PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

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Phil. Trans. R. Soc. Lond. B 1988 **320**, 237-238
doi: 10.1098/rstb.1988.0073

Phil. Trans. R. Soc. Lond. B **320**, 237–238 (1988) [237]
Printed in Great Britain

A comment on nomenclature and abbreviations

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Recently, attempts have been made to harmonize and simplify the nomenclature and abbreviations for inositol derivatives of biological importance, chiefly lipids and a variety of isomeric phosphates. The simplest suggestion was made by participants at the 1984 Chilton Conference (Agranoff *et al.* 1984). They proposed reducing the relatively cumbersome IUB/IUPAC-recommended abbreviations (e.g. PtdIns(4,5)P_2 for phosphatidylinositol 4,5-bisphosphate, and Ins(1,4,5)P_3 for inositol 1,4,5-trisphosphate) to much simpler and easily spoken alternatives (PIP_2 and IP_3 for the above compounds). This proposal was simple and attractive at the time, but it was immediately rendered obsolete by the discovery of inositol 1,3,4-trisphosphate, which would have had to share a Chilton abbreviation with inositol 1,4,5-trisphosphate from which it is derived. To add to this potential confusion, we now have to contend with a minimum of three inositol tetrakisphosphate isomers. Following this meeting, we must also have distinct abbreviations for phosphatidylinositol 3-phosphate and phosphatidylinositol 4-phosphate: they cannot share PIP. 'Modified Chilton' systems that retain the brevity implicit in using an initial P to represent 'phosphatidyl' and I to represent 'inositol' have since been used in some publications (e.g. PI(4,5)P_2 for phosphatidylinositol 4,5-bisphosphate, and I(1,4,5)P_3 or (1,4,5)IP_3 for inositol 1,4,5-trisphosphate). However, these are cumbersome to speak and have important disadvantages. 'I' is the accepted abbreviation for inosine, which also forms phosphate derivatives that have their own abbreviations (e.g. ITP), and bad typing often confuses I with 1; and, at least for the lipids, a capital P has two meanings within a single abbreviation, namely phosphatidyl (which should be a roman capital P) and phosphate (which should be italic).

We therefore decided that we would edit the abbreviations in all papers in this meeting to conform to the IUB/IUPAC recommendations: we hope the result is unambiguous. We have also attempted, wherever possible, to include locants in abbreviations only when the structures of particular compounds are reasonably certain. For example, the non-committal abbreviation InsP_3 is used whenever an unidentified InsP_3 isomer or an unresolved InsP_3 fraction from chromatography is referred to. A problem that has recently become acute is that strict application of the IUB/IUPAC rules can lead to confusing changes in numbering as compounds traverse a metabolic pathway. For example, the chemically correct name for the major InsP_2 formed from Ins(1,3,4)P_3 (D-inositol 1,3,4-trisphosphate) is L-inositol 1,6-bisphosphate rather than the much more readily understood Ins(3,4)P_2 (D-inositol 3,4-bisphosphate). However, an IUB/IUPAC recommendation is now under active consideration that would relax the strict rule outlined above and allow all biologically relevant compounds of inositol to be numbered as D-inositol derivatives: the abbreviation Ins would then mean D-*myo*-inositol (and L-inositol derivatives would be named fully at every mention). Where necessary, this new convention has been followed by our authors.

A point on which there is so far no agreement, and one on which we as editors took no stand, is choice of the most appropriate name (and derived abbreviation) for the receptor-activated

phospholipase C that hydrolyses PtdIns(4,5)P_2 (and possibly also PtdIns4P and/or PtdIns). Almost all of the available names are used by one or other of the authors: these include phosphoinositidase C (PIC) (Michell *et al.*; Downes *et al.*); polyphosphoinositide phosphodiesterase (PPE-PDE) (Cockcroft & Stutchfield); phosphatidylinositol 4,5-bisphosphate-specific phospholipase C (PtdIns(4,5)P_2-PLC) (Pouysségur *et al.*); phospholipase C (PLC or PL-C) (Rittenhouse *et al.*; Somlyo *et al.*; Busa; Berridge *et al.*; Payne *et al.*). A major part of the problem is that there is no agreement on the precise substrate specificity of the particular enzyme species concerned. This enzyme appears to be membrane-bound and primarily or exclusively to hydrolyse PtdIns(4,5)P_2 when activated by a G-protein (through a receptor, a GTP analogue or a fluoroaluminate). However, it may be capable of hydrolysing other inositol lipids if they are offered appropriately and/or when activated by a less physiological stimulus, and there are widespread and closely related cytosolic enzymes that do catalyse these other reactions. Of the names above, the most non-committal and most popular is 'phospholipase C'. It is also the least satisfactory, in that there are many entirely different phospholipases C (notably, though not exclusively, from bacteria). Moreover, this name ignores the undoubted specificity for inositol lipids of the mammalian enzymes. A choice from among the more precise names (PIC, PPI-PDE and PtdIns(4,5)P_2-PLC) remains difficult, given the unresolved question of precise substrate specificity, but those that retain a suggestion of attack on membrane phospholipids seem preferable to 'phosphodiesterase': to most biochemists, the latter term is likely to suggest a nucleotide-based substrate rather than attack on a membrane lipid.

The confusion over phospholipase terminology is further exacerbated by the existence of bacterial phospholipases specific for phosphatidylinositol and its glycan derivatives (but not capable of attacking PtdIns4P or PtdIns(4,5)P_2) and a newly discovered mammalian glycosylphosphatidylinositol-specific phospholipase. These appear only in Saltiel's contribution, where they are abbreviated as PI-PLC and glycosyl-PtdIns phospholipase C, respectively, to distinguish them from the other enzymes discussed above.

Another usage on which our authors are inconsistent is in naming G-proteins, either with or without subscripts (e.g. Gp or G_p). This may not be a trivial point when abbreviations for stages of the cell cycle appear in the same article, as in Pouysségur *et al.* For example, the G-protein G_o (or Go) could readily be confused with cells at the G0 (or Go) stage, and similar confusion might be generated by G1 (or G_1) and Gi (or G_i).

Reference

Agranoff, B. W., Eisenberg, F. Jr, Hauser, G., Hawthorne, J. N. & Michell, R. H. 1984 Comment on abbreviations. In *Inositol and phosphoinositides: metabolism and regulation* (ed. J. E. Bleasdale, J. Eichberg & G. Hauser), pp. xxi–xxii. Clifton, New Jersey: Humana.

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