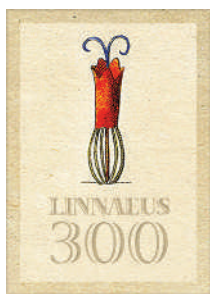


# Spreading the word

Keeping track of new species names is a growing challenge for modern taxonomists. **Sandra Knapp, Andrew Polaszek and Mark Watson** make the case for electronic publication of scientific names.

**W**hen Carl Linnaeus was born in 1707, plants and animals were not given 'scientific' Latin names. Instead they were referred to by 'phrase names' consisting of complete descriptions in Latin,



sometimes running into several paragraphs. By the time Linnaeus died in 1778, taxonomy was an established discipline and people communicated information about organisms using his simplified binomial system. These two-word 'trivial names' are what we now call the genus and species. Twenty years after Linnaeus's death, rumblings about the lack of stability in the system of plant and animal naming led to the Codes of Nomenclature that today govern the naming of all living things. Biology owes a great deal to the willingness of the taxonomic community to adhere voluntarily to these codes: names, and their consistent application, make biology a repeatable science.

Modern taxonomy has engendered much comment in the past few years<sup>1</sup>. Its products, descriptions and hypotheses concerning the identity and relationships of life on Earth, are rightly seen as increasingly important in documenting biodiversity. But the business of communicating the findings has outpaced the traditional means of publication. In our view, the products of taxonomy are too useful to the rest of biology to be relegated to a handful of obscure, privately published books or journals of limited distribution, both physically and intellectually. Taxonomy must not be left behind in the electronic age.

Each of the four codes (for animals, plants, cultivated plants and bacteria) applies a set of conventions to naming, which are governed in slightly different ways<sup>2</sup>. But all the codes share two central pillars: validity of publication and the principle of priority — whereby the first validly published name for a given taxonomic concept is the correct one. The rules governing publication are arguably the most important of all the codes' regulations, as it is through reference to publications that hypotheses are supported or rejected.

In Linnaeus's day, publication involved printing presses and personal payment; many of



In Linnaeus's day, new names were published in printed books, few of which survive today.

the works published in the eighteenth century survive only as single copies in a few libraries. Linnaeus himself published and distributed the dissertations of all his students, some 400 printed books in limited print runs. How different from the world of publication today, with its instantaneous electronic access to all corners of the globe.

## Up to speed

The difficulty of tracking down taxonomic publications has rightly been identified as the greatest impediment to the work of taxonomists and its use by other biologists. Old, rare publications are difficult enough to find, but today there are some 25,000 new names for organisms proposed every year. These new names are published in thousands of journals, many of very limited distribution; keeping track is an almost impossible task. How can taxonomy join the rest of science and take advantage of the speed and reach of electronic publishing?

Online community initiatives, such as the International Plant Names Index (IPNI, [www.ipni.org](http://www.ipni.org)), which began life as *Index Kewensis* with a legacy from Charles Darwin<sup>3</sup>, exist for the recording and electronic dissemination of new names published elsewhere. Similar compilations for bacterial names, and the recent

ZooBank ([www.zoobank.org](http://www.zoobank.org); ref. 4) and MycoBank ([www.mycobank.org](http://www.mycobank.org)) initiatives will contribute a great deal towards making names available to all. However, none of the current Codes of Nomenclature allows publication of new names by electronic media alone.

Will this change? Periodic tweaks are made to the codes, usually to maintain stability in the naming system. The communities governing the codes are conservative and wary of sweeping changes that may cause more problems than they solve. But as publishing goes electronic, the landscape is changing slowly. The zoological code now allows for publication on CD instead of print, while the botanical code

**"The products of taxonomy are too useful to be relegated to a handful of obscure journals."**

is recommending publication in peer-reviewed print journals with electronic distribution instead of in print-only journals<sup>5</sup>. In our view, print-dependence for the naming of new organisms slows taxonomy down.

Eventually, pure web-based taxonomies, such as those being developed by the CATE project ([www.cate-project.org/](http://www.cate-project.org/)) and the Planetary Biodiversity Inventory projects ([www.actionbioscience.org/biodiversity/page.html](http://www.actionbioscience.org/biodiversity/page.html)) will radically improve access to the products of taxonomy. However, electronic media alone will not speed up publication. Rapid review is also critical for rapid publication. Today most,

but not all, print journals in taxonomy are peer reviewed, and as publication migrates to the web it is important that standards go up and we don't create an unregulated free-for-all. Peer review is not now an explicit condition of publication for new names in most of the codes. We believe electronic taxonomic publishing must include rigorous peer review, alongside fast and wide dissemination of results.

A culture of rapid, high-quality peer review is essential to keep a field moving, and taxonomy needs to move faster to contribute effectively to advances in biodiversity science. An example of a successful journal that publishes simultaneously online and in print is *Zootaxa* ([www.mapress.com/zootaxa/](http://www.mapress.com/zootaxa/)). It has proved a popular and effective means for publishing new animal names, in part due to its electronic distribution, but also due to its quick turnaround. A paper can take up to two years from acceptance to publication in some taxonomic journals, whereas in *Zootaxa*, turnaround varies from weeks to months. The Linnean Society of London and Blackwell Publishing are discussing a similar initiative for botanical names.

### In a safe place

There are other issues on which taxonomists will need to work with the publishing industry to find solutions. Important objections to electronic publication are the problems of permanent archiving and accessibility. The current system, paper archiving, is itself no guarantee of permanence: the ancient 'copyright' Library of Alexandria was famously destroyed by fire on several occasions. In recognition of this, the codes require that copies of new names are deposited in at least five major public libraries. This remains necessary until stable and permanent electronic publications are attainable.

The worldwide web is archived regularly ([www.archive.org](http://www.archive.org)), but with no guarantee that this will be permanent. However, it is inconceivable that investments in electronic databases such as those for genome sequences or astronomical data will be allowed to disappear — a stable archive is protection of this investment, so there is ample incentive to get it right. Archiving is just as essential to protecting the investment made over centuries in taxonomy, and projects such as the Missouri Botanical Garden's *Botanicus* ([www.botanicus.org](http://www.botanicus.org)) and the Biodiversity Heritage Library ([www.bhl.si.edu/](http://www.bhl.si.edu/)) will go a long way towards doing this.

An alternative to archiving all original publications is an automated system for registering



**A secure means of archiving is essential to protecting both old and new taxonomic information.**

new names, whether voluntary or mandatory. Names for fungi can now be registered on

Mycobank, and from mid-2007 a form for registering new names will be available via ZooBank. The flowering-plant community will, however, continue to use IPNI as its recording system. These systems are all voluntary, or in the case of IPNI, maintained by institutions. Moving to mandatory registration would imply that any new taxon name could not be considered valid until it had both been published and registered, a two-step process that would require a change to the codes.

Mandatory registration of taxonomic names has proved controversial in the past, largely for sociological reasons having to do with how it would work, rather than objections in principle: one system of centralized registration was rejected by the 1999 International Botanical Congress. However, with the advent of globally unique and persistent identifiers for taxon names or web documents (a concept borrowed from software applications) by groups such as the Taxonomic Databases Working Group ([www.tdwg.org](http://www.tdwg.org)) and the Global Biodiversity

Information Facility (GBIF, [www.gbif.org](http://www.gbif.org)), the pieces necessary for making name registration work effectively across all biology are coming together.

### Open access

GBIF is also dedicated to making taxonomic (biodiversity) information accessible as widely as possible. Restrictions to online access of journals and articles can work against this, and although free access to the entire published literature may not be possible, a registration system that guaranteed open access to important nomenclatural information (such as names and original descriptions) could satisfy the needs of both taxonomists and the publishing industry. What better longer-term role for GBIF than to assume eventual responsibility for registration and assignment of globally unique identifiers for all new taxonomic names?

Ultimately, issues surrounding access to new names transcend the medium of their publication. The increasing reliance by peer-reviewed journals on electronic editions and the decreasing purchasing and storage capacities of libraries worldwide means that print media face an uncertain future. Access to taxonomic information will increasingly come to rely on the Internet, whether by 'unitary'<sup>1</sup> or by distributed means. As already noted, the codes currently accept publication of new names only in library print or CD copies, preferably those linked

to major name-indexing centres, but the main dissemination of such works can, and we think should, be electronic.

The time has come to think as Linnaeus himself once did when he and his students began to use his binomial 'nomina trivialia' as aids to memory. Linnaeus knew his work was important, and that it mattered. He used whatever new ideas and technologies he could to disseminate it and make it useful. It would be fitting if in 2007, his tercentenary, the taxonomic community made significant steps towards bringing nomenclature into the electronic age. ■

Sandra Knapp is in the Department of Botany, and Andrew Polaszek is at the International Commission on Zoological Nomenclature, The Natural History Museum, Cromwell Road, London SW7 5BD, UK; Mark Watson is at the Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh, EH3 5LR, UK.

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