

## Session TBD

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“Big theory for big data”

### Abstract

The current interest in big data and machine learning has generated the widespread impression that such methods are capable of solving most problems without the need for conventional methods of scientific inquiry. One of the characteristic features of big data approaches is that they have a strong “black box” aspect to them, which is at once an advantage and a weakness. The methods are often presented as being in some sense universal, while at the same time their domain of validity is poorly defined. There is a relative paucity of results available with which to constrain their application in reliable ways while the quantity of data required for the methods to perform reliably is typically underestimated. We look at one or two findings which serve to pinpoint limitations of these approaches as a consequence of the size of the data being investigated. Dynamical phenomena, such as those which commonly arise in life and medical sciences, are particularly challenging for machine learning methods due to the vastness of the data which would need to be acquired in order to apply blind big data methods. Finally, we look at ways in which big data approaches can be made to work synergistically with complementary modelling methods which take into account the structural characteristics of the problem in hand, as exemplified by cancer and the human immune response.

### Bio

Prof Peter V. Coveney holds a chair in Physical Chemistry, is an Honorary Professor in Computer Science at University College London (UCL) and is Professor Adjunct at Yale University School of Medicine (USA). He is Director of the Centre for Computational Science (CCS) at UCL. Coveney is active in a broad area of interdisciplinary research including condensed matter physics and chemistry, materials science, as well as life and medical sciences in all of which high performance computing plays a major role. He has published more than 400 scientific papers and co-authored two best-selling books (The Arrow of Time and Frontiers of Complexity, both with Roger Highfield) and is lead author of the first textbook on Computational Biomedicine (Oxford University Press, 2014). Coveney is a founding member of the UK Government’s E-Initiative Leadership Council and a Medical Academy Nominated Expert to the UK Prime Minister’s Council for Science and Technology on Data, Algorithms and Modelling which has led to the creation of the London based Turing Institute.

