

# Surveying UW-Eau Claire Campus for the Presence of Methicillin Resistant *Staphylococcus aureus*

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## Abstract

Methicillin-resistant *Staphylococcus aureus* (MRSA) was first discovered in 1961 shortly after the introduction of the antibiotic methicillin. In 2005 the CDC reported 94,000 cases of MRSA infections and of those infections 19,000 resulted in deaths. Approximately 85% of the MRSA cases were associated with hospitals (hospital acquired MRSA) and the remaining 15% were from the community (community acquired MRSA). We surveyed the UW-Eau Claire campus for the presence of MRSA. The results indicate that of all the bacteria isolated, the percentage of *S. aureus* isolated from the student athlete equipment (gymnastics beams) was up to 43%. Of those *S. aureus* isolates we tentatively confirmed 4 (0.47%) MRSA isolates. Similarly, of all the bacterial isolates from general student athletics we isolated up to 16% *S. aureus* from which we tentatively confirmed 3 additional MRSA isolates (from elliptical and treadmill). In the general student population areas (ATM keypads, water fountains, etc.) up to 36% of the isolates were *S. aureus*, with all of the strains testing negative for methicillin resistance. We are currently in the process of gathering more samples and potential MRSA isolates as well as confirming the identities of isolates by polymerase chain reaction (PCR).

## Introduction

*Staphylococcus aureus* are gram positive cocci able to ferment mannitol. *S. aureus* is normally found in the nasal cavities of humans. Recently there have been concerns about the spread of antibiotic resistances in bacteria, more specifically methicillin resistant *S. aureus* (MRSA). MRSA was first reported in 1961 (2), shortly after the introduction of methicillin and has become increasingly more prevalent in recent years. There are two general strains of MRSA, a strain acquired by nosocomial infections (hospital acquired) and a community acquired strain (3). CDC reported in 2005, that there were 94,000 MRSA cases in the United States, and of those cases 19,000 resulted in death (Fig 1). Approximately 85% of MRSA cases in 2005 were the result of nosocomial infections while the remaining 15% were as a result of community acquired infections(1). Because of this, there has been increased awareness of MRSA in the general population as well as in the hospital setting.

We looked at the incidence of MRSA in the community, more specifically the UW- Eau Claire campus. We surveyed the general student population (desks, vending machines, water fountains, etc), the general student athletic only population (treadmills, free weights, exercise machines, etc), and athletic team equipment only (volleyballs, gymnastic beams, etc).

## Materials & Methods

**Sampling.** Sterile cotton swabs were dipped into sterile water and a 4 in x 4 in square was swabbed. The cotton swab was then streaked onto both a Mannitol Salt Agar (MSA) (Difco, MI) plate and a MSA containing 2ug/mL oxiccillin. Plates were then incubated for 48 hours prior to counting colonies.

**Presumptive *S. aureus* tests.** Mannitol positive (ferment mannitol) colonies were selected from MSA containing 2ug/mL oxiccillin and streaked for isolation for future testing. Gram staining was performed to determine that isolates are gram positive cocci (Fig 5). Catalase testing was performed in order to determine if isolates possess the enzyme catalase (fig 4).

**Agglutination Test.** We used the BactiStaph Latex 150 Test kit (Remel, KS) according to the directions supplied. The BactiStaph Latex 150 Test kit tested for the presence of coagulase and protein A associated with *S. aureus* strains.

**Antibiotic Resistance Test.** Serial 2-fold dilutions of *S. aureus* grown in Todd-Hewitt Broth (THB) (Difco, MI) were performed to determine the minimum inhibitory concentration (MIC) of Methicillin (oxiccillin) and other antibiotics.

