Naming extraterrestrial life

SIR — The fields of extraterrestrial life, extrasolar planets, origin of life, theoretical biology, interstellar travel and communication, extraterrestrial intelligence and civilization, and SETI have no generally accepted collective nomenclature. Suggestions include astrobotany, astrobiology, bioastronomy, astropalaeontology and astroarchaeology, cosmobiology (unfortunately linked to astrology), and biocosmology, bioastronautics, space biology, planetary biology, intellexobiology, and exosociology, each of which fails as a general term in taking as axiomatic that intelligence, technology and civilization require life or society, an arguable and imprudent assumption. The acronym SETI (Search for Extraterrestrial Intelligence) excludes biology and is inelegant.

Exobiology¹ is similarly flawed and is not universally accepted. Astronomy and Astrophysics Abstracts lists subject categories for extraterrestrial civilizations, intelligence and life, but not for exobiology. Physics Abstracts treats astrobiology and exobiology as minor keys to extraterrestrial life. NASA Thesaurus and International Aerospace Abstracts list all to avoid confusion. Many STAR Abstracts "exobiology" entries pertain to aerospace medicine, while the survival of Earth-life in space and life in the Solar System are also included under "extraterrestrial life". Further confusion is possible because "exobiology" has been coined by taxonomists to refer to future biology, in particular the prospects for a purely genotype-based biological taxonomic system². Xenobiology³ axiomatizes life, hence also fails. The most suitable word must be least limiting, suggesting the rootless forms exology and xenology.

Exo-/ex- (Greek or Latin, outside of, outer, outer part) words customarily describe a spatially displaced familiar, as in exogamy, exogenetic, exoplasm and exoskeleton. This does not reflect the necessity for the extraterrestrial entities under study not to be native to Earth. Xeno-/xen- (Greek, xenos, strange, a stranger, foreign) emphasizes the unfamiliar or foreign regardless of physical location, as in xenobiosis, xenogamy, xenogenetic and xenomorphic, hence is more appropriately applied to extraterrestrial studies. Further, ex-/exo- prefixes are already etymologically over-extended. My survey of 117 dictionaries and encyclopaedias published during 1959–79 reveals that exo- is 2.4 times more common than xeno-, and ex- occurs 97 times more often than xen-. No xen-/xeno-term is common, so xeno-neologisms are less likely to resemble existing words than exo- terms, which include some of the most common words in English⁴. The almost-

virgin xeno- prefix should be used to designate extraterrestrial entities (for example, xenobiont), concepts and subdisciplines (for example, xeno-biology, xenosociology), and exo- reserved for life outside of but native to Earth as in human space colonies.

A.G.W. Cameron (personal communication, 1979) claims "xenology" describes the study of xenon isotopic anomalies in rocks. Xenology in this sense was first coined by Reynolds⁵, but subsequent papers by him do not refer to the new term. Xenology also does not appear in the texts of papers citing Reynolds during 1969–79, and none of 17 papers on xenon meteoritic radiochronology selected randomly from this period mentions the new word in its text. (A better term is xenonology⁶.) Xenology was not used as a subject category by eight leading geological sciences abstracting services during 1963–79, nor in any physics, aerospace, NASA or geological sciences dictionary surveyed. Clearly Reynolds' neologism has negligible currency in the literature, whatever its informal status, so xeno- should not be considered pre-empted for extraterrestrial studies.

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1. Lederberg, J. *Science* **132**, 393–400 (1960).
2. Cowan, S.T. *A Dictionary of Microbial Taxonomy* (Cambridge University Press, 1978).
3. Heinlein, R.A. *The Star Beast* (Scribner, New York, 1954).
4. Heinlein, R.A. & Wooster, H. *Science* **134**, 223–225 (1961).
5. Reynolds, J.H. *J. geophys. Res.* **68**, 2939–2956 (1963).
6. Trimble, V. *Rev. mod. Phys.* **47**, 877–976 (1975).

What is life?

SIR — In the issue of 10 November 1982, (p.10), there is a letter from Dave Perry of Glasgow setting forth the view of the Catholic Church on the origin of life. I should like to point out that from the viewpoint of the legal profession, the beginning of life is implicit in the definition of the end of life which many jurisdictions accept: namely the cessation of electrical activity in the brain. If the end of such activity represents the end of life, then the beginning of such activity must represent the beginning of life.

There is, to the best of my knowledge, no reliable information available as to the time of onset of electrical activity in the brain, although I suspect that David Woolam of Cambridge has approached the problem.

It would seem that the subject should be investigated since the law appears to be thrusting a problem at science which has inadequate data to solve it. I would imagine that the religious community might also regard such research with some interest.

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UCCA admissions

SIR — The leading article in your issue of 25 November 1982 (p.302) contains the statement "... their (the universities') willingness to delegate the selection of the students whom they will teach to a computer centre in Cheltenham is a proof that they are only half serious". There is no such delegation and the statement is utterly false. One of the hallmarks of British university admissions is that they are conducted efficiently through a communications system (located in the office in Cheltenham) which leaves the decisions about admissions entirely in the hands of the admitting institutions.

The universities are entitled to expect a higher level of factual accuracy than this from Nature: to perpetuate such a grotesque and ill-founded inaccuracy destroys trust in the article as a whole.

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UCCA protests too much; the obvious point of the offending sentence is that too many universities make too little use of the responsibility left "in their hands". Editor Nature.

Naming problems

SIR — You published a letter (Nature **300**, 212; 1982) from an M.C. McKenna of the American Museum of Natural History commenting that the gender of nouns and pronouns in Chinese "remains confusing". McKenna states that the "Mr" Qi in the 16 September issue of Nature (p.200) should actually be "Mrs" Qi. May I ask why it should not be "Ms" if we are truly speaking about gender and not marital status? Furthermore, how are we to assess the gender of M.C. McKenna who gives as few clues to the gender of M.C. as we ordinarily have about Chinese personal names?

Finally, with the adoption of the pinyin system of transliteration by the Peoples' Republic in 1979, hyphens are no longer used in romanization. Thus, the only way for a foreigner unfamiliar with Chinese to discern which name is the family name and which is the personal is the rule of thumb that the personal name is usually (but not always) two syllables and the family name one. All in all, I find McKenna's comments out of date both in fact and in social niceties.

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