

Received knowledge

SIR — Nomenclature is not always easy or interesting for biologists. We prize our terms, perpetuate private jokes in naming proteins, seek importance through obfuscation. It's hard to get too worked up about such matters; they contribute character to our field. On the other hand, clarity and precision are among the virtuous aims of most of our endeavours, so it seems appropriate to mention that the naming of membrane-spanning proteins is approaching a crisis.

For instance, adrenergic receptors are becoming known as 'adrenoceptors', which seems to reduce the word receptor beyond sense. The literature also reflects a desire to describe groups of membrane receptors by the number of times the proteins traverse the membrane. Thus, we have 'single transmembrane spanning receptors' and 'seven transmembrane spanning receptors'.

Recently, some of our colleagues, tongue-tied by such phrases, have resorted to alternatives. 'Seven transmembrane spanning receptors' have been termed 'serpentine receptors'. While this usage conjures up the overall shape of such proteins, it does not distinguish among membrane proteins that may be equally serpentine but that have other than seven transmembrane spans, it risks confusion with the mineral of the same name ($Mg_3Si_2O_5(OH)_4$) and it might even appear to suggest some devious receptor activity *à la* Satan and Eve of biblical fame. Moreover, I fear that such usage will encourage blatant anthropomorphizing and that we will shortly have elephantine or obese receptors (large aggregates, such as the nicotinic cholinergic receptor) and phallic receptors (those, such as the EGF receptor, that penetrate the bilayer once). Enough.

How about a system that draws on an established logic, such as the numerical prefixes used to describe polygons and polymers, in combination with the word 'span', a single traversal of the membrane? Thus, a seven transmembrane spanning protein would be a 'heptaspan'. Such a system would be more precise than adjectives such as serpentine and would avoid the ambiguity of the awkward phrase seven transmembrane spanning receptors in which it is not clear whether seven refers for the number of transmembrane spans or the number of receptors. I propose that we simply combine common numeric prefixes (mono, di (and do), tri, tetra (or quadra), penta, hexa, octa, nona, deca, and so on) with span to create

descriptors for groups of membrane spanning proteins. A few examples:

No. of spans	Noun (Adjective)	Example
1	Monospan (monospanning)	Many growth factor receptors, such as the EGF receptor
7	Heptaspan (heptaspanning)	G-protein-linked receptors, such as the β -adrenergic receptor
12	Dodecaspan (dodecaspanning)	Adenylyl cyclase

This scheme is based on words that convey precise numeric meaning and that most scientists already know. My experience is that after a few tries dotriacontaspan (132 spans) will roll off the tongue as readily as hemisemidemi-quaver.

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Credit where due

SIR — I was both intrigued and disturbed to read Bob Ward's letter concerning publication rights of the student (*Nature* **368**, 579; 1994). Whether true or not, these comments strike at the heart of the student-supervisor relationship, and perhaps a viewpoint from a different perspective may be worthwhile.

First, I regard it as the responsibility of the supervisor to provide an environment in which the student can learn how to perform research and to think for him or herself, while engaged in a programme of research. It is the responsibility of the student to take advantage of those opportunities.

Second, I suggest that in most scientific disciplines the student-supervisor relationship is based less on conflict and more on teamwork in which the supervisor acts as team leader. Thus, where a research programme is supported by a grant, the team leader (supervisor) will probably have had to provide a detailed proposal of research in which the basic ideas, objectives, methods and likely outcomes of the research are presented. From this perspective, the team leader carries the responsibility for the research programme.

Finally, perhaps students could be permitted to submit the results of their research for publication provided that (1) they have financial support independent of a research proposal submitted by the supervisor, (2) the students define the project, perform and interpret the work and write the papers themselves, (3) the institute at which the students perform the

research, and which has a legal responsibility for these students, sanctions publication and finally (4) the students accept full responsibility for the content of the papers. In the sciences in general, the responsibility for a research programme more commonly rests with the supervisor, and the most direct way of expressing that responsibility is by having that person's name associated with the results of that programme in the open literature.

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SIR — The inclusion of supervisors' names on research publications by graduate students is an issue that has been examined closely in preparing for the next Funding Council's Research Assessment Exercise (RAE) to be undertaken in 1996. The funding councils have now completed their review of the responses to the joint consultation and expect to publish a framework document in June outlining the arrangements planned for the 1996 exercise. I am sure that Ward (and others) will be pleased to see that it is proposed that, for the next RAE, publications by research students can be included even if not co-authored by the supervisor, provided the work can be identified as a genuine outcome of a supervised study.

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Carnot fils

SIR — The review of *The Refrigerator and the Universe* (*Nature* **368**, 598; 1994) is almost as baffling as the second law. Could the swashbuckling Carnot (1753–1823) pictured by the founder of thermodynamics? Hardly, for he died a year too early. It is, of course, Lazare Carnot, the 'Organizer of Victory' of the French Revolution, who took time out, in 1795, to beget his illustrious son (it will always be a mystery how this associate of Robespierre and St Just avoided the guillotine, except that he ran the army). As to the author of the second law, curiously described here as Nicolas Carnot: true he was baptised (assuming baptism was practised in Paris in 1796) Nicolas-Léonard Sadi, but he has been universally known as Sadi Carnot (1796–1832). To keep things completely straight, the fourth president of the Third Republic, Marie-François Sadi Carnot (1837–94) was Sadi Carnot's nephew, and Lazare's grandson.

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