How are your standards?

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When developmental biology was primarily a science of morphological description, the standardization of animals was not critical. The descriptions themselves implicitly identified the subject organism even if the investigator's formal identification was incomplete or erroneous. Now, developmental descriptions are at the molecular level and the approach is analytical, with the result that reports do not inherently include the types of information needed to reconstruct accurate identification, even though variations at the molecular and the subcellular levels can be of great significance in ultimate interpretations.

Misidentification, however, is not the sole source of variation and many sources can be listed with a few moment's thought, although others may not come to mind immediately. In the literature, there is much evidence that few use adequate measures to guard against inadequate standardization as a source of variation. Such measures involve action both before and after the conduct of an investigation.

Before the investigation it is axiomatic that the species and the source be identified. Afterward, the publication should include this information. But how often are either of these done, and are they enough?

Those who use the mouse, rat, or drosophila are conditioned to specify the strain. Only occasionally do they name the source of the animal or the method of care. These are considered to be inherent in the strain designation or are "such standard procedures" as not to require elaboration! Those who use other organisms seldom do more than provide a species name. Authoritative documentation of this identification is seldom given. Sources are almost never cited or, if commercial, are downplayed, apparently for fear of seeming to advertise. Specifics on care are even less frequent.

To the extent that developmental biologists still examine isolated phenomena rather than attempt to produce a unified understanding of the development of any specific organism, such laxity may be tolerable. But even isolated phenomena such as fertilization, induction, etc. do vary and we have much evidence that variation exists not only between species but also between populations and individuals. In addition to genetic differences, individuals may vary because

of nutritional state, disease history, and status as regards reproductive, seasonal and age-dependent cycles and eggs and embryos reflect parental variation caused by such factors. These parameters of variation must be known and controlled if our results are to contribute to a unified understanding of the development of "an organism" in sufficient depth to permit us to control that development. The debate on the extent of similarity between genome donor and cloned progeny reflects this.

Generation of control over these parameters for frogs is one of the objectives of the Amphibian Facility. Initially we had hoped that, once we had mastered problems such as redleg, the development of inbred and standard strains would be quite straightforward. We have learned, however, that multigenerational control of reproduction is complex for a frog such as Rana pipiens. It follows a complicated life cycle as a result of its adaptation to environmental cycles with great seasonal extremes. Thus, under culture and without hibernation, reproduction can occur within 8 to 12 months in comparison to the 24 or 36 months required in nature. How may we objectively evaluate when a specific individual is ready to reproduce? How may clutch number influence development? Developmental defects among the progeny of some animals suggest that nutrition of the female has a marked influence on the development of her eggs. How is this reflected in molecular and cellular properties at the early stages of development? These observations and thoughts lead us to skepticism about controversies among developmental biologists who do not seem to behave on the assumption that variation is the rule and that it arises from many internal and external sources.

It behooves us to attempt to maintain standards as tightly as possible. This requires not only the development of genetically defined strains, not just mutation bearing genealogies, but also control of variation arising from environmental sources. Until the Axolotl Center, the Amphibian Facility, the Louisiana State University Bullfrog Laboratory and the Hiroshima Laboartory of Amphibian Biology have developed the strains and necessary standard procedures, we must do the best we can. This includes not only a full disclosure of the history of the animals in publications reporting their use, but also the retention of voucher specimens as recommended by the Committee on Resources in Herpetology (see Wake, 1975, in bibliography of the accompanying document). Such voucher specimens should represent the group of animals from which materials were collected for study. Such voucher specimens permit verification of identification and continued value of the data even when systematists change the formal names of the animals in question. To conserve such materials might seem onerous to the developmental biologist, but the major museums are increasingly willing to serve as the repositories for voucher specimens.

In such facilities the specimens have value in addition to that for which they were initially used, and, by this multiple use, can contribute to our efforts to conserve natural resources.

Much of this issue of the Axolotl Newsletter is devoted to the distribution of "Sources of Amphibians for Research. II." In addition to providing information on the sources of amphibians, often of species which are normally inaccessible to developmental biologists, its presentation of a standard terminology for animal quality consitutes part of an effort to add meaning to the citation of origins when data is published. While this standard terminology is not a final answer because it does not include the season, disease history and nutritional status of the animals, it should lead to improved designation of animal quality and, hopefully, to actual improvement in the quality of animals which are used. Note also that the text gives recent information to help identify the leopard frogs, and the warning must be emphasized that dealers may not provide this identification and may even mix the species.

Also given is information on new housing units for small animals. The wide adoption of a standard unit of this type would greatly reduce the variation generated by the hodgepodge of holding facilities now in use. Are your animals exposed to plasticizers and to uncontrolled bacterial populations harbored in inadequately constructed enclosures? A second benefit of their use is that current estimates are that between receipt and use, whether for teaching or for research, between 25 and 50% of amphibians are lost, and only a few animals are held for multiple use, e.g., strip eggs for research, then use for physiology or anatomy class. As biologists we must be concerned for such conservation of our natural resources. Indeed, the cost of these enclosures is quickly recovered because the reduction in lost animals soon results in the reduced cost for research and teaching animals.

The price list for animals from the Amphibian Facility is also attached. Recent renovations of the Amphibian Facility have resulted in a capacity for increased production. We are in a particularly favorable position to provide tadpoles at almost any season, and are willing to help in whatever way we may. We particularly invite all those who are users of the Axolotl Newsletter to visit the Amphibian Facility in Ann Arbor should they find occasion to be in the vicinity. It would help, of course, if you gave us a warning.

ADDENDUM to "Sources of Amphibians for Research. II".

Already there are additions to "Sources II".

a. Animals of Distinction
Rt. 4, Box 241
Fort Pierce, Florida 33450
Att: Bob Roth
Tel: 305-465-2092

Aganychnis callidryas redeye tree frog
Smilisca baudini masked or blotched tree frog
Triprion petasatus casque head tree frog
Hyla s. staufferi golden tree frog
Phrynohyas venulosa marbled tree frog

b. The Shed
6932 N.W. 46th St.
Miami, Florida 33166
Att: Joe Beraducci
Louis Porral
Tel: 305-542-3484

Bombina orientalis fire bellied toad
Triprion petasatus casque headed treefrogs
Agalychnis callidryas red eyed tree frog
Rana pipiens (albino) leopard frog
Megophrys nasuta Asian horned frog
Atelopus varius poison arrow frog
Eleutherodactylus inopatus Haitian forest frog
Phrynohyas venulosa marbled tree frog
Smilisca baudini Central American tree frog
Pyxicephalus delalandei puddle frog
Pyxicephalus adspersus African bullfrog
Bufo alvarius Colorado River toad
Xenopus laevis (albino) African clawed frog
Hyla gratiosa barking tree frog
Hyla versicolor gray tree frog
Hyla septentrionalis Cuban tree frog
Bufo cognatus Great Plains toad
Bufo speciosus Texas toad
Scaphiophus hammondi western spadefoot
Pleurodeles waltl ribbed newt
Salamandra s. terrestris European salamander
Typhlonectes natans aquatic caecilian
Dermophis mexicanus Central American caecilian

c. Zoological Imports and Products, Inc.
400 E. Warren Lane
Inglewood, California 90302
Att: Paul A. Benson
Tel: 213-677-1202
Cable: "TELIMPO"
Telex: 686112

Ambystoma maculatum spotted salamander
Ambystoma t. mavortium barred tiger salamander

Ambystoma tigrinum tiger salamander
Notopthalmus v. viridescens red-spotted newt
Siren i. intermedia eastern lesser siren
Taricha granulosa rough-skinned newt
Dendrobates sp. red and brown arrow frog
Hyla cinerea green tree frog
Hypopachus mulleri Muller's sheeps frog
Kaloula pulchra asiatic painted frog
Megophrys nasutus asiatic horned frog
Rana adspersa burrowing bullfrog
Rana pipiens leopard frog
Rachophorus l. leucomystax Thailand gliding frog
Smilisca phaota C.A. green tree frog
Bufo alvarius Colorado River toad
Bufo garmani spotted toad
Bufo poweri garden toad
Bufo quericus oak toad
Bufo melanostic black spiny toad
Bufo paruus banded legged toad