

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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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^T, 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

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