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A SUGGESTED CLASSIFICATION AND NOMENCLATURE
FOR ORGANISMS OF THE PLEUROPNEUMONIA GROUP

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Recently in reviewing the pleuropneumonia group of microorganisms the need for a nomenclature, agreeable to those working in this field, was stressed (1). However, the existence then of disagreement regarding the relationship of the organisms to bacteria, particularly to bacteria in the L phase, made an attempt at nomenclature seem premature. Freundt (2), Edward (1) and Klieneberger-Nobel (3) had pointed out differences between organisms of the pleuropneumonia group proper and the L phase of bacteria and classified them separately. Dienes and Weinberger (4) and Tulasne (5), on the other hand, suggested that the former might be derived from bacteria through the formation of persistent L phase variants. Tulasne and Brisou (6) have now suggested a classification and nomenclature in which pleuropneumonia-like organisms without a proven derivation from bacteria are placed in one new order Pleuropneumoniales and the L phase organisms are assigned to a second order Bactepneumoniales. Since these workers agree to grouping organisms of the pleuropneumonia group proper separately from the L phase organisms, it would seem useful to suggest a system of nomenclature for the former group that conforms to the International Bacteriological Code of Nomenclature. The position has moreover been further clarified by a preliminary statement published by the Editorial Board of the International Bulletin of Bacteriological Nomenclature and Taxonomy (7), regarding the validity and priority of names for the organisms of bovine pleuropneumonia.

An attempt to classify the pleuropneumonia group now may have the advantage of focussing attention on the organisms and of stimulating study. The settling up of named species may also encourage the detailed study of individual strains for purposes of identification. It is, therefore, proposed to suggest a provisional classification and nomenclature with particular reference to species which have been isolated and studied in this laboratory.

Principles

This classification is based on certain principles. Firstly, it is believed that the organisms of the pleuropneumonia group differ from both bacteria and viruses (1); they are thus assigned to a new order. In Bergey's Manual of Determinative Bacteriology (8) the orders Virales and Rickettsiales are placed as supplements to the classification of bacteria, since their relationships are uncertain. If this scheme is adopted the new order would be included as a third supplementary group.

A number of different organisms of the group have been described; some undoubtedly represent species, but the status of others is more questionable and it may be argued that they should rather be regarded as varieties or serological subtypes. There are no longer in existence strains of some of the species which have been described. Where the original description is inadequate it would seem unwise to include these species in the classification. Even when a species has been defined by as full an examination as is now possible it may be found that in the light of later knowledge such a definition was inadequate. It is thus desirable that for each named species there should be kept in collections of type cultures a representative strain upon which the properties of that species have been based.

Sabin (9) suggested grouping the species into genera according to the animal from which they were isolated. His system of classification and nomenclature has not been generally accepted in spite of subsequent revision (10). Any scheme of classification in which animal host alone determines the establishment of genera is open to objection; every property should be taken into account and particular attention paid to cultural and biochemical properties which form the basis for classifying bacteria. It may be noted that two species of pleuropneumonia-like organisms which have been isolated from cattle differ markedly from each other in their cultural properties. On the other hand, the differences in cultural properties between the organisms causing pleuropneumonia in cattle and goats respectively are negligible and provide no justification for placing the organisms in different genera.

If the pleuropneumonia-like organisms are to be classified into more than one genus, metabolic behavior would

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seem to provide the soundest basis for distinguishing between the genera. However, since at present little is known of their metabolic processes it would seem wise to recognize only one genus. A case might be made for assigning the saprophytic strains to a second genus, but, although their normal habitat is outside the animal body and they can grow on media devoid of serum, this may not represent an absolute difference in growth requirements. The organism of goat pleuropneumonia can grow to some extent without serum.

A proposal to set up a new order to contain only one genus is open to obvious objection, but is regarded as being only provisional. In attempting to classify the organisms at this stage of our knowledge it would seem wisest to err on the side of simplicity, rather than to suggest a more complex scheme which might quickly be found to be undesirable in the light of further discoveries in this rapidly expanding field. New genera can be set up later and existing species assigned to them.

Type Species

The organism of bovine pleuropneumonia would seem the obvious choice as type species. It was the first to be isolated and has been studied the most. Moreover, it has already provided the name by which the organisms of the group have hitherto been known (pleuropneumonia-like organisms). The choice by Sabin (10) of the organism of agalactia as the type species was perhaps unfortunate; its cultural properties had not then been firmly established (1).

The Editorial Board of the International Bulletin of Bacteriological Nomenclature and Taxonomy (7) has recently published a preliminary statement regarding the validity and priority of names for these two organisms. Asterococcus mycoides was the first name given to the organism of bovine pleuropneumonia, (Borrel et al. 1910). The generic name is invalid as it had previously been used to name a genus of algae; the specific epithet remains valid. The first valid generic name given to the organism was Mycoplasma (Nowak, 1929). Subsequently, Wroblewski (1931) suggested Asteromyces for the organism of bovine pleuropneumonia and Anulomyces for the organism of agalactia. Borrelomyces (Turner, 1935) was a later synonym for the genus, the fourth in order of priority. The Editorial Board suggest two alternatives for naming the genus. The first proposal is to ac-

cept Mycoplasma since it was the first legitimate name proposed. The second is to accept Borrelomyces, as other names with priority over it have not found general usage.

If the rules of nomenclature are to be strictly observed there is no doubt that Mycoplasma is the legitimate name. It is true that it has not been generally used, but nor have the other generic names, with the exception of Asterococcus, now found to be invalid. Rule 23 of the Rules of Nomenclature specifically excludes rejection of a legitimate name "because it is inappropriate" or "because another is preferable or better known." There does not seem to be any justification for claiming an exception to this rule in the case of Borrelomyces, which has not been generally used in papers published by workers in this field, in spite of its occasional acceptance, and it would not appear to be a more appropriate name. All the names which might legitimately be considered are unfortunate because they suggest a relationship with the fungi. For Mycoplasma it may be claimed that it has the advantage of drawing attention to one generally accepted property of the organisms, namely, their plasticity.

Name for the Order

The suitability of the name of the order is probably more important than suitability of the generic name, as it is the former which is likely to provide the common name used for the whole group of organisms, distinguishing them from bacteria, viruses and other microorganisms. If the genus is to be named Borrelomyces, it would probably be necessary to accept Turner's (14) suggestion of Borrelomycetales for the order.

The amended Rules of Nomenclature state:-

"Rule 2. Names of all taxonomic groups (taxa) above the rank of family are taken preferably from a combination of characters covering the nature of the taxa as closely as possible, or from a single character of outstanding importance. Recommendation:- Names of orders and suborders may appropriately be based upon the name of a contained family." Thus it is not obligatory to base the name of the order on the name of the type genus; it is, in fact, preferable to base it on an outstanding character. If Mycoplasma is accepted as the legitimate name for the type genus, it is permissible to suggest a new name for the order. Microscopical exami-

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nation of the organisms, including the use of the electron microscope, has shown that they lack a definite cell wall and are bounded only by a plastic membrane. This would seem to be an outstanding character and may be of fundamental importance in explaining some of their cultural and metabolic peculiarities. Mollicutales, based on this characteristic, is therefore suggested as a name for the order.

Tulasne and Brisou (1955) have suggested Pleuropneumoniales as a name for the order. It incorporates "pleuropneumonia" which has provisionally come into general use to provide a comprehensive term for the group, but it would perhaps be unfortunate if a name based on a disease rather than on the organism itself were perpetuated. The type species causes pleuropneumonia but other species do not. Although Pleuropneumoniales has priority over Mollicutales, it is desirable that workers in this specialized field should have some choice from among the suggestions which are now being made as a result of informal discussions between them. In this way it may be possible to arrive at a system of classification and nomenclature which is generally acceptable. The following classification is therefore offered as a suggestion for other workers.

Suggested Classification and Nomenclature

Order Mollicutales ordo nov. Includes all organisms of the pleuropneumonia group, as defined elsewhere (Edward, 1954).

Family Mycoplasmataceae fam. nov.

Genus Mycoplasma Nowak, 1929.

The type species is Mycoplasma mycoides.

Individual species

1. Mycoplasma mycoides (Borrel et al., 1910) comb. nov.
Organism causing contagious pleuropneumonia of cattle.
Representative strain:- N.C.T.C. No. 3278 (P G 1*).

*No. of culture in collection at the Wellcome Research Laboratories.

- Mycoplasma mycoides var. capri (Edwards, 1954) comb. nov. Organism causing contagious pleuropneumonia and other infections in goats. Representative strain:- P G 3*.
2. Mycoplasma agalactiae (Wroblewski, 1931) comb. nov. Organism causing contagious agalactia. Representative strain:- P G 2*. Specific epithet was originally spelt agalaxiae, but agalactiae is preferable (7). Cultural properties described by Edward (1954).
 3. Mycoplasma bovigenitale sp. nov. P strains from cattle (Edward, 1950). Representative strain:- P G 11*.
 4. Mycoplasma spumans sp. nov. strains from dogs (Edward and Fitzgerald, 1951). Representative strain:- P G 13*.
 5. Mycoplasma canis comb. nov. strains from dogs (Edward and Fitzgerald, 1951). Representative strain:- P G 14*. The specific epithet is that used by Shoetensack (1936), but it is no longer possible to determine whether the organism is the same as he isolated.
 6. Mycoplasma maculosum sp. nov. strains from dogs (Edward and Fitzgerald, 1951). Representative strain:- P G 15*.
 7. Mycoplasma hominis comb. nov. Type 1. Human type 1 strains (Edward, 1954). Representative strain:- P G 21*. Type 2. Human type 2 strains (Edward, 1954). Representative strain:- P G 27*.
 8. Mycoplasma fermentans sp. nov. Human type 3 strains (Edward, 1954), based on the cultural and biochemical examination of one strain (P G 18*) isolated by Ruiter and Wentholt (1952).
 9. Mycoplasma salivarium sp. nov. Human type 4 strains (Edward, 1954). Representative strain:- P G 20*. Has

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not yet been compared with strains isolated in America, (Morton et al., 1951).

10. Mycoplasma neurolyticum (Sabin, 1941) comb. nov. Type A and L 5 strains from mice. Representative strain:- L 5 (P G 28*).
11. Mycoplasma arthritidis (Sabin, 1941) comb. nov. L 4 strains from rats. Representative strain:- "Preston" (P G 6*).
12. Mycoplasma pulmonis (Sabin, 1941) comb. nov. L 3 strains from rats (Klieneberger, 1938). Representative strain:- "Ash".
13. Mycoplasma laidlawi (Sabin, 1941) comb. nov. Sewage and other saprophytic strains. Representative strain:- Sewage A (Laidlawi and Elford, 1936), (P G 8*).

Other strains

a) From rats and mice. A large number of strains with different properties has been isolated from rats and mice. They appear to belong to different species, but one species, at least, has been found inhabiting both rats and mice. More work is required to examine and compare strains isolated in different laboratories. In the present state of our knowledge it is largely a matter of opinion how many species should be recognized and named, especially since strains of some of the species that have been described are no longer in existence, although specific antisera may still exist. In this classification three species, M. neurolyticum, M. arthritide and M. pulmonis, have been recognized, each based on the examination of a single existing strain.

b) From fowls and turkeys. Strains have been isolated from fowls and turkeys, particularly in association with infection of the upper respiratory tract, but until these strains have been compared with each other and their properties established it would seem premature to establish a named species.

*No. of culture in collection at the Wellcome Research Laboratories.

c) From other animals. Although pleuropneumonia-like organisms have been isolated from other animals, the strains have not yet been sufficiently described to deserve the status of named species.

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