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Recommended rejection of the names *Malacoplasma* gen. nov., *Mesomycoplasma* gen. 1 nov., *Metamycoplasma* gen. nov., *Metamycoplasmataceae* fam. nov., *Mycoplasmoidaceae* fam. 2 nov., *Mycoplasmoidales* ord. nov., *Mycoplasmoides* gen. nov., *Mycoplasmopsis* gen. nov. 3 [Gupta, Sawnani,

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1 **Title:** Recommended rejection of the names *Malacoplasma* gen. nov., *Mesomycoplasma* gen.  
2 nov., *Metamycoplasma* gen. nov., *Metamycoplasmataceae* fam. nov., *Mycoplasmoidaceae* fam.  
3 nov., *Mycoplasmoidales* ord. nov., *Mycoplasmoides* gen. nov., *Mycoplasmaopsis* gen. nov.  
4 [Gupta, Sawnani, Adeolu, Alnajar and Oren 2018] and all proposed species comb. nov. placed  
5 therein. Request for an Opinion.

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27 **Keywords:** *Tenericutes*, *Mollicutes*, *Mycoplasma*, nomenclature

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29 **Abstract:** The consensus of the members of the International Committee on Systematics of  
30 Prokaryotes' Subcommittee on the taxonomy of *Mollicutes* is that recently proposed sweeping  
31 changes to nomenclature of members of the *Mycoplasmatales*, specifically involving  
32 introduction of the names *Malacoplasma* gen. nov., *Mesomycoplasma* gen. nov.,  
33 *Metamycoplasma* gen. nov., *Metamycoplasmataceae* fam. nov., *Mycoplasmoidaceae* fam. nov.,  
34 *Mycoplasmoidales* ord. nov., *Mycoplasmoides* gen. nov., *Mycoplasmaopsis* gen. nov., and all  
35 proposed species or subspecies comb. nov. placed therein, should be rejected because they  
36 violate one or more essential points of the International Code of Nomenclature of Prokaryotes.  
37

38 Since its inception, the International Code of Nomenclature of Prokaryotes ("the Code") [1] has  
39 emphasized the importance of type material as a reference to be used when considering the  
40 identity of specimens. Nomenclatural types permanently bear the name of the taxon. The  
41 names that are to be used must conform to the Code's rules regarding valid publication,  
42 legitimacy, and priority of publication to ensure that each taxon bears only one correct name  
43 [Code Principle 8, "Each order or taxon of a lower rank with a given circumscription, position,  
44 and rank can bear only one correct name, i.e., the earliest that is in accordance with the Rules  
45 of this Code."] The correct name also requires a given circumscription, which is an indication of  
46 the limits of the taxon [Code Principle 8, *Note 2 (i)*, "By circumscription is meant an indication of  
47 the limits of a taxon..."]. Such circumscription is reasonably expected to reflect the phenotypic  
48 potential and ecology of the strains in the taxon [2,3].

49  
50 Competing systems of nomenclature are not new for genus *Mycoplasma* and related members  
51 of the orders *Mycoplasmatales* and *Entomoplasmatales* [4]. The determinative characteristics  
52 used over the past century to circumscribe about 200 of those species lead to significant  
53 paraphyly and polyphyly in later 16S rRNA gene sequence-based systematics [5]. The most  
54 striking example is the situation of *Mycoplasma mycoides* subsp. *mycoides* strain PG-1<sup>T</sup>, the  
55 nomenclatural type of genus *Mycoplasma*, hence family *Mycoplasmataceae*, order  
56 *Mycoplasmatales*, and class *Mollicutes*. In a 16S rRNA gene sequence-based framework, *M.*  
57 *mycoides* subsp. *mycoides* and a few closely related *Mycoplasma* species and subspecies  
58 constituting the "mycoides cluster" sit amid other genera correctly placed in family  
59 *Entomoplasmataceae* of order *Entomoplasmatales*. The historical basis for this anomaly is well-  
60 understood but it has been impractical to resolve [4,5]. Most recently, Gupta et al. [6,7]  
61 attempted to address it through retrospective searches for signature core genomic indels,  
62 signature amino acid sequences, or concatenated amino acid sequences of selected members  
63 of the class *Mollicutes* that might justify the sweeping nomenclatural revisions necessary to

64 attain comprehensive monophyly within these orders. Eight of the new names proposed  
65 subsequently appeared on Validation Lists in IJSEM [8,9] and so became subject to Request for  
66 an Opinion.

