

## Editorial Policy Should Require Voucher Specimens!

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As the age of biotechnology looms brighter, scientists may forget that the spots on their two-dimensional polyacrylamide gel electrophoresis plate were actually derived from an organism! Correct and verifiable identification of the organism that produced the chemicals represented by those spots is of primary importance to both the immediate and the future significance of the information on the plate. Only through properly preserved specimens and cultures can future workers confirm which species of plant, animal, fungus, bacterium, protozoan, virus, viroid, or

spiroplasma belonged to which spots.

As scientists, we should always be playing "I doubt it!" and consider what evidence will be necessary in the future to verify the identity of the organisms involved in our experiments and discoveries. Anatomical, genetic, or physiological studies cannot be replicated exactly unless the isolates used in the original study can be reexamined. Deposition of voucher specimens and cultures in recognized institutions is crucial for future reference to these research organisms. Without voucher specimens, research reports about an organism, whether characterizing an enzyme or recording a new disease, are almost worthless and at best are not verifiable.

A voucher specimen can take many forms: living culture, dried culture, dried specimen with or without the host, host with symptoms only. If an organism can be identified only in descriptive terms, so be it. In any case, it is crucial that future workers be able to reexamine a specimen of the organism on which the research was performed, either to verify the identification in order to make a more accurate determination or to conduct further research on that particular entity.

In the literature there are incidents where the existence of a voucher specimen clarified an ambiguous statement or cleared up what otherwise would have remained a mystery. For example, dwarf bunt on wheat (*Tilletia controversa*) was thought to have spread rapidly "after its discovery" in 1952 but had actually been around for some time, being regularly misidentified as just another specimen of *T. caries* (Conners, I. 1954. Can. J. Bot. 32:426-431). Voucher specimens can also clear up problems caused by geographical confusion and ambiguous common names, as pointed out by John McCain, assistant curator of the Arthur Rust Herbarium, Purdue University, in a letter to me quoted here: "I once found some tropical rusts in our herbarium filed under *Michigan* because someone had not realized 'Mich.' could also be the Mexican state of Michoacan. This type of mistake might easily happen in an index and, once started, could be hard to stop without a voucher. One great Wisconsin vegetable pathologist once erred in that some people in this part of the U.S., especially Hoosiers, refer to red peppers as 'pimentos,' so he reported that the rust of the true pimento tree (*Pimenta*, Myrtaceae) could attack *Capsicum* (Solanaceae). Recently, some South American authors feared that this rust was quite dangerous with a wide host range, because it could attack both families, so this little slip almost led them into very shaky theories and research. We tell our students that the scientific method works by independent reverification of results by other scientists. In some

areas of plant pathology, the only way to 'repeat an experiment' is to examine a voucher specimen or culture. The mere fact of getting something published is not proof enough."

The resources for depositing voucher specimens are available to all research scientists. The American Type Culture Collection accepts living cultures that are of interest to the scientific community, particularly any culture about which something has been published. The ATCC takes great care to store the cultures in conditions that will allow as little alteration as possible during long-term storage. Depositing a culture is free, and depositors may obtain their cultures back from the ATCC free of charge at any time. Considering the expertise and expense involved in long-term maintenance of living cultures, the ATCC's charge for supplying cultures is minimal and we, as research scientists who pay thousands of dollars for our equipment, should include in our research budgets the relatively inexpensive costs of obtaining the organisms on which we work. According to the Code of Nomenclature, a newly described fungal species must be based on a dried specimen deposited in a recognized herbarium such as the National Fungus Collections. New species based on living cultures must be typified by a dried culture. The NFC accepts free of charge all fungal specimens of scientific importance, and any specimen may be obtained on loan free of charge. Both the ATCC and the NFC make considerable effort to ensure that their specimens are maintained and cared for carefully and permanently and that their specimens are available for future workers located anywhere in the world. I have used the American Type Culture Collection and the National Fungus Collections as examples of recognized institutions where voucher specimens and cultures may be deposited because those are the institutions with which I am most familiar. Certainly there are many other institutions throughout the world where specimens may be deposited and maintained in perpetuity. I advocate only that voucher specimens and cultures be deposited somewhere!

Some curators and caretakers of herbaria and culture collections take it upon themselves to solicit voucher and type specimens. These requests are usually favorably answered. The researcher is often unaware of the importance of voucher specimens and cultures but once made aware sees the value of such specimens. Occasionally, cultures and specimens have been lost by the time an article is published, and it is not possible to verify or voucher the identification of the organisms involved. In my opinion, the responsibility rests on research scientists to guarantee the future value of their work. Each scientist should be acutely aware of the necessity for ensuring repeatability and verification of the work. This means accurate identification, as accurate as possible given the taxonomic state of that particular group of organisms, and the deposition of voucher specimens and cultures so that future workers can verify and/or update the identification.

In order to ensure the repeatability and reliability of reports on the characteristics and occurrence of plant pathogens, I recommend the editors of *PLANT DISEASE* and *Phytopathology* require that: 1) all organisms referred to in an article or report be supported by voucher specimens or cultures deposited in a recognized institution and 2) the author name that institution in the article or report. Such a policy would be difficult to enforce. Occasionally, an author forgets a promise to deposit type or other specimens, and the responsibility is left to a conscientious curator if the specimen is ever to be deposited. This activity is not the responsibility of the curator but lies rather with the author. Despite the unenforceability of this policy, inclusion of this requirement in the instructions to authors would create an awareness of the necessity and importance of voucher specimens that does not at present exist in the plant pathology community.