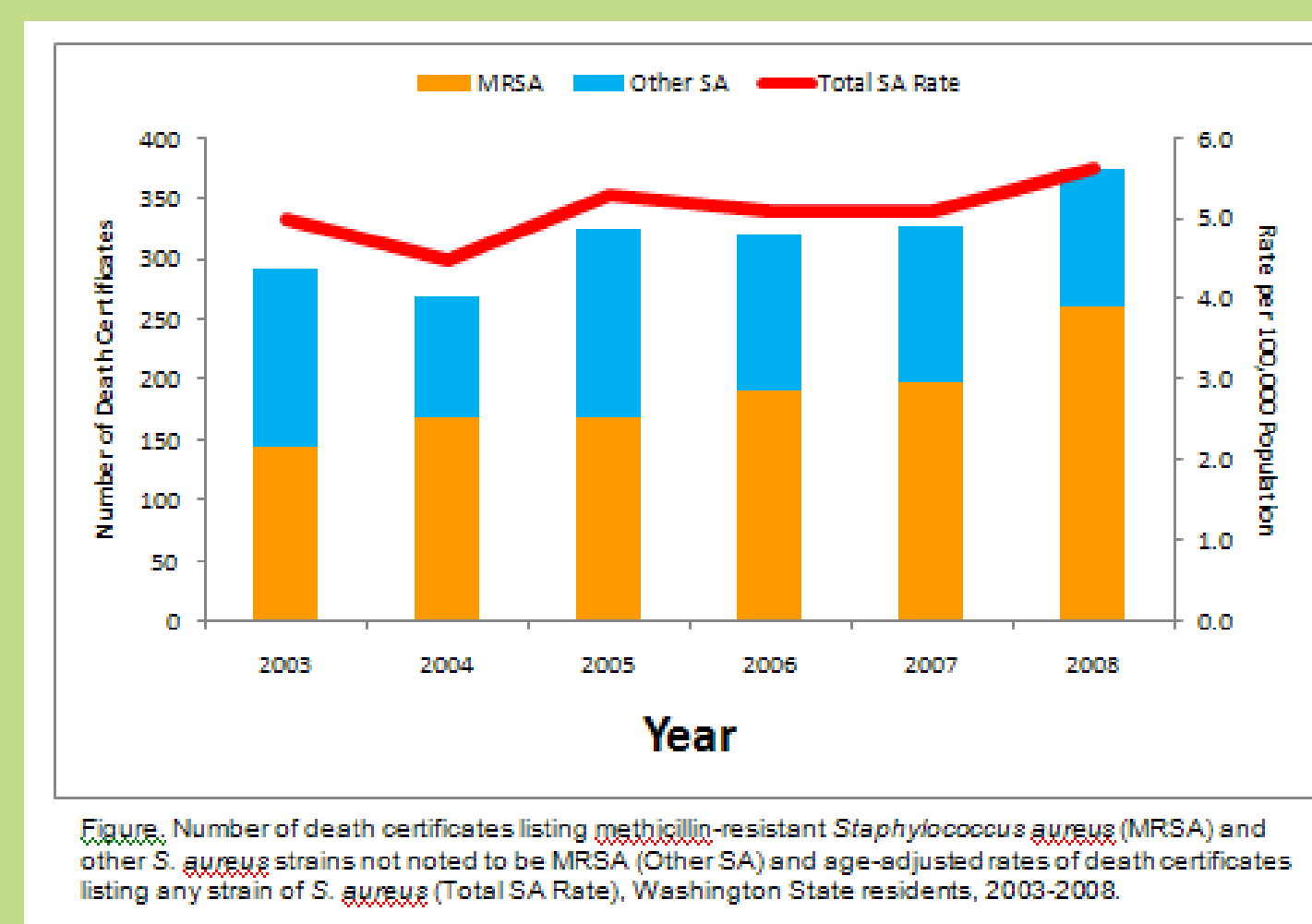


Fig 1. Number of death certificates listing MRSA and other *S. aureus* strains for Washington state residents from 2003-2008.



Photo Credit: Gregory Moran, M.D.  
Fig 2. MRSA infection in a patient's hand.

