PNIS EDITORIAL

Guide to understanding scientific writing. II. Common Phrases (Part 1: the Latin ones)

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Prologue: *Reading a scientific paper can be daunting and frustrating, especially if you are unfamiliar to the various conventions of scientific writing. This multipart series of articles is designed to introduce the virgin reader to these idiosyncrasies and decrease communication barriers between science and the public.*

We continue our guide to scientific writing by explaining many of the phrases that are commonly used in the scientific literature, but which may not be readily interpretable by the layperson. As most of these phrases are only observed in articles and rarely uttered in common conversation[1], we believe they deserve a detailed explanation here. [For previous satirical takes on popular scientific phrases, see Graham (1957) and Kritchevsky and van der Wal (1960).]

Many commonly used phrases are Latin, a symptom of many scientists' desire to think of themselves as bilingual (or even multi-lingual, as, for instance, when a German scientist uses Latin phrases in a British journal with French abstracts). Other popular phrases typically show up in parenthetical asides that good scientific writers use to deflect concerns regarding their own methodology. These concerns are usually brought to their attention during peer review, and scientists would rather not deal with them because they have a grant to write and the college hasn't given them a TA this semester. In this Part 1, we focus on the Latin phrases. The non-Latin common phrases will be covered in Part 2.

As before, we have ordered these phrases based on their frequency of use according to a Google Scholar search (see here for more details).

in vivo (3.13 million results), *in vitro* (3.11 million), *in situ* (2.41 million), *in utero* (0.35 million)

What do they mean? – *In vivo* literally means "in the living[2]" , *in vitro* means "in glass", *in situ* means "in position", and *in utero* means "in the uterus".

How are they used? – Typically, these phrases refer to the physical location that a scientific experiment has been conducted: *in vivo* means that an experiment was conducted using the entire organism in order to determine the organism's whole response to some manipulation (these experiments often do not turn out well for the organism); *in vitro* means that the experiment was isolated from the organism (usually conducted in a test tube or petri dish), and *in utero* means that the experiment was conducted in the uterus (as a point of reference for relationship-challenged scientists, generally it is considered poor form to request that someone allow you to conduct your experiment

1 This is probably a good thing. For instance, it is not recommended to respond "the results were qualitatively similar" when your partner asks you how a night of passionate love-making went.

2 Translations provide by the Merriam-Webster Dictionary

in their *utero*). The phrase *in situ* has many specific meanings across scientific disciplines, but generally means a study took place in a "natural" place (e.g., studying fish behavior in a natural lake).

Why are they used? – Primarily so that scientists don't come off as being a bunch of sadists. Consider the following paired descriptions of the same studies:

1a. We performed *in vivo* measurements of the effects of lead poisoning on *Rana pipiens*.
1b. We fed some frogs a pile of lead shavings.

2a. The effects of lead on the heart tissue of mice were evaluated *in vitro*.
2b. We cut the hearts out of living mice, chopped the hearts up into little pieces, and immersed them in a stew of Frankenstein-ien chemicals designed to keep heart cells functional for a few days. Then we added in piles of lead shavings.

3a. We assessed the effects of *in situ* lead contamination on a fish community.
3b. We found a nice natural lake in Canada with a healthy fish community. Then we dumped in piles of lead shavings. Fish died.

4a. The effects of lead were measured *in utero*.
4b. [Nope, not even going to write that one.]

Even if the latter descriptions may more accurately describe what scientists are doing, the former examples are the descriptions almost always used. Somewhere, Cormac McCarthy is shaking his head.

Sensu **[632,000 total; includes *sensu lato* (121,000), *sensu stricto* (116,000), and *sensu amplo* (244)]**

What do they mean? – The basic *sensu* means "in the sense of", with the more specific phrases offering additional context. *Sensu lato* means "in the broad sense", *sensu stricto* means "in the strict sense", and *sensu amplo* means "in a relaxed sense".

How are they used? – *Sensu* is mainly used alone when authors want to reference a concept or method that was defined or conceived by another author. For example, if author Smith is eviscerating rats using a method previously described by author Jones as "gut cutting", Smith would write, "rats were eviscerated by gut cutting (*sensu* Jones 1999)." Somewhere, Cormac McCarthy is smiling approvingly.

Sensu lato and *sensu stricto* are mostly used when discussing the classification of species. For example, monkeys *sensu lato* might include species that are not monkeys, but which might, in some circles, be called monkeys, such as apes, chimpanzees and orangutans, while monkeys *sensu stricto* only includes species that fit the actual definition of monkey. *Sensu lato* is therefore a handy way for the scientist to say "fuck it, I'm calling it whatever I want." Authors using *sensu lato* in this way are both precise *sensu lato* and dedicated to clarity *sensu lato*.

What about sensu amplo*?* – As you can see from the statistics above, *sensu amplo* ("in the relaxed sense") is almost never used in scientific writing. This is likely because scientists are too uptight and never refer to anything in a relaxed sense. Maybe if they pulled those sticks out of their asses, they could *sensu* fucking *amplo*.

Ad libitum **(333,000)**

What does it mean? – "at one's pleasure".

How is it used? – Out of all the things that one could do at one's pleasure, it is perhaps revealing that in scientific writing *ad libitum* is used almost exclusively to refer to the diets of experimental animals, and, more specifically, to denote that food was given to them whenever it was observed that they needed more food. When you go away on vacation for a couple of days and leave an automatic food dispenser for your cat, you are feeding it *ad libitum*. This usage is so common that only about 20% of Google Scholar entries for ad libitum do not specifically refer to animal diet[3].

Well, other than for food, what else do researchers use ad libitum *for?* – Smoking and alcohol consumption make up a good chunk of the non-diet related applications of *ad libitum* (e.g., smoke if you got 'em). Then, there are random-yet-scientifically-interesting entries, such as *ad libitum* tooth brushing, *ad libitum* sleeping, and *ad libitum* sunscreen application.

That's it? There's no other way that scientists use ad libitum*, a phrase which literally means "at one's pleasure"? (<wink>)* – I think I see what you're getting at. No, to our knowledge, scientists haven't looked at any effects of *ad libitum* sexual intercourse. Well, unless you were talking about non-human *ad libitum* sex, in which there's quite a lot of (link, link, link). Sometimes, it's good to be a lab rat.

3 Based on a search of: "ad libitum" –food –fed –diet –dietary -feeding