

POINTS OF VIEW

The importance of vouchers

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We object to the recently instituted policy of some editors that prohibits the publication of voucher information in printed issues of the journal. Editors of scientific journals are under several pressures: to reduce the backlog and the time from submission to publication and, at the same time, to keep publishing costs—and subscription rates—as low as possible. In general, publishing journals is getting more expensive: printing and mailing costs are increasing and journals are publishing more pages, using larger formats and/or increasing the number of issues per year in response to increasing submissions of quality work. These factors have brought about policy changes in several journals with regard to publishing voucher information in printed issues. In 2003, *American Journal of Botany* (*AJB*) eliminated voucher information from their printed versions and relegated it to online access only. Recently, *Systematic Botany* changed its format from tables to paragraph form with smaller fonts. Three issues of *Taxon* from 2004 left out voucher information following *AJB*'s distressing example. Unless something is done to stem the tide, and even reverse the flow, it seems likely that other journals will adopt similar policies in the near future. We believe that eliminating voucher data from printed journals is ill advised and reflects a poor understanding of science. The *Editor-in-Chief* of *Taxon* has just reversed *Taxon*'s exclusion of hard-copy voucher information for future issues. But the failure to publish hard copy of voucher information is still the policy of *AJB* and it is under consideration by other journals. It is critical that the issue be clearly understood and discussed before such decisions are made.

The elimination of voucher lists is described as a cost-saving measure. The rationale for this policy is that voucher data are “supplemental”, and their absence, unlike that of figures or tables, does not adversely affect authors' arguments, analyses, or conclusions. Furthermore, advocates argue, electronic access is available world-wide with few exceptions, and the websites hosted by sponsoring scientific societies are acceptable repositories of voucher information. We challenge each of these assertions. While we acknowledge that voucher tables often occupy considerable space and may be expensive to typeset and print, we think that such infor-

mation is integral to the publication and to the very process of scientific research. Separating voucher information from the printed version of the publication effectively eliminates vouchers from consideration. Electronic publication, however laudable as a goal, is neither universally accessible nor guaranteed in the future.

Natural history collections provide a critical service in the housing and maintenance of voucher specimens. A further consequence of this policy of down-grading the importance of vouchers is that natural history collections will find it even more difficult to illustrate the critical role that specimens play in scientific research. This ill-conceived policy will therefore add another hurdle to garnering continued or increased support for collections, at a time when collections worldwide are struggling.

IMPORTANCE OF VOUCHERS

We particularly object to the characterization of voucher information as “supplementary materials”. This implies that this information is not important for the analysis and essentially can be ignored. To the contrary, vouchers tie all experimental results to specific, permanently preserved specimens that can be consulted for correct determination, morphology, locality, ecology, plant and animal associations, and other features. Vouchers are essential for clarifying unexpected results, which may be due to convergence, to misinterpretation of morphological or other data, or—perhaps most commonly—to misidentification. As such, vouchers are the basis of reproducibility, an essential part of the scientific method.

The fate of mid-20th century cytological studies presents a particularly relevant historical lesson. In many groups of plants, chromosome numbers provide basic information that cannot be guessed from external morphology, yet which often carries considerable phylogenetic value. However, the absence of vouchers for literally thousands of early chromosome counts—a majority of all counts made prior to 1965—has rendered those data essentially worthless: the identity of the plants cannot be verified. The enormous effort made by those early cytologists comes to little or nothing at all. To the great

frustration and confusion of biologists then and now, it is impossible to know if disparate chromosome counts from that period represent natural variation—a matter of great interest—or if they simply are wrong, based on misidentifications.

These same issues are of concern today with the current wave of molecular studies. Some investigators collect all of their own experimental material, but most get at least some samples from herbaria, botanical gardens, or other collectors, often as a leaf or two sent in silica gel or even as extracted DNA. Few systematists could tell if the plant sent to them is a species of *Oenothera* or *Camissonia*, or for that matter *Arabidopsis*, if all they receive is a few leaves or extracted DNA. Even when the investigator personally takes material from an herbarium sheet, the identification may or may not be correct. As one respondent to a recent online discussion stated, “Too many molecular systematists have a touching but misplaced faith in the taxonomic skills of those botanists who write plant labels...”. Without vouchers, the enormously costly and time-consuming extractions, sequencing, alignments, and analyses may be worthless, since there can be no serious questioning or reexamination of results and conclusions.

In a recent online discussion Dennis Woodland gave cogent examples: “...25 years ago mycologists began to check on the named host plants of various described plant diseases. If I recall correctly, over 70% of the host species were misidentified”. Woodland also cited an example from neurophysiological research, where results from a study using unvouchered crickets could not be duplicated. The difficulty ultimately was traced to misidentification of the crickets, which had been supplied by a commercial vendor.

Without vouchers, experiments cannot be replicated and there is no way to determine if unexpected results are of great biological interest or are due to misidentification. Vouchers clearly are not “supplementary information” and therefore should be treated as integral parts of all manuscripts.

THE INTERNET

Access to electronic resources is neither universal nor dependable outside of the “developed world”, at least as judged by our experience with correspondents in Africa, Asia, and Latin America. The internet, and the computers and other peripherals needed to use it, are still expensive and/or unreliable for many and in some countries, governments restrict access to the internet. Despite the continued expansion of access, there remain many scientists who are unable reliably to see, much less download, information from the internet. Some who

have access to the internet often cannot print copies because of the expense and time for downloading.

