

COMMENTARY

'Ome Sweet 'Omics-- A Genealogical Treasury of Words

By Joshua Lederberg and Alexa T. McCray

"So intricate and inscrutable a mystery is the origin of language that in 1866 the French Society of Linguistics formally banned further research on the subject."

--J. H. Dirckx, 1977. (*Dx + Rx: A Physician's Guide to Medical Writing*)

Genomics and *Proteomics* are the buzzwords of the dawning millennium. There is no counting of www-ics.com and www-ix.com sites to be found on the Web. That most of these terms, old and new, have been contrived as slogans to attract attention, does not diminish their likely substance, and they are embedded in the advancing edge of science and technology. Defying the French Linguists' caveat, we may yet ask, where do terms such as *genome* and *genomics* come from? What do the suffixes *-ome* and *-omics*, so abundant in today's vocabulary, signify?

The *Oxford English Dictionary* (*OED*) attributes *genome* to Hans Winkler, 1920; the full reference is his book *Verbreitung und Ursache der Parthenogenesis im Pflanzen- und Tierreiche*, (Verlag Fischer, Jena). At page 165, he writes (in rough translation): "I propose the expression *Genom* for the haploid chromosome set, which, together with the pertinent protoplasm, specifies the material foundations of the species" He discusses this in the context of hybrids that may comprise distinctive genomes from the respective parents, and are then *heterogenomatisch*. The term was used sporadically in the 1920s and 1930s--Theodosius Dobzhansky scorned it; he would have preferred a "non-committal expression like 'set of chromosomes.'" (1937--*Genetics and the Origin of Species*)

The *OED* also offers an etymology, that Winkler's *Genom* is an irregular formation from *gen* + *some*--from chromosome--and this is recopied in many other sources. *OED* scholarship can rarely be contested, but it has to be challenged here: the story is more interesting, though it must be conjectural for want of specific documentary evidence from Winkler or his contemporaries. As a botanist, Winkler must have been familiar with a host of *-ome* words like *biome*, *rhizome*, *phyllome*, *thallome*, *tracheome*--all of which predated 1920. They share in common, the concept of *-ome* signifying the collectivity of the units in the stem. Thus *rhizome* is the entire root system, or modifications thereof. Any zoologist would have known *coelome*, or system of cavities. Hence, *genome* would be understood to be the collectivity--dare we say the genre--of the genes.

Genomics was introduced 24 years ago by Victor McKusick and Frank Ruddle, as the catchword for the new journal of that name they had just founded. It has the same narrower connotation today, of emphasis on linear gene mapping and DNA sequencing. Hence we also see flanking extensions like functional genomics and structural genomics, to widen the horizon of genomic studies to what resembles the overall medley of genetics of yesteryear, albeit with all the power of high technology.

Our favorite sources on scientific terminology include Roland W. Brown's *Composition of Scientific Words*, 1954 (but often reprinted), and W.E. Flood's *Scientific Words*, 1961. Brown offers: "-ome: < Gr, -oma, signifying condition, having the nature of." Brown also remarks how "words, when they make their debut in scientific or literary society ... should be simple, euphonious, pure and mnemonically attractive." *Genome* does qualify on all counts.

Flood says: "-ma Gk. ... produces a noun often expressing the result of a verbal action" Thus drama, panorama, plasma, edema, cinema. He also cautions that starting from sarcoma, the medical profession has co-opted the *-oma* suffix to signify an overgrowth or neoplasm of any specified tissue.

Finally, a Sanskrit-speaking friend offers that "-OM signifies fullness, completeness as in divinity ..., it encompasses the entire universe in its unlimitedness." Ωμ, with its endless intonation, is then redolent with the Ω, the greatest and the very last character in the Greek alphabet. What could resonate more with today's *-ome* terms!

In physics, probably starting with Faraday's ion, cation, anion, the *-on* suffix has tended to signify an elementary particle, later materially focused on the photon, electron, proton, meson, etc., whereas *-ome* in biology has the opposite intellectual function, of directing attention to a holistic abstraction, an eventual goal, of which only a few parts may be initially at hand. The accompanying table illustrates a number of prevailing examples. It includes Lederberg's own recent coinage of *microbiome*, to signify the ecological community of commensal, symbiotic, and pathogenic microorganisms that literally share our body space and have been all but ignored as determinants of health and disease.

The very neolexical process evokes some provocative analogies: our individual minds interact to constitute human culture, which we can relabel as the *noöome*, to take a leaf from Teilhard de Chardin.

Joshua Lederberg is professor-emeritus and Sackler Foundation Scholar at The Rockefeller University. He chairs the Editorial Advisory Board of The Scientist. He has played the neological game himself with entries like plasmid, exobiology, euphenics, and prototroph. Eugram (for what is now called E-mail) never caught on. Alexa T. McCray is the director of the Lister Hill National Center for Biomedical Communications. She is a linguist by training and inclination.

antigenome	immunogenome	plastidome
bacteriome	immunome	plerome
basidiome	haptenome	proteinome
biome	karyome	proteome
cardiome	leptome	psychome
caulome	microbiome	regulome
chondriome	mnemome	rhabdome
cladome	mycetome	rhizome
coelome	neurome	stereome
epigenome	odontome	thallome
erythrome	osteome	tracheome
genome	pharmacogenome	transcriptome
geome	phenome	trichome
hadrome	phyllome	vacuome
histome	physiome	

Listed above we present a lexicone of terms, suffixed by *-ome*, extracted from the MEDLINE database, the *OED*, and the *Web of Science*. Our aim was to select terms using the *-ome* suffix in the sense of this article. For the most part this excludes the suffixes *-tome*, *-stome*, *-some*, *-drome*. Some terms are best known as the *-omics* derivative. Today, we should assume that further derivations are no longer from Greek or Sanskrit, that the *-ome* idea is borrowed from the multitude of terms already ensconced into English or the scientific lingua franca. Most of these terms are already in print; almost all should be self-revealing; a few are conjectural. Guess which of these *-omes* were made up only just now; even for these, there may well be an **-omics.com** to match.

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