

### EDITORIAL

## 'Big History', history and citations in nutritional science

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An understanding of history is of crucial importance and we are each taught selected elements of it from an early age. This may be centred on the region or country where we live, or on the wider world. In addition to the history of our own region, many of us – certainly in Europe – are taught the importance of Greece and Rome in the development of the ideas and culture that underpin Western civilisation. There is also a considerably larger view of history which far transcends the human era – what has been termed 'Big History'. Big History in effect seeks to see we humans in the context of the history of our planet, and indeed of the universe as a whole. This perspective has been pioneered by Professor David Christian from Macquarie University in Australia.<sup>(1)</sup>

Big History begins with the 'big bang' and the origin of the universe some 13.8 billion years ago, followed by the birth of our own planet, earth, 4.5 billion years ago (through accretion from the solar nebula). The field is characterised by multidisciplinary, including diverse scientific disciplines from cosmology to astrophysics, chemistry, geology and biology; this is in contrast to traditional history as the provenance of professional historians.

It seems probable that the first forms of life developed on earth at least 3.8 billion years ago<sup>(2)</sup> and these were very simple organisms. At the time of the emergence of life forms, and indeed of the formation of the planet, the atmosphere was very different from what it is now, oxygen being present at just one part in a million<sup>(3,4)</sup>. For the first 2 billion years of earth's existence, diatomic oxygen was essentially absent from the atmosphere. It was only some 2.45 billion years ago that significant amounts of atmospheric O<sub>2</sub> began to emerge in a process termed the 'Great Oxidation Event'<sup>(5–7)</sup>. The concentration of O<sub>2</sub> gradually rose, then fell, stabilising at the current level of 21 % by approximately 600 million years ago<sup>(5)</sup>.

The emergence of substantial amounts of O<sub>2</sub> in the atmosphere led to the development of multicellular organisms with

increasing metabolic complexity, and subsequently of large animals. The extensive availability of O<sub>2</sub> also resulted in this molecule becoming a key 'nutrient', with the evolution of mitochondria. According to the endosymbiotic hypothesis, these organelles were originally prokaryotes that became endosymbionts within eukaryotic cells, enabling specific oxidative processes to be undertaken<sup>(8,9)</sup>. I have recently argued that the extent to which O<sub>2</sub> is a key nutrient has essentially been overlooked in nutritional science<sup>(10,11)</sup>.

When the focus moves from Big History to documented human history, early recognition of the importance of nutrition is evident. Hippocrates in Ancient Greece and Galen in Rome, together with their followers, viewed food and diet as central to the prevention and treatment of disease (and this was also the case in other early civilisations). Indeed, dietetics was often considered to be the most prestigious part of medicine. More recently, of course, we recognise giants in the development of modern nutritional understanding with the rapid development of science that followed the Enlightenment in the 17/18th centuries in Europe. Major figures from Lavoisier and von Liebig onwards have profoundly shaped our understanding and are rightly acknowledged in the history of nutrition.

In practice, we all engage in the history of our subject each and every time we write a scientific article. This is through describing the background and context of a study, and in the referencing of articles that have previously been published – whether many years earlier, or in the preceding weeks. There is a strong responsibility to cite correctly, referencing a given paper accurately (author names, year, volume, page numbers), mistakes being far from uncommon. It is especially important that the correct articles are cited in support of a given statement, proper attribution of ideas and original observations being fundamentally a question of ensuring the accuracy of the historical record. In addition, it is important to ensure that those who are



the original source of a particular observation, piece of data or hypothesis receive due recognition for their contribution. There are significant issues of personal reputation and career, and this is underlined by the widespread use of citation metrics – citation counts, ‘h’ indices and so on – which in many institutions are used as key determinants for career progression.

Proper attribution can be compromised, of course, by limits placed by journals on the number of references that can be cited in an article (I can recall major journals which used to have some 30 references as a maximum). Limits are, however, increasingly unusual as more and more journals are exclusively online with a consequent reduction in the pressures on space. I note that there has been a limit on the number of references for ‘Perspectives’ papers in *JNS*, but we are able to remove this – as exemplified in a recent article on vitamin D<sup>(12)</sup>.

One of the consequences of limits in the number of references is that it increases the attraction of citing review articles, and indeed reviews are frequently used to summarise key information. In a number of instances, this is undoubtedly appropriate, especially when certain facts or views are axiomatic, or well established, within a field. Who would feel it appropriate to cite the original papers, for example, describing the Krebs Cycle or the discovery of vitamin D, other than in the context of a genuinely historical review? There is, nonetheless, a grey area when deciding whether something is, or is not, sufficiently established such that citation is considered unnecessary. There is also a question of context. Importantly, if there are mistakes in attribution, then a high-profile review can induce a serious distortion in the history of a field and be perpetuated in subsequent articles. This danger has been highlighted by Petersen in a recent Editorial in the journal *Function*<sup>(13)</sup>.

The history of nutrition requires that not only are the giants in the field recognised and celebrated, but that the veracity of the historical record is maintained at all levels through the references cited during the preparation of an article.

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