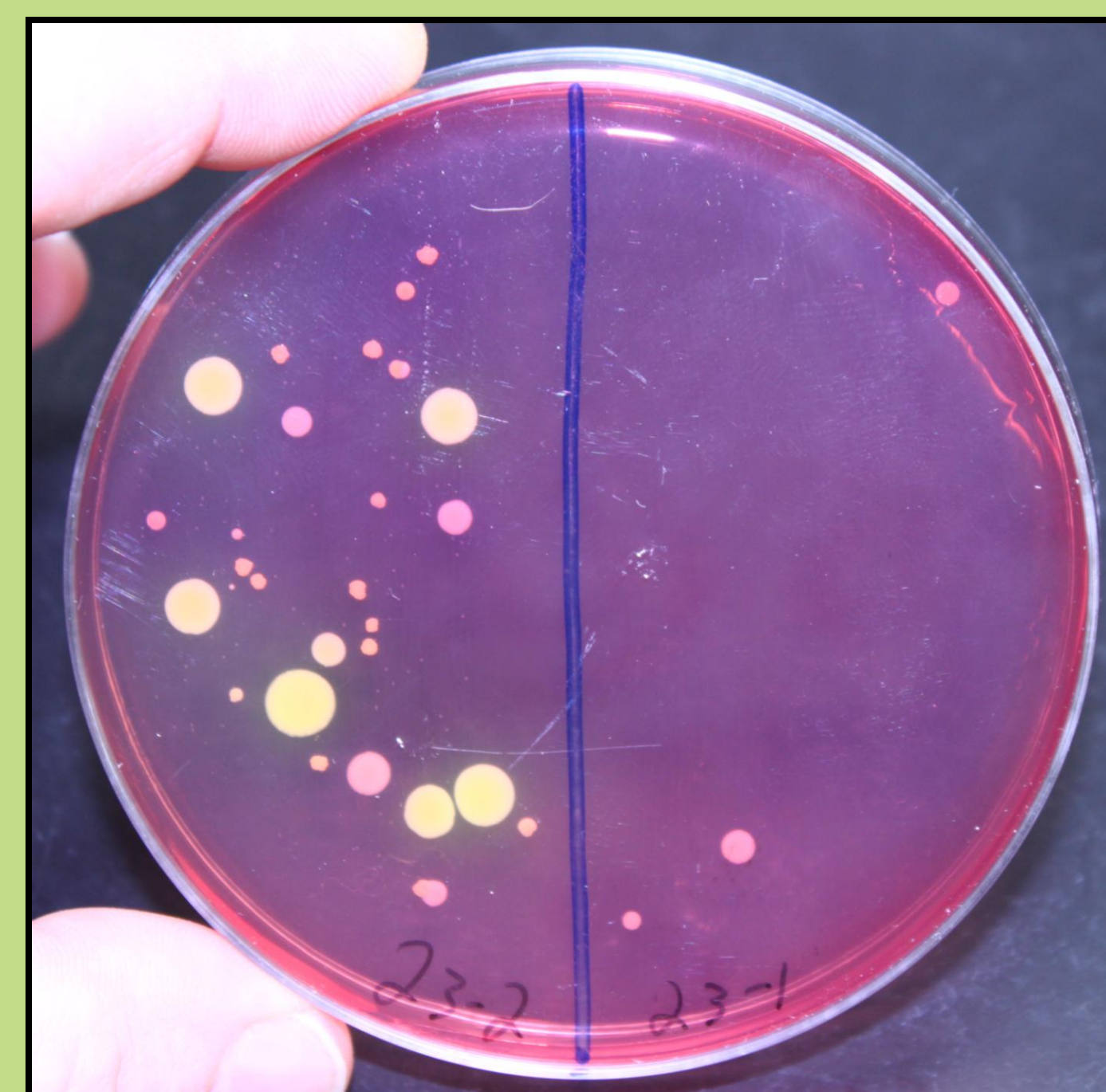


Fig 3. Mannitol Salt Agar. Yellow colonies are mannitol positive.



Fig 4. Catalase test. Catalase positive (left) and catalase negative (right) results.

