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Credibility in computational biology based on experimental mechanics

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Abstract

In a digital world where physical tests are often perceived to be difficult, time-consuming, unreliable, and expensive, what is the role of experimental mechanics? One answer to this question is to develop measurement techniques that are more straightforward, quick, more reliable and cheaper. And, many researchers have tackled these challenges with considerable success and, often by embracing digital technologies. An alternative answer is to celebrate the richness of the data generated by well-designed physical tests incorporating the best in experimental mechanics and to develop data analysis and interpretation techniques that maximise the impact of test data on modelling and decision-making. The latter requires experimental mechanicians to think about epistemiology, or how we know what we know, and how to communicate that knowledge to stakeholders and decision-makers. This is not straightforward for a complex engineering system and becomes an order of magnitude more difficult in computational biology when the 'design' is undefined, the system is non-linear and exhibits emergent behaviour, and experiments might yield limited on no quantitative data. These issues will be explored, starting from efforts in aerospace and nuclear engineering to establish credibility in computational mechanics models using experimental mechanics, and progressing to the transition of the concepts into computational biology and current work on establishing credibility for predictive toxicology in support of regulatory processes.

BIOGRAPHY

Eann Patterson holds the AA Griffith Chair in Structural Materials and Mechanics at the University of Liverpool where he is also a University Learning and Teaching Fellow. He held a Royal Society Wolfson Research Merit Award from 2011 to 2016 and previously held joint appointments in Departments of Mechanical Engineering and of Chemical Engineering and Materials Science at Michigan State University from 2004 to 2011. He earned his BEng and PhD at the University of Sheffield, where he was a member of staff from 1985 to 2004. He is a fellow of Society for Experimental Mechanics and is a recipient of their Frocht Award and Zandman Award.