

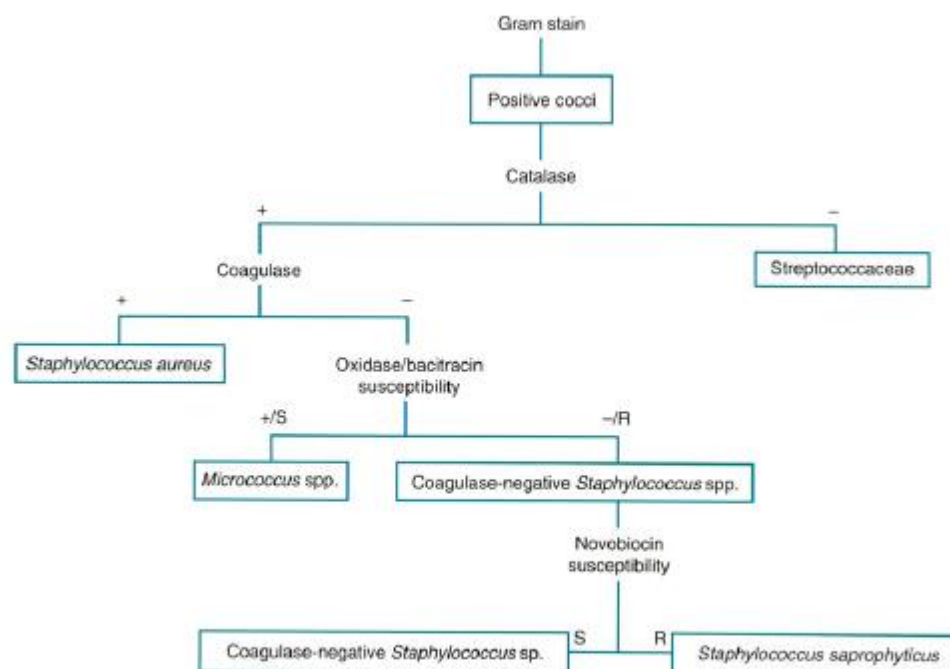
**TABLE 12-2** Phenotypic Characteristics for the Differentiation of *Staphylococcus*, *Micrococcus* and Related Species, and *Micrococcus*

Characteristic	Reaction/Description for:		
	<i>Staphylococcus</i>	<i>Micrococcus</i> and Related Species <sup>a</sup>	<i>Micrococcus</i>
Organism size	0.6–1.6 μm	1–1.8 μm	1.3–2.5 μm
Colony profile	Raised, low convex	Convex	Low convex, domed
Growth rate	Slow to rapid	Very slow	Slow
Fermentation of glucose	+	–	–
Furazolidone susceptibility (100 μg furazolidone disk)	S	R	S
Bacitracin susceptibility (0.04 unit TaxoA disk)	R	S	R
Modified oxidase test	– <sup>b</sup>	+	+
Susceptibility to lysostaphin	S	R	S
Facultative growth under a coverslip on blood agar	1+ to 4+	–/1+	NA
Acid production aerobically from glycerol in the presence of 0.4 μg/mL erythromycin	+	–	NA

<sup>a</sup>Includes the genera *Micrococcus*, *Kytococcus*, *Dermacoccus*, *Nesterenkonia*, and *Kocuria*.

<sup>b</sup>All *Staphylococcus* species are modified oxidase-negative except for *S. vitulinus*, *S. sciuri*, and *S. lentus*.

+, positive reaction; –, negative reaction; S, susceptible; R, resistant; NA, data not available.



**FIGURE 14-8** Schema for the identification of staphylococcal species. NOTE: Other *Staphylococcus* spp. that are coagulase positive besides *S. aureus* include *S. schleiferi* and *S. lugdunensis* (which can be slide-test positive), *S. intermedius*, and *S. hyicus* (tube positive and slide positive).

