



Let's Get Something Straight

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Taxonomy: What's in a Name? Doesn't a Rose by Any Other Name Smell as Sweet?

Carl Linnaeus, also known as Carl von Linné (Carolus Linnaeus) was born May 23, 1707 and lived to January 10, 1778. Linnaeus was a Swedish botanist, physician, and zoologist who laid the foundations for the modern scheme of nomenclature and, not coincidentally, is also considered one of the founders of modern ecology; he is known as the “father of modern taxonomy.” He was the son and grandson of churchmen and raised to be a minister, but early in his life he decided that botany was more interesting. After doing research on the sexual reproduction of plants, he decided to attend medical school, eventually rising to the Chair of Medicine and then the Chair of Botany at Uppsala University. Whether he realized it or not, his desire was to organize things – plants, animals, even minerals. He liked things “neat” and he was not satisfied with the unwieldy names used at that time for biological

entities (“*Physalis annua ramosissima, ramis angulosis glabris, foliis dentato-serratis*” do not exactly roll off the tongue). He brilliantly and consistently applied to all sorts of living things what we call “binomial nomenclature,” a system that had been developed by Gaspard (or Caspar) and Johann Bauhin almost 200 years earlier, but Linnaeus used it consistently. It is a “neat” system, and a useful one. For example, there are more than 800 000 recognized species of insects on earth, more than all the other plants and animals combined. Of these 800 000, nearly half are beetles; thus, one fifth of the 1.5 million recognized species are beetles! As J.B.S. Haldane said, “God has an inordinate fondness for beetles.” How to sort out all this? Linnaeus showed us the way.

In the system Linnaeus created, partly logic, partly biological, Kingdoms are the broadest categories of taxonomic organiza-

tion. Based on increasing levels of divergence, there are phyla (singular: phylum), classes, orders, families, genera (singular: genus) and species. Groups of organisms at any of these ranks are called “taxa” (singular: taxon) or “taxonomic groups.” The “binomial” aspect provides latinized names at all levels, the most commonly used being the genus and species levels, such that we have *Homo sapiens* for the human, *Canis familiaris* for the dog, and so on. Each species of mammal, bird, insect, plant, etc. has its own name, so that one cannot confuse a human and a dog, irrespective of whether they both could be classified as “land mammals”.

Stephen Jay Gould, an American paleontologist, evolutionary biologist, historian of science and baseball fanatic, who, with Niles Eldredge, developed the theory of “punctuated equilibrium,” said “Taxonomy (the science of classification) is often underval-

ued as a glorified form of filing – with each species in its prescribed place in an album; but taxonomy is a fundamental and dynamic science, dedicated to exploring the causes of relationships and similarities among organisms. Classifications are theories about the basis of natural order, not dull catalogues compiled only to avoid chaos.”

If, by now, taxonomy is a branch of biology, rather than a necessary peculiarity, why do so many otherwise intelligent people have so much difficulty understanding and applying it? I do not know, but I am certain that many scientists have a nonsensical indifference to it, even going as far as responding irately to this necessity for neatness.

Good scientists are somewhat compulsive about most subjects within their areas of expertise. There realistically is not much information available about anything, and much more we need to know. Of course, we will never be satisfied with the amount of available information and nowadays it takes knowledge and energy simply to have access to information and to keep it organized for easy retrieval. Computers are useful, as are files, book shelves, table tops, boxes, floors, and walls. Whatever it takes!

Whereas taxonomy, the hierarchical classification of living things, is certainly not for the obsessive-compulsives among us, it is beyond neat. Taxonomy

is a rational method for putting things in order so that we can understand where something fits (or does not fit) with other things. We could classify mammals as sea mammals and land mammals, fish as large or small, rodents as edible or inedible, etc. but what good would that be?

Most people, that is people who find that organization is more functional than is disorganization, put their lives in order in ways that are helpful to them. They arise at a certain time, go to bed at a certain time, separate the knives, forks, and spoons in drawers, choose certain days to shop, leave themselves notes, and make lists of things “to do,” and then prioritize the items on the lists.

Whereas one can use any type of organizational system that works, one cannot simply go about renaming genera and species for one’s personal convenience. That would be counterproductive because no one else would know what you are talking about. The taxonomic system currently in use is a universal system, not one that varies from place to place. For example, you can call your dog “Bruno” and then change it to “Kurjaky” and no harm is done, except to the poor dog. However, the genus and species of “Kurjaky” (or “Bruno”) remains *Canis familiaris*.

