

DISPUTANDA

The Words 'Protist' and 'Protista'¹

Problems of nomenclature are often vitally connected with problems of experimental science. The field of experimental microbiology is being increasingly affected by concepts on the evolution of microorganisms. It is the application of such ideas to our experimental work that has led us to consider the following nomenclatural problem.

In recent years the word 'protist' and the group name 'Protista' have come to mean different things to two groups of workers. The confusion that inevitably arises from this fact impairs the usefulness of these terms. Since we feel that they will serve a valuable function if general agreement as to their meaning can be realized, we propose to describe and explain the area of disagreement and to suggest a solution.

In 1866, HAECKEL first used the term 'Protistenreich'² or 'Protista'³ for a 'kingdom' of primitive, mostly unicellular organisms, to be distinguished from 'Pflanzenreich', or 'Plantae' (= metaphytes + certain multicellular algae) and 'Thierreich', or 'Animalia' (= metazoa + certain protozoa). In the Protista, HAECKEL recognized eight 'Stämme' or phyla, which ranged from the 'Moneres'-later (1868) emended by him⁴ to 'Monera' (including bacteria along with some hypothetical and misinterpreted 'primitive' forms)—to 'Spongiae', or 'Porifera' (consisting of the sponges). Later, in 1894⁵, he elaborated his classification extensively, but the bacteria remained near the base of his phylogenetic tree of the Protista. Although the exact composition of the Protista has varied according to the worker, the group has, by and large, been treated by most in essentially the Haeckelian sense and has therefore included the bacteria. This is true, for example, for the German journal *Archiv für Protistenkunde*, which began in 1902—although it has, to be sure, tended to concentrate on the higher protists.

All would probably have been well, had it not been for the decision of COPELAND⁶ in 1938 to restrict the 'kingdom Protista' to primitive organisms above the level of the bacteria and blue-green algae and to segregate these latter two groups as a separate, more primitive 'kingdom Monera'. This 'kingdom' was accepted by STANIER and VAN NIEL⁷, and there has thus grown up a usage in which by 'protists' and 'Protista' is meant all unicellular (and some of the simpler multicellular) organisms except the 'monerans'⁸. In the mean-

time, COPELAND himself⁹ has abandoned the kingdom names Monera and Protista and replaced them with Mychota Enderlein, 1917, and Protoctista Hogg, 1860, respectively.

One of us (E.C.D.) has recently¹⁰ been using the words 'protist' and 'Protista' in the early (1938) sense of COPELAND; but we now feel that such restriction is ill-advised and accordingly urge the general acceptance of the words essentially in their Haeckelian sense (with certain minor modifications that increased knowledge might be expected to render inevitable). This does not mean, however, that we propose abandonment of the words 'moneran' and 'Monera'. Actually we hold that it would be useful to recognize three grades of protists and accordingly suggest the following nomenclature: *lower protists*, or *monerans* (bacteria and blue-green algae); *intermediate protists*, or *mesoprotists* (red algae); and *higher protists*, or *metaprotists* (all higher organisms except metazoa and metaphytes).

These groupings express what we feel to be successive, basic advances in the evolution of primitive organisms; and we believe them to be monophyletic. Members of the first group are to be distinguished from all other living entities by the primitive nature of the nucleus (not lack thereof, as COPELAND¹¹ would have it). The second and third groups, although both possessing more highly organized nuclei of basically similar structure, are distinguished by the primary absence, in mesoprotists, and presence, in metaprotists (except where secondarily lost), of one to many complex flagella (or cilia) having a longitudinal fibrillar structure organized as a central pair of, and a peripheral ring of nine, fibrils, the ring sometimes secondarily multiplied, but almost always in nine groups¹². By present evidence, the bacterial and metaprotistan flagella are non-homologous, the latter being an invention of a progressive group of mesoprotists, now no longer (apparently) in existence.

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Résumé

Les auteurs estiment que l'on devrait employer les mots «Protiste» et «Protista» à peu près dans le sens originel de HAECKEL (1866) – c'est-à-dire pour l'ensemble Bactéries, Algues, Champignons, et Protozoaires – et ne pas en exclure ni les Bactéries ni les Algues bleues-vertes comme l'a fait COPELAND en 1938. Dans ces conditions, l'on peut distinguer trois catégories de Protistes: les *Monères*, ou *Protistes inférieurs* (Bactéries et Algues bleues-vertes), les *Mésoprotistes*, ou *Protistes intermédiaires* (Algues rouges), et les *Métaprotistes*, ou *Protistes supérieurs* (la plupart des Algues, les Champignons, et les Protozoaires).

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² E. HAECKEL, *Generelle Morphologie der Organismen*, 1. Bd. (Reimer, Berlin 1866), p. 203, 204.

³ E. HAECKEL, *Generelle Morphologie der Organismen*, 2. Bd. (Reimer, Berlin 1866), Tafel 1.

⁴ E. HAECKEL, *Jena. Z. Med. Naturw.* 4, 64 (1868).

⁵ E. HAECKEL, *Systematische Phylogenie der Protisten und Pflanzen*, 1. Teil (Reimer, Berlin 1894).

⁶ H. F. COPELAND, *Quart. Rev. Biol.* 13, 383 (1938).

⁷ R. Y. STANIER and C. B. VAN NIEL, *J. Bact.* 42, 437 (1941).

⁸ T. L. JAHN and F. F. JAHN, *How to know the Protozoa* (W. C. Brown Co., Dubuque, Iowa 1949). – P.-P. GRASSÉ, *Traité de zoologie*, tome I, premier fascicule (Masson & Cie., Paris, p. 1 1952). – E. C. DOUGHERTY, *System. Zool.* 4, 145 (1955); *J. Protozool.* 3 (Suppl.), 11 (1956).

⁹ H. F. COPELAND, *Amer. Nat.* 81, 340 (1947); *The classification of lower organisms* (Pacific Books, Palo Alto, California 1956).

¹⁰ E. C. DOUGHERTY, *System. Zool.* 4, 145 (1955); *J. Protozool.* 3 (Suppl.), 11 (1956).

¹¹ H. F. COPELAND, *Quart. Rev. Biol.* 13, 383 (1938); *Amer. Nat.* 81, 340 (1947); *The classification of lower organisms* (Pacific Books, Palo Alto, California 1956).

¹² J. R. G. BRADFIELD, *Symposia of the Society for Experimental Biology*, No. IX (University Press, Cambridge 1955), p. 306.