**TABLE 12-5** Phenotypic Characteristics for Identification of Staphylococci Commonly Isolated From Human Clinical Specimens

Test	<i>S. aureus</i>	<i>S. epidermidis</i>	<i>S. saprophyticus</i>	<i>S. haemolyticus</i>	<i>S. warneri</i>	<i>S. hominis</i> subsp. <i>hominis</i>	<i>S. hominis</i> subsp. <i>novobioceticus</i>	<i>S. lugdenensis</i>	<i>S. schleiferi</i> subsp. <i>schleiferi</i>
Clumping factor	+	-	-	-	-	-	-	+ <sup>d</sup>	+
Coagulase	+	-	-	-	-	-	-	-	-
Novobiocin	S	S	R	S	S	S	R	S	S
Polymyxin B	R	R	S	S	S	S	NA	S/R	S
PYR	-	-	-	+	-	-	-	+	+
ODC	-	V-	-	-	-	-	-	+	-
URE	V	+	+	-	+	+	+	V	-
ACET	+	+	+	+	+	V	V	+	+
PAL	+	+	-	-	-	-	-	-	+
Heat-stable nuclease	+	-	-	-	-	-	-	-	+
β-GAL	-	-	+	-	-	-	-	-	+ <sup>d</sup>
Acid produced aerobically from:									
GLU	+	+	+	+	+	+	+	+	+
MAL	+	+	+	+	+ <sup>d</sup>	+	+	+	-
SUC	+	+	+	+	+	+ <sup>d</sup>	+ <sup>d</sup>	+	-
MNTL	+	-	V	V	V	-	-	-	-
MANN	+	+ <sup>d</sup>	-	-	-	-	-	+	+
TREH	+	-	+	+	+	V	-	+	V

+ , positive reaction; - , negative reaction; +<sup>d</sup> , slow or delayed positive reaction; V , variable reaction; V- , variable reaction, most strains negative; S , susceptible; R , resistant; NA , data not available; PYR , Pyrrolidonyl arylamidase; ODC , Ornithine decarboxylase; URE , Urease; PAL , Alkaline phosphatase; ACET , Acetoin (VP); β-GAL , β-Galactosidase; GLU , Glucose; MAL , Maltose; SUC , Sucrose; MNTL , Mannitol; MANN , Mannose; TREH , Trehalose.