67  
68 The International Committee on Systematics of Prokaryotes' (ICSP) Subcommittee on the  
69 taxonomy of *Mollicutes* reviewed the work of Gupta et al. [6] during its 2018 meeting [10]. The  
70 core genome sequence-based taxonomic framework was viewed as being entirely consistent  
71 with the existing polyphasic taxonomy of *Mollicutes* and a significant vindication of many  
72 decades of work by mycoplasmologists. It showed how a whole genome-based taxonomy of  
73 *Mollicutes* may be achievable eventually if the approach can be independently replicated and  
74 refined to accommodate multiple genomes per species, additional taxa, and the well-recognized  
75 critical role that horizontal gene transfer has played in the evolution of many members of the  
76 class. However, the consensus opinion of the Subcommittee members is that the proposed  
77 nomenclatural revisions [6,7] are at the present time an unnecessary over-reach verging on  
78 taxonomic vandalism. It is highly doubtful the nomenclature proposed will ever be adopted,  
79 either on practical grounds involving the names of major pathogens currently regulated in  
80 medicine and agriculture by international laws, or by the community of specialists based on one  
81 or more of the following eight essential points in nomenclature as emphasized in the Code.

82 Aim at stability of names. The Preface ("While the Code regulates nomenclature, one of  
83 its main goals is to maintain stability in names...") and the primary essential point of the Code's  
84 very first Principle ("Aim at stability of names.") both stress the great importance of preserving  
85 validly established names. Gupta et al. [6,7] rename about 40 extant species in various genera  
86 and introduce 11 new taxa to accommodate them throughout various levels in the hierarchy of  
87 *Mollicutes*. Because the original names would retain standing in nomenclature such that either  
88 name could be used [6], the changes would destabilize the nomenclature for microbiologists  
89 and regulatory agencies who actually use these names to refer to living organisms for practical

90 purposes. This retreat toward the past, when some species of *Mycoplasma* had as many as five  
91 different names [5], can be expected to further isolate theoretical systematists from applied  
92 microbiologists. In addition, because the proposed scheme of nomenclature depends in part on  
93 genomic differences as minor as a single indel, and only a single genome sequence was  
94 analyzed for each of these rapidly-evolving species, frequent nomenclatural amendments may  
95 be necessary to maintain monophyly as has already been experienced by Gupta et al. [7].

96 Avoid or reject the use of names which may cause error or confusion. The next essential  
97 point of the Code's first Principle is, "Avoid or reject the use of names which may cause error or  
98 confusion." Further, in Chapter 3 the Code's Rule 56a(5) states, "A name may be placed on [the  
99 list of rejected names (*nomina rejicienda*)] for various reasons, including the following... A  
100 **perilous name** (*nomen periculosum*), i.e. a name whose application is likely to lead to  
101 accidents endangering health or life or both or of serious economic consequences." Many of the  
102 proposed comb. nov. names [6] refer to species that are very important in medicine or  
103 agriculture. Examples include *Mycoplasma* ("*Mycoplasmoides*") *genitalium*, *Mycoplasma*  
104 ("*Metamycoplasma*") *hominis*, *Mycoplasma* ("*Mycoplasmoides*") *pneumoniae*, *Mycoplasma*  
105 ("*Mycoplasmopsis*") *agalactiae*, *Mycoplasma* ("*Mycoplasmopsis*") *bovis*, *Mycoplasma*  
106 ("*Mycoplasmoides*") *gallisepticum*, *Mycoplasma* ("*Mesomycoplasma*") *hyopneumoniae*, and  
107 *Mycoplasma* ("*Mycoplasmopsis*") *synoviae*. Avian and bovine mycoplasmosis are World  
108 Organisation for Animal Health (Office International des Epizooties; "OIE")-listed notifiable  
109 diseases (<http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2019/>) and are also  
110 notifiable in many states in the US. The risk of confusion between *Mycoplasma*,  
111 *Mesomycoplasma*, *Metamycoplasma*, *Mycoplasmopsis*, and *Malacoplasma* seems very high.  
112 Medical errors and confusion with respect to diagnosis, treatment, and prevention and control of  
113 diseases that endanger life or health of humans and animals, and to the application of  
114 international laws that govern transportation, import/export, and quarantine of microorganisms  
115 or infected individuals, with potential serious economic consequences, are highly likely to result

116 from attempts to replace the well-established and universally recognized name *Mycoplasma*.  
117 *Mesomycoplasma*, *Metamycoplasma*, *Mycoplasma*opsis, and *Malacoplasma* are *nomina*  
118 *periculosa* that will detract from understanding also by the non-scientific public.

119 Avoid the useless creation of names. According to Principle 1 of the Code it is also  
120 essential to "Avoid the useless creation of names." The proposed names [6] provide no benefit  
121 to the large majority of basic and applied microbiologists or regulatory agencies who are most  
122 concerned with the phenotypic potential or ecology of the strains. Only the smallest minority of  
123 specialists, cladists who pursue monophyly in all things, may have use for them. On balance,  
124 this contravenes Principle 1.

125 The purpose of giving a name to a taxon is not to indicate the history of the taxon.  
126 According to Principle 4 of the Code, "The primary purpose of giving a name to a taxon is to  
127 supply a means of referring to it rather than to indicate the characters or the history of the  
128 taxon." The principal goal of the nomenclatural revisions proposed [6,7] was to attain  
129 comprehensive monophyly within the *Mycoplasmatales* and *Entomoplasmatales*. To achieve  
130 this, numerous comb. nov. were created with no purpose other than to signify a presumed  
131 history of descent from a common ancestor. This contravenes Principle 4.

132 The name of a taxon should not be changed without sufficient reason. Principle 9 of the  
133 Code states, "The name of a taxon should not be changed without sufficient reason based  
134 either on further taxonomic studies or on the necessity of giving up a nomenclature that is  
135 contrary to the Rules of this Code." Nothing about the extant nomenclature is contrary to the  
136 Code. The Subcommittee does not dispute that the nomenclatural changes proposed are based  
137 on new studies, but the majority of members are united in judgment that the findings are clearly  
138 not sufficient to justify those changes for any other than cladistic purposes, which are far  
139 outweighed by more important practical reasons to avoid nomenclatural destabilization and the  
140 risk of errors and confusion that the new names introduce. On balance, this contravenes  
141 Principle 9.



142           Avoid names that are very long or difficult to pronounce. The primary advice of Chapter  
143 3, Recommendation 6 of the Code is, "Avoid names or epithets that are very long or difficult to  
144 pronounce." *Metamycoplasmataceae* and *Mycoplasmoidaceae* are long names and awkward to  
145 pronounce.

146           A name is not validly published if it was proposed in anticipation of the future acceptance  
147 of a particular circumscription. The Code's Rule 28b states, "A name or epithet is not validly  
148 published in the following circumstances... (2) It was merely proposed in anticipation of the  
149 future acceptance of the taxon concerned or the acceptance of a particular circumscription,  
150 position, or rank for the taxon which is being named or in anticipation of the future discovery of  
151 some hypothetical taxon." Despite their presence on Validation Lists [8,9] serious doubt remains  
152 among the community of specialists represented by the Subcommittee regarding acceptability of  
153 the circumscriptions given by Gupta et al. [6,7]. As stated above, the analyses remain to be  
154 independently replicated, and there is serious concern that frequent nomenclatural amendments  
155 may be necessary as the approach to circumscription is refined to include multiple genomes  
156 within species, additional taxa, etc.

157           A change in the name of a taxon is not warranted by an alteration of the diagnostic  
158 characters or of the circumscription. The renaming proposed [6,7] is based entirely on selected  
159 diagnostic characters of the genomes (indels, coding sequences, etc.) that are used to alter the  
160 extant circumscriptions. This plainly contravenes Rule 37b of the Code, "A change in the name  
161 of a taxon is not warranted by an alteration of the diagnostic characters or of the  
162 circumscription."

163  
164 For these reasons, as anticipated only to a limited extent by Gupta et al. ("...the possibility exists  
165 that in the future Requests for an Opinion will be submitted to the Judicial Commission of the  
166 International Committee on Systematics of Prokaryotes, proposing to place some of the new  
167 names on the list of *nomina rejicienda*..." [6]) the Subcommittee on taxonomy of *Mollicutes*

168 respectfully recommends that the Judicial Commission of the ICSP should promptly issue an  
169 Opinion rejecting the proposed names *Malacoplasma* gen. nov., *Mesomycoplasma* gen. nov.,  
170 *Metamycoplasma* gen. nov., *Metamycoplasmataceae* fam. nov., *Mycoplasmoidaceae* fam. nov.,  
171 *Mycoplasmoidales* ord. nov., *Mycoplasmoides* gen. nov., *Mycoplasmaopsis* gen. nov., and all  
172 proposed species or subspecies comb. nov. included therein [6,7]. Failure to do so can be  
173 expected to exacerbate the divide between systematists and applied microbiologists, and the  
174 larger community's general disinterest in adherence to the Code.

175

#### 176 **Author Statements**

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