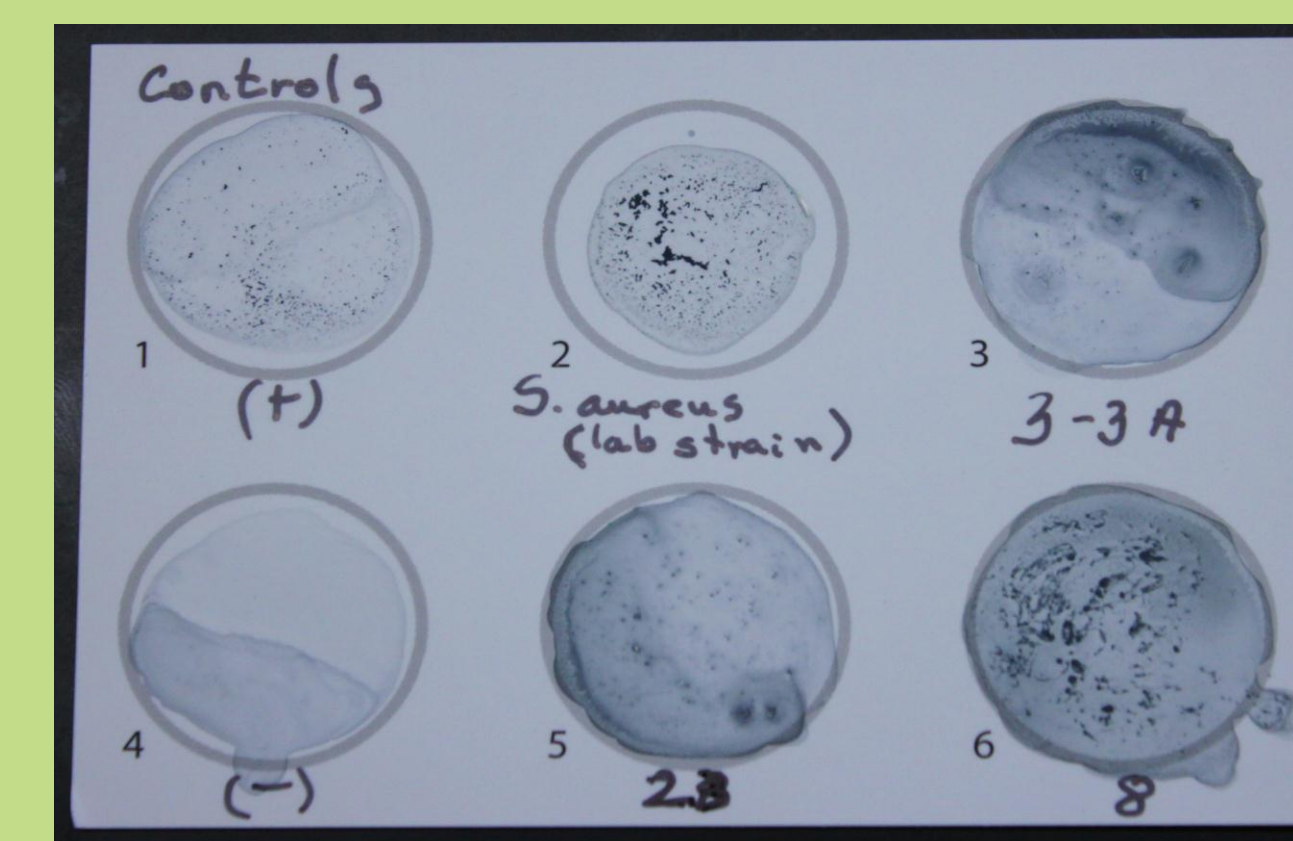


Fig 6. Agglutination Test. Positive and Negative controls compared to laboratory strain of *S. aureus* and several potential MRSA isolates.

Strain ID #	Gram Stain	Catalase Test	Agglutination Test	MIC Oxiccillin (ug/mL)	MIC Other Antibiotics (ug/mL)
3-3A	+(cocci)	+	++	1250	Erm (39)
3-3B	+(cocci)	+	-	312	Erm (39)
7	+(cocci)	+	-	156	
23	+(cocci)	+	++	312	Erm (78)
2-7	+(cocci)	+	+	156	Erm (1250)
8	+(cocci)	+	++	ND	ND

ND : Not determined + : positive (catalase)/ weak positive (agglutination)  
- : negative ++ : moderate positive (agglutination) +++ : strong positive (agglutination)

## Discussion/Conclusion

- For a total of 6878 colonies tested, 853 (12%) were mannitol positive (possibly *S. aureus*)
- Of 843 mannitol positive colonies 4 isolates (0.5%) were presumed to be MRSA.
- Most of the oxiccillin resistant colonies were isolated from the general student athletic areas.
- Methicillin strains were also resistant to erythromycin.
- In order to confirm the identities of the isolates PCR analysis will be performed.

## Results

**Sampling.** Mannitol positive colonies were found and selected for isolation (Fig 3). We found in the General student population 428 mannitol positive colonies of which 5.14% were presumed to be MRSA. In the general student athletic only population 142 mannitol positive colonies were found and of those 26.76% were presumed to be MRSA. Athletic Team only equipