

Short note:

Numbers in Biology

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It is surprising how many microscopists have little idea about the length, let alone volume, of the specimens that they examine. In the modern world of multi-dimensional imaging, this ignorance of fundamental knowledge is surprising. Having some idea about the size of an object being examined helps to decide which is the most appropriate objective to use, and how long it might take to set up the microscope and to collect the data.

I write now to mention The *BioNumbers* database [1,2], set up in 2007 as a source of fundamental values by three research scientists at Harvard Medical School, to assist calculations for experimental work. For example, the size and volume of the nucleus of various species has been calculated countless times since its first detailed description in 1831 in Brown's lecture [3] to the Linnean Society. Nevertheless, it can often be surprisingly difficult to look up these values. Until recently, there was a dearth of published information on the sizes of cells and organelles; the *Biology Data Book* published by Wiley [4] in 1978, is now out of print. An earlier attempt, the *Handbook of Biological Data* (1956), received only a mediocre review [5]. Handbooks of quantitative data are common in chemistry, engineering and physics [6,7], but not so in the life sciences. Even in *Molecular Biology of the Cell*, the 'Bible' of cell and developmental biologists [8], there is only passing reference to the approximate size of organelles, cells and organs. One of the few references [9] that gave both length and volume measurements was Chapter 2 on 'Basic Light Microscopy' in *Essential Cell Biology*, from the OUP Practical Approach series.

The *BioNumbers* database is a wiki community effort, with users contributing useful data. Of course, the drawback of wiki-led enterprises, such as Wikipedia, is that although most of the information is useful and accurate, certainly not all of it is so. To counter this, the *BioNumbers* team and users enter useful values from peer-reviewed literature. Entries have supporting references and a unique ID number: an audit trail underpins all data. The Export function creates an Excel spreadsheet of all the displayed information. Table links lead to supporting information or primary sources. The >> hyperlink leads to further information about the selected entry. The originators and curators of the database have published explanatory papers in the scientific press [10-12], and a brief explanation of *BioNumbers* is in Wikipedia [13].

Besides being a repository of quantities and metrics, an additional purpose of the database is to derive estimates of key biological quantities from assumptions based upon elementary facts – the so-called 'Fermi problem' named after the nuclear physicist who possessed an uncanny ability to do this. One of the useful aspects of the database is the Key Numbers entry, which permits rapid access to facts and figures

References

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13. <http://en.wikipedia.org/wiki/Bionumbers>