

## Concepts out of Context : The Pied Pipers of Science

BY DR. N. W. PIRIE, F.R.S.

*ABSTRACT* of Paper read on 23rd April, 1951

The more useful and illuminating a concept or generalisation is in the field in which it was originally proposed, the more dangerous it may be in other fields if it is too easily assumed that it is also applicable in them. Three examples illustrate this : Species, Purity and Efficiency.

The system of classification devised for the metabionta by Linneaus is so satisfactory that efforts are often made to classifiy bacteria and viruses in the same way and to organise them into genera and families defined by binomials. Linneaus based his classification on pure morphology long before the evolutionary origin of species was accepted but we now see that it is this evolutionary origin that gives the system its logical justification. Each species has a unique history and the classification, to some extent, defines it. It is uncertain that bacteria have a similar evolutionary origin and it is very improbable that viruses have. What seems to be the same virus may have appeared several times and in more than one way. It is therefore misleading to try to use the species concept in virus classification ; they should be classified as proteins are, or will be. This means that many alternative groupings of equal validity are possible. Because of the absence of that unique system of interconnections that evolution has given the metabionta, we can define our species and classification as well in terms of one set of observations as of another and we already have enough evidence to see that the systems arrived at will be different.

The concept of purity is not only definable for small molecules but it is demonstrable because the minimum change in the number and nature of the component atoms is a significant proportion of the whole. As our interest turns to larger molecules the minimum theoretical difference becomes a smaller percentage of the whole and differences become first hard to demonstrate and then theoretically indemonstrable. The mechanism used by the cell to make large molecules probably does not turn out a series of identical replications but makes particles that are distributed about a series of modes. We can postulate an ideal particle. When any measurement is made on a preparation supposed to contain particles like it a clear statement should be made of the amount of deviation from the ideal that could have been present and escaped detection by the method of measurement used. Purity is a quantitative and not an absolute property of a preparation. Preparations free from demonstrable heterogeneity but which are of such a nature that true homogeneity cannot be demonstrated might well be termed Homogeneous.

It is natural to assume that a structure or substance in an organism is doing something and to arrange experiments to see what it is doing and what advantage the organism gets from its presence. The assumption really being made is that Nature is efficient and that useless structures would not survive. When a heavy drain in metabolites is involved this is probably true of any organism with a long evolutionary history but there is no reason to think that there would be any selective weeding out of useless trivialities. The concept of efficiency is thus valuable but quantitative and even grossly inefficient mechanisms may well survive if they are not a significant drain on the organism.

The use of concepts derived from other sciences is unavoidable and it is probable that there is considerable advantage in the "cross fertilisation" of the sciences that thus goes on. But we should be on our guard lest the uncritical acceptance of a concept leads us to accept false conclusions and to overlook potentially valuable lines of approach. A concept, like the music of the Pied Piper, may be followed willingly to our disadvantage.