Foreword

Computers and quantitative methods are fundamental tools in all branches of modern science, and paleontology is no exception. It has not always been this way, however. Quantitative approaches were of course always used by paleontologists, but the mainstream literature used to focus on qualitative description. In general, paleontology was surprisingly slow in adopting quantitative methods, compared with geology and particularly biology. One reason could be the idea that the fossil record is too incomplete for statistical treatment. What is the point of using sophisticated methods on such poor data? This is a misunderstanding – in fact the opposite is the case. It is precisely when the data are incomplete that we need the machinery of statistics to assess the effects of sampling. On the subject of mathematical modelling, a common objection is that the complexities of biological systems cannot be captured in a simple model. Again I would argue otherwise, that exactly when the system is complex beyond the capabilities of the human brain, a reduced model can lead to fundamental understanding by virtue of its very simplicity. After all, the purpose of modelling in paleontology is insight, not prediction.

A spectacular, early application of computers in paleontology was Raup's modelling of shell coiling. Another pioneer was Richard Reyment, who contributes to this volume. Now, computers are used almost everywhere in the paleontological work flow, from field work, data collection and visualization (Mallison; Poza-Rey; Stoinski; this volume) to morphometrics (Reyment) and data management (Skjerpen and Dolven). Quantitative methods are also fundamental in studies of paleoecology, development and evolution (Brusatte; Zachos and Sprinkle; Weaver; Petrakis). Paleontology as a science has improved as a consequence of this development. Quantitative approaches do not always give more "correct" answers, but they do make the arguments clearer and the results easier to falsify. Also, modern methods of data analysis and visualization have the power to suggest new research questions that would not have appeared otherwise.

There is something intriguing about the combination of modern technology and the vastness of geological time. The use of laser scanners, CT machines or DNA sequencing on fossils rarely fails to interest the media. This fascination was used to

full effect in the blockbuster movie Jurassic Park (1993), where molecular biology and computer science interfinger with the horrors of the Mesozoic. This movie was also a technological breakthrough concerning the use of 3D computer graphics for visualizing ancient life forms. Such technology has since been used in countless movies and TV documentaries, contributing greatly to the present interest in paleontology among the general public.

Finally a piece of informal scientometrics: The ratio between hits for "computational paleontology" and "paleontology" on Google is presently 0.0036%. We therefore have some way to go compared with physics or biology, where the similar ratios are 1.3 and 2.0%. Slightly more alarming is the ratio for the "soft" science of archaeology, at 0.0049%. Hopefully, this book will contribute to us beating the archaeologists!

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