**Table 7-3 Key Characteristics of Pseudomonads**

	OXIDASE	MOTILITY	PROVERDIN	YELLOW	GLUCOSE	MALTOSE	LACTOSE	MANNITOL	ARGININE	LYSINE	NO <sub>2</sub> -NO <sub>2</sub>	NO <sub>2</sub> -N <sub>2</sub>	UREA	ONPG	DNASE	ACETAMIDE	ESCULIN	H <sub>2</sub> S IN KIA	POLYMYXIN
<b>Genus <i>Pseudomonas</i></b>																			
<b>Fluorescent group</b>																			
<i>P. aeruginosa</i>	+	+	++	-	+	V	-	V	+	-	+	V	V	-	-	+	-	-	S
<i>P. fluorescens</i>	+	+	++	-	+	V	-	V	+	-	V	V	V	-	-	-	-	-	S
<i>P. putida</i>	+	+	++	-	+	V	-	V	+	-	-	V	V	-	-	-	-	-	S
<b>Stutzeri group</b>																			
<i>P. stutzeri</i>	+	+	-	-	+	+	-	V	+	-	+	+	V	-	-	-	-	-	S
<i>P. mendocina</i>	+	+	-	-	+	-	-	-	+	-	+	+	V	-	-	-	-	-	S
CDC group Vb-3	+	+	-	-	+	+	-	+	+	-	+	+	V	-	-	-	-	-	S
<b>Alcaligenes group</b>																			
<i>P. alcaligenes</i>	+	+	-	-	-	-	-	-	-	-	V	-	V	-	-	-	NA	-	S
<i>P. pseudoalcaligenes</i>	+	+	-	-	-	-	-	-	V	-	+	-	-	-	-	-	-	-	S
<i>Pseudomonas</i> sp. group 1	+	+	-	-	-	-	-	-	V	-	+	-	-	-	-	-	NA	-	S
<b>Yellow-pigmented group</b>																			
<i>P. luteola</i>	-	+	-	+	+	+	-	+	V	-	V	-	V	-	-	-	+	-	S
<i>P. oryzae</i>	-	+	-	+	+	+	-	+	-	-	-	-	V	-	-	-	+	-	S
<b>Genus <i>Burkholderia</i></b>																			
<i>B. pseudomallei</i>	+	+	-	-	+	+	+	+	+	-	+	+	V	-	-	-	V	-	R
<i>B. cepacia</i> complex	w	+	-	V	+	+	+	+	w	-	V	-	V	-	-	V	V	-	R
<i>B. gladioli</i>	-	+	-	-	+	-	-	+	-	-	V	-	+	-	-	-	-	-	R
<b>Genus <i>Ralsstonia</i></b>																			
<i>R. pickettii</i> Va-1	+	+	-	-	+	+	+	-	-	-	V	V	+	-	-	-	-	-	R
<i>R. pickettii</i> Va-2	+	+	-	-	+	-	-	-	-	-	+	+	+	-	-	-	-	-	R
<i>R. mannitolilytica</i>	+	+	-	-	+	+	+	+	-	-	V	V	+	-	-	-	-	-	R
<b>Genus <i>Delftia</i></b>																			
<i>D. acidovorans</i>	+	+	-	-	-	-	-	+	-	-	+	-	-	-	-	+	-	-	S
<b>Genus <i>Brevundimonas</i></b>																			
<i>B. diminuta</i>	+	+	-	-	w	-	-	-	-	-	-	-	-	V	-	-	-	-	V
<i>B. vesicularis</i>	+	+	-	+	w	V	-	-	-	-	-	-	-	V	-	-	+	-	S
<b>Genus <i>Stenotrophomonas</i></b>																			
<i>S. maltophilia</i>	-	+	-	-	+	++	+	-	-	+	V	-	-	+	+	-	+	-	S
<b>Genus <i>Shewanella</i></b>																			
<i>S. algae</i>	+	+	-	-	+	-	-	-	-	-	+	-	-	-	+	-	-	+	S
<i>S. putrefaciens</i>	+	+	-	-	+	+	V	+	-	-	+	-	-	-	-	-	V	+	S
<b>Genus <i>Sphingomonas</i></b>																			
<i>S. paucimobilis</i>	+	+	-	+	+	+	+	-	-	-	-	-	-	+	-	-	+	-	S

+ , 90% or more strains positive; -, 90% or more strains negative; V, 11-89% of strains positive; ++, strong positive reaction; +, weak positive; S, susceptible; R, resistant; ONPG, orthonitrophenyl-β-D-galactopyranoside. Key reactions are shaded.  
Data from reference<sup>249</sup>.

**Table 7-24 Oxidase-Negative, Motile Nonfermenters**

ORGANISM	LYSINE		OF MANNITOL	ESCULIN	POLYMYXIN	PIGMENT
	DECARBOXYLASE	OF MALTOS				
<i>Stenotrophomonas maltophilia</i>	+	+	-	+	S	Yellow Lavender
<i>Burkholderia cepacia</i> complex	+	+	+	V(67)	R	Yellow
<i>Burkholderia gladioli</i>	-	-	+	-	R	Yellow
<i>Bordetella trematum</i>	-	-	-	-	NA	Gray-white
<i>Sphingomonas paucimobilis</i>	-	+	-	+	V(89)	Deep yellow
<i>Pseudomonas luteola</i>	-	+	+	+	S	Dull yellow
<i>Pseudomonas oryzae</i> habitans	-	+	+	-	S	Dull Yellow

Data from reference<sup>249</sup>.

+, 90% or more strains positive; -, 90% or more strains negative; V, 11-89% of strains positive; ++, strong positive reaction; NA, results not available; R, resistant; S, susceptible. Numbers in parentheses are percentages of strains giving positive reactions.

**Box 7-2 Medically Important Nonfermenters**

Motile With Polar Flagella

**Family Pseudomonadaceae**

(rRNA group I)

Genus *Pseudomonas*

**Family Burkholderiaceae**

(rRNA group II)

Genus *Burkholderia*

Genus *Cupriavidus*

Genus *Lautropia*

Genus *Pandoraea*

Genus *Ralstonia*

**Family Comamonadaceae**

(rRNA group III)

Genus *Comamonas*

Genus *Acidovorax*

Genus *Delftia*

**Family Caulobacteraceae**

(rRNA Group IV)

Genus *Brevundimonas*

**Family Xanthomonadaceae**

(rRNA Group V)

Genus *Stenotrophomonas*

**Family Sphingomonadaceae**

Genus *Sphingomonas*

**Family Oceanospirillaceae**

Genus *Balneatrix*

**Family Alteromonadaceae**

Genus *Alishewanella*

Genus *Shewanella*

**Family Oxalobacteraceae**

Genus *Herbaspirillum*

Genus *Massilia*

**Family Methylobacteriaceae**

Genus *Methylobacterium*

Genus *Roseomonas*

**Organisms Whose Taxonomic Position Is Uncertain**

CDC Groups Ic, O-1, O-2, O-3, Vb-3

Motile With Peritrichous Flagella

**Family Alcaligenaceae**

Genus *Achromobacter*

Genus *Alcaligenes*

Genus *Bordetella* (*B. avium*, *B. bronchiseptica*, *B. hinzii*, *B. trematum*)

Genus *Kerstersia*

Genus *Oligella* (*O. ureolytica*)

**Family Rhizobiaceae**

Genus *Rhizobium*

**Family Brucellaceae**

Genus *Ochrobactrum*

**Family Halomonadaceae**

Genus *Halomonas*

Nonmotile, Oxidase-Positive

**Family Flavobacteriaceae**

Genus *Flavobacterium*

Genus *Bergeyella*

Genus *Chryseobacterium*

Genus *Empedobacter*

Genus *Myroides*

Genus *Weeksella*

**Family Sphingobacteriaceae**

Genus *Sphingobacterium*

Genus *Pedobacter*

**Family Moraxellaceae**

Genus *Moraxella*

Genus *Psychrobacter*

**Family Neisseriaceae**

Genus *Neisseria*

**Family Alcaligenaceae**

Genus *Oligella* (*O. urethralis*)

**Family Rhodobacteraceae**

Genus *Paracoccus* (EO-2)

**Organisms Whose Taxonomic Position Is Uncertain**

CDC groups EO-3, EO-4, EF-4b

CDC groups IIc, Iie, IIg, IIh, Ili,

Gilardi rod group 1

Nonmotile, Oxidase-Negative

**Family Moraxellaceae**

Genus *Acinetobacter*

**Family Alcaligenaceae**

Genus *Bordetella* (*B. pertussis*, *B. parapertussis*, *B. trematum*)

**Organisms Whose Taxonomic Position Is Uncertain**

CDC group NO-1

CDC group EO-5

**TABLE 7-11** Key Characteristics of *S. maltophilia* and *B. cepacia* complex<sup>a</sup>

Test	<i>S. maltophilia</i>	<i>B. cepacia</i> Complex
Oxidase	–	+ (93)
Motility	+	+
Growth on MacConkey	+	+
OF glucose	A or Wk	A
OF maltose	A	A
OF lactose	V (86)	A
OF mannitol	–	A
NO <sub>3</sub> reduction	V (42)	V (37)
NO <sub>3</sub> to gas	–	–
Arginine	–	–
Lysine	+	V
Esculin hydrolysis	+	V (67)
ONPG	+ (93)	V (79)
DNase	+	–
Polymyxin B	S	R
Pigment	gray, slight yellow, lavender	gray, chartreuse, yellow

<sup>a</sup> Data from reference 1172.

+, 90% or more strains positive; –, 90% or more strains negative; V, 11%–89% of strains positive; A, acid reaction; Wk, weak acid; S, susceptible; R, resistant; NA, not available. Numbers in parentheses are percentage of strains giving positive reaction.