Transfer of *Sarcina* Goodsir from the Family *Micrococcaceae* Pribram to the Family *Peptococcaceae* Rogosa

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Peptococcus Kluyver and van Niel, *Peptostreptococcus* Kluyver and van Niel, and *Ruminococcus* Sijpestein have recently been placed in the family *Peptococcaceae* Rogosa. Because *Sarcina* Goodsir also comprises gram-positive, anaerobic cocci whose general metabolism and other characteristics are consistent with the characteristics of *Peptococcaceae*, it is herein proposed that the genus *Sarcina* Goodsir be transferred from *Micrococcaceae* Pribram to *Peptococcaceae* Rogosa.

The genera *Peptococcus* Kluyver and van Niel (4), *Peptostreptococcus* Kluyver and van Niel (4), and *Ruminococcus* Sijpestein (A. K. Sijpestein, Ph.D. thesis, Univ. of Leiden, The Netherlands, 1948) recently have been included in a new family, *Peptococcaceae* Rogosa (6). The descriptions of these gram-positive, anaerobic cocci have also been updated (6).

On further reflection, it appears that there is nothing in the description of *Peptococcaceae* (6) which is inconsistent with the generic concept of *Sarcina* Goodsir as propounded in modern terms by Canale-Parola et al. (2) and Canale-Parola (1). Although the cell arrangement of *Sarcina* is in cubical packets, the description of *Peptococcaceae* is comprehensive enough to permit this. The general metabolic characteristics of *Sarcina*, particularly glucose fermentation with major production of CO₂, H₂, certain lower fatty acids, variable (as to species) production of ethanol, and lack of lactic acid as a major product are also consistent with the description of *Peptococcaceae* (6). Other definitively known characteristics of *Sarcina*, including the ability to grow at extremely acid (pH 1) and alkaline (pH 9.8) reactions, are permissible as *Peptococcaceae* was described (6).

The packet-forming cocci capable of aerobic growth are phylogenetically distant from those which are strictly anaerobic. For example, the percentage of moles of guanine plus cytosine in the deoxyribonucleic acid of the aerobic species *S. lutea* is 73.5, whereas the deoxyribonucleic acid from *S. maxima* and *S. ventriculi*, both

anaerobes, give values of 28.6 and 30.6, respectively (2). Canale-Parola et al. (2) have ably summarized the evidence for including only the strictly anaerobic sugar-fermenting species (*S. ventriculi* and *S. maxima*) in the genus *Sarcina*. Also, *Sarcina* was first used by Goodsir in 1842 to name *S. ventriculi*, one of the two species of anaerobic, sugar-fermenting, packet-forming cocci presently recognized.

From the foregoing, it seems appropriate to include *Sarcina* Goodsir in the same family as certain other genera of gram-positive, anaerobic cocci. Therefore, it is here proposed to transfer *Sarcina* Goodsir from *Micrococcaceae* Pribram (5) to *Peptococcaceae* Rogosa. Thus, the genera of *Peptococcaceae* Rogosa are: (i) *Peptococcus* Kluyver and van Niel, 1936 [type species *P. niger* (Hall) Kluyver and van Niel]; (ii) *Peptostreptococcus* Kluyver and van Niel, 1936 [type species *P. anaerobius* (Krönig) Kluyver and van Niel]; (iii) *Ruminococcus* Sijpestein, 1948 (type species, *R. flavefaciens* Sijpestein); and (iv) *Sarcina* Goodsir, 1842 (type species, *S. ventriculi* Goodsir).

Peptococcaceae Rogosa, *Peptococcus* Kluyver and van Niel, *Peptostreptococcus* Kluyver and van Niel, and *Ruminococcus* Sijpestein have been described recently in contemporary terms (6); *Sarcina* Goodsir has been described in updated terms by Canale-Parola et al. (2) and Canale-Parola (1). The general differentiating characteristics of the genera of *Peptococcaceae* are presented in Table 1.

TABLE 1. General differentiating characteristics of the genera of the family *Peptococcaceae*

Genus	Growth at pH 2-2.5	Cell arrangement		GC ^a	Carbo- hydrates fermented	Cellulose digested	Major products			Peptones or amino acids main nitrogen and energy source
		Chains	Cubic packets				Suc- ci- nate	Ethanol	Volatile acids with >3 carbon atoms	
<i>Peptococcus</i>	- ^b	±	-	35.7- 36.7	±	-	-	-	+	+
<i>Peptostreptococcus</i>	-	+	-	33.5	±	-	-	±	+	+
<i>Ruminococcus</i>	-	+ or -	-	39.8- 45.4	+	+	+ or -	+ or -	-	-
<i>Sarcina</i>	+	-	+	28.6- 30.6	+	-	-	+ or -	+ or -	-

^a Mole percentage of guanine plus cytosine in the deoxyribonucleic acid.^b +, Positive; -, negative; ±, usually positive; ±, usually negative or limited.

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