Even in countries where internet access is relatively speedy and reliable, many regular readers of journals (subscribers, in particular) prefer to read the printed version. Some of us are even known to read in locales as yet untouched by Ethernet and telephone cables, such as on public transport, under trees, and on the loo. Even at these times, we feel it necessary to have access to voucher information. Wireless internet will soon encroach on some of these cherished places, but we would like to read the printed versions of our journals, *and* have access to information on voucher specimens. And wireless internet will not alter the problems encountered by the rest of the world.

In defending the policy of placing voucher information solely online, the editors claim or assume that archiving vouchers on a society website is sufficient. There are several reasons why this may not be the case. (1) Currently, there is no standard format for voucher tables in the archives for *AJB* or other journals; we all have had some difficulty reading and printing from the *AJB* archive—tables run off the page, those from recent issues cannot be found, etc. As a result, access to these materials ranges from fair to poor. (2) GenBank is often cited as an excellent example of an online data source, but GenBank does not require voucher information, so it cannot be used as a replacement or even a source of information. More importantly, while GenBank has many limitations of its own, it is a massive NCBI-funded, highly structured institution, and society websites pale in comparison. No one worries much about GenBank being there in 20 or 50 years or about being able to access that material in some reasonable format; the same absolutely cannot be said for online resources posted by societies. Are societies fully prepared to maintain these archives for 20 years? ...50 years? ...in perpetuity? The electronic journal almost certainly will survive in some form or another, but because this does not include the original data—the vouchers—they may or may not survive along with the article in a form that will be of any use. (3) Some authors or readers inevitably will mistakenly infer that once something is relegated to the “supplemental material” section, it is not important and can be ignored. One recent experience with *AJB* will serve as an example. One of us recently received a molecular systematic manuscript from *AJB* for review. The manuscript contained no voucher table, nor even any reference to the vouchers or the source of the experimental material. The authors were contacted by the reviewer and responded that they would be glad to send it, except that they had not yet prepared the table. So *AJB* allowed submission of the manuscript without vouchers, and sent it that way for review. In effect, if not in stated editorial policy, *AJB*

seems to have taken the position that vouchers are extraneous to the publication of scientific results. Will other journals do the same?

IMPORTANCE TO COLLECTIONS

Wrongfully designating voucher specimens as “supplemental” information undermines the ability of herbaria to demonstrate their important role as stewards of plant collections. Any scientific study that includes voucher specimens to document the study organisms (which in our opinion is *most* studies) relies on an institution to accept and archive the specimens. Furthermore, nearly every systematic or phylogenetic paper is ultimately based on specimens.

Because of the importance of collections it behooves everyone publishing articles on plant diversity to concern themselves with the long-term viability of herbaria. Herbaria throughout the world have undergone reductions in staff and services due to budget cuts, and some have even been forced to close and liquidate their collections. For collections to be able to demonstrate that the investment required for their maintenance is small compared to the benefits provided by the specimens, it is imperative that their substantial contribution to science be made highly visible. Only by so doing can we educate and inform researchers, readers, and administrators of the importance of maintaining support to collections.

POSSIBLE SOLUTIONS

We agree that full tables, although useful and easy to read, take up space in journals. There are, however, several possible alternatives. The basic information (plant name, collector and number, herbarium) and minimal geographic location can be printed in paragraph format, using smaller type font, as in the case of *Systematic Botany*. Voucher data could appear as an appendix at the end of the paper in the “white space,” utilizing compressed format with line wrapping and smaller font, as is now being done in *Taxon*. Some types of investigations, such as phylogeographic studies, may require more detailed geographic information. To strike the right balance minimizing the amount of information in the printed version, and maximizing readability in the online version, we urge editors to add a question to their editorial review form that asks “Is the appropriate amount of voucher information presented for both printed and online versions of the manuscript?” Additional format changes are possible, although we do not necessarily favor them. For instance, journals could adopt the compressed literature citation style found in *Science*, or, titles

of publications in the literature cited could be omitted, leaving only the minimum information to make a complete citation (author, year, place of publication). One could save additional space by reducing redundant parts of Materials and Methods that have been published elsewhere. All white space in the journal could be used by starting articles at the end of the previous article rather than at the top of the next page. Any or all of these options would save space (and money), and increase the effective size of the journal, and would do far less damage to the integrity of the scientific research than would the elimination of voucher information.

CONCLUSION

The incoming editor of *AJB* is considering reversing the policy of placing voucher data only online, and the current editor of *Taxon* has changed their new policy effective with the first issue of 2005. We believe these are steps in the right direction. We all take issue with the current *AJB* policies and until the policies are reversed none of us will consider this journal our first choice for a publication. In fact, some of us have chosen to send manuscripts to other journals because of these unfortunate policies. We would encourage others to do likewise. We hope that botanical societies and their journals will be receptive to the needs of their members and authors and reinstate voucher information in the printed version of the journals.

At the recent *Botany 2004* meeting in Utah one attendee remarked that it would be better to leave out the “discussion” section in the paper than the vouchers since the discussion “will soon be outdated” but the voucher information will always be important. While this may sound extreme, the speaker made a valid point: vouchers are critical to understanding and interpreting data and should not be considered supplemental. If the voucher information is placed only in online archives, it unacceptably limits access to the information and creates the risk that the data could be forever lost. We think that just when morphology is making yet another comeback we are excluding some of the critical information from the printed versions of the papers and devaluing the very collections that provide the basis for morphological, molecular, and other data.

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