If one captures a deer mouse in a trap, one has captured a deer mouse (genus *Peromyscus*, spe-

cies *maniculatus*), not a *Peromyscus maniculatus*. One cannot capture a species because taxa are non-concrete entities; they do not exist, except as names on lists that certain people retain. Concrete entities are real. They have substance. They can be picked up or dropped on the floor. They can be weighed and measured. Their genomes can be sequenced. Studies of them can be funded. One cannot sequence the genome of a species because species do not possess genomes; they do not “possess” anything. Thus, there is a huge difference between the process of (for example) identifying viruses or bacteria using one or a few diagnostic properties, and the process of creating virus taxa using a combination of many properties.

A common name of an entity is the name that is normally used and the one that therefore should be used, and the binomial name is used to classify that entity, so that we do not confuse dogs and cats, fish and birds, smallpox virus and West Nile virus, and other things that have some characteristics in common but which are, in fact, only distantly related. If your child went outside to kick a football and you wanted her or him to come home for dinner, you would not shout “Come to dinner, *Homo sapiens*”. You could do that, but you might also have representatives from the local mental health department knocking

gently on your door. Rather, you call the child's name; her or his species is irrelevant for day-to-day conversations.

Personally, I do not care for organization. At the national level, it provides too much opportunity for malevolence. However, I like things "neat". A teacher of mine said, "Everything in its place, and a place for everything."; she was correct. Whether taxonomists get things right, whether they have every living thing in the exact place it belongs, whether you agree or disagree with the current taxonomic style or the current taxonomic placement of your favorite species must not matter. What matters is that you know where things belong within the hierarchy. Keep in mind that "neat" does not at all indicate "correct."

Of what real use is taxonomy? Is it simply a manifestation of compulsive behavior? When we have placed our favorite organism or animal or plant or other in a taxon are we better off than we were before? Who uses taxonomy? Everyone rational. Physicians in emergency departments triage injured people based on the patient's need for or likely benefit from immediate medical treatment. Psychiatrists name the many, different (if not completely distinct, ie, "subtypes") and various psychiatric disorders that afflict humans, so that they will not be confused one for the other because, if confused, they may be treated im-

properly. Plumbers have names for the parts of a sink, so that the correct part can be placed in the correct place. Indeed, everyone categorizes – as unimportant, necessary, familiar, warm, tasty, comfortable, safe, dangerous, or otherwise – everything. That is why we have dictionaries, laws, and judges to determine their extents, departments, societies, and opinions. However, to make lists and to categorize is insufficient for science. We need to know not only whether things are related, but how they are related and to what they are related.

Ignoring proper taxonomy is ignoring not only history but the similarities and differences between living things, and to ignore the evolutionary aspects of classification and choose chaos over neatness. Virologists, bacteriologists, parasitologists, mycologists, mammalogists, ornithologists, ichthyologists, and just about everyone else sort their subjects of study and separate them into related categories. To do otherwise or to not sort things and then try to make sense of the resulting pile of unrelated items may be a first indication of the need for psychiatric help. People who collect postage stamps, coins, books, beer bottles, autographs, or any of hundreds of other things know what I mean; many of these people are otherwise normal.

When you write a scientific manuscript about your favor-

ite deadly disease agent, rest assured that you do not have to be a taxonomist. The first time you mention your microscopic friend, provide the genus and species names and then never mention them again. It is really simple and it adds depth to your paper. The reader immediately knows in which section of the brain to store this information and can then move on to read your paper with greater understanding. Taxonomy is one way in which you let the world know you know what you are doing. Taxonomy may not be important in the grand scheme of things, but it is useful. The insightful brilliance of Carl Linnaeus has provided for us a platform to discretely distinguish entities and to do so in a manner that allows and provides for neatness.

Further reading

- Calisher CH and Mahy BW. Taxonomy: get it right or leave it alone. *Am J Trop Med Hyg.* 2003;68:505-6
- Fauquet CM, Mayo MA, Maniloff J, Desselberger U, editors. *Virus Taxonomy: VIIIth Report of the International Committee on Taxonomy of Viruses.* San Diego (CA): Elsevier, Inc.; 2005.
- Van Regenmortel MH. Virus species, a much overlooked but essential concept in virus classification. *Intervirology.* 1990;31:241-54.
- Van Regenmortel MH, Mahy BW. Emerging issues in virus taxonomy. *Emerg Infect Dis.* 2004;10:8-13.
- Van Regenmortel MH, Maniloff J, Calisher CH. The concept of virus species. *Arch Virol.* 1991;120:313-4.
- Bauhin, Caspar. Available from: <http://www.goldcanyon.com/Patten/html/9.html>. Accessed: April 11, 2007.
- Carl Linnaeus (1707-1778). Available from: <http://www.ucmp.berkeley.edu/history/linnaeus.html>. Accessed: April 11, 2007.