A Note on the Taxonomic Status of Strains Like 'Campo,' Hitherto Classified as *Mycoplasma hominis*, Type 2

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SUMMARY

The classification of strains similar to *Mycoplasma* strain pg 27 of 'Campo' as *Mycoplasma hominis* Type 2 should be withdrawn. These strains have now been identified as *M. arthritis*.

Nicol & Edward (1953) in an examination of 91 strains of *Mycoplasma*, isolated by them from the human genital tract, showed that all except one belonged in a single species, then termed 'Human Type 1'. An additional 13 genital strains were received from other laboratories. Of these, 9 from three laboratories were found to belong to 'Human Type 1'. A tenth strain was identified as a different species, later to be called *Mycoplasma fermentans*. The other three strains differed serologically from the 'Type 1' and were provisionally classified as 'Human Type 2'. Edward (1954) noted later that the 'Human Type 2' strains produced abscesses in mice when inoculated subcutaneously together with agar. This was a property that 'Human Type 1' strains did not have, but was one shared by certain rat isolates. On the other hand, Ruiter & Wentholt (1952) described abscess formation when their 'G' strain (*M. fermentans*) was inoculated into the foot-pads of mice. Unfortunately, no serological comparison was made at the time between the 'Human Type 2' and the rat strains. Edward & Freundt (1956) suggested a classification and nomenclature for the Pleuropneumonia Group (family Mycoplasmataceae), in which the 'Human Type 1' and 'Human Type 2' strains were regarded as two varieties of a single species, namely *M. hominis* Type 1 and *M. hominis* Type 2, the representative strain of the latter being strain 'Campo' (pg 27), maintained at the Wellcome Research Laboratories. Classification was proposed in this way because the two groups of strains were similar in their biological and cultural properties and apparently had a common source; they differed only serologically. Lemcke (1964) pointed out that strain 'Campo' was indistinguishable serologically, using the complement fixation test, from five rat strains of *M. arthritis*. She therefore suggested that strain 'Campo' should no longer be regarded as a distinct species. *M. arthritis* has been frequently found in rats and was a recognized pathogen for that animal; its natural host seemed to be the rat and thus 'Type 2' strains in man should be regarded as commensals or saprophytic contaminants. Use of the agar-gel double diffusion technique revealed a slight difference between 'Type 2' strains and *M. arthritis*, but not sufficient to justify regarding the former as a distinct species (Lemcke, 1965). In confirmation, Leach (1965, per. comm.) by using the agglutination reaction obtained identical titres in reciprocal tests with both strain

'Campo' (PG 27) and *M. arthritidis* antigens against rabbit antisera to these antigens. In the growth-inhibition test, antisera to strain 'Campo' and to *M. arthritidis* inhibited both strains. In these tests the designated representative strain of *M. arthritidis*, namely strain 'Preston', was used. A re-examination of biological properties failed to reveal any difference between strain 'Campo' and strain 'Preston'.

The evidence is, therefore, that the strains examined in England and originally classified as a Type 2 variety of *Mycoplasma hominis* are strains of *M. arthritidis*, an already established species of Mycoplasmataceae. (Sabin, 1941) *M. arthritidis* is a well-known pathogen of rats and there seems no justification for including *M. hominis* Type 2 among the 'human' species of *Mycoplasma*, although many biochemical studies have been done with 'Campo' and related strains as representative of human *Mycoplasma* (see Hayflick & Chanock, 1965).

There remains the question of the real origin of strains, alleged to have been isolated originally from the human genital tract and now, after much subcultivation, found to be identical with *Mycoplasma arthritidis*. These strains are few. Strain 'Campo' was isolated from a human male urethra about 1939-40. Two lines of this strain were examined by Nicol & Edward (1953): one line was from the laboratory of origin and the other from another laboratory; both behaved similarly. The two other strains with similar serological properties were strain 07 and strain 39. In addition to these strains, which on examination have been shown to belong to *M. arthritidis*, Nicol & Edward (1953) referred to reports of the isolation of ten other strains, isolated from human genital tracts and found to be serologically similar to strain 'Campo'. Bailey *et al.* (1961) also reported two other strains as serologically similar to their strain of 'Campo', one (CH) isolated by them from the human genital tract and the other (sp-1) isolated from a HeLa cell line.

One possible explanation of the 'Campo'-like strains is that they have resulted from laboratory misadventures occurring during their long subcultivation, allowing the replacement of a human strain by a rat strain. Many of the risks encountered in subcultivation are obvious. Moreover, since most species of *Mycoplasma* do not differ from each other significantly in their colonial appearances, a contaminating *Mycoplasma* may be unrecognized and eventually outgrow and replace the original strain. Edward (1950) described the properties of a strain he believed he had isolated from mice, only to discover later (Edward, 1954) that it was identical with the human genital strain he had been maintaining. Freundt (1954) claimed to have made two isolations of *Mycoplasma mycoides* var. *mycoides* from the human genital tract, but these were made at a time when a bovine strain of this species was under study in his laboratory. He noted that the fermentation of mannose was slower with the genital strains than with the bovine strain. Nevertheless the most likely explanation of his genital isolations is that they resulted from laboratory pick-ups. It is perhaps significant that *M. mycoides* has never been isolated from man subsequently, although very many strains have been carefully examined. Lemcke & Csonka (1962) reported that a strain, isolated by them from the external genitalia of a man, had been identified serologically as a mouse strain. A subsequent re-examination of this strain by Dr R. M. Lemcke (personal communication) showed that it was a strain of *M. hominis* (type 1), the original erroneous identification having been made because a mouse strain was under investigation in that laboratory at the same time.

If this theory of contamination is correct, there was, and may still be, a strain of

'Campo' representative of the original genital isolate. This must be borne in mind in considering reports that genital isolates have been found serologically similar to strain 'Campo'. The identity of these isolates and whether they were different from the common human genital species, *Mycoplasma hominis* (type 1), must remain uncertain.

Obviously the alternative hypothesis is that there have in fact been several isolations of *Mycoplasma arthritidis* in the U.S.A. from the human genital tract. Since *Mycoplasma* spp. in general show a high degree of host specificity it would be important to know whether a pathogen of rats could also be commensal or a pathogen for man; further work is highly desirable. The need for a reference laboratory or laboratories is becoming more and more apparent in this now rapidly opening field, to examine isolates of human and animal origin. There is also a need, not only for extending, but also for standardizing the biological tests, such as the determination of haemolysis in blood agar. The differences between strain 'Preston' and strain 'Campo' originally noted by Edward (1954) were not confirmed in a re-examination by Dr R. H. Leach (personal communication). The observations of Somerson, Taylor-Robinson & Chanock (1963) emphasize the difficulties with this test of haemolysis.

The conclusion must be that the classification of strains similar to strain PG 27 of 'Campo' as *Mycoplasma hominis* Type 2 should be withdrawn, since these strains have now been identified as *M. arthritidis*.

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