of Logic (I)”, which made the aforementioned workshop possible. Finally, we want to thank the authors for their contributions and considering this journal as a suitable venue for their research, and to Silvano Zipoli and the rest of the staff of *Humana.Mente* for their assistance during the process of getting this special issue published: they kindly dealt with our delays, idiosyncrasies and other difficulties still inherent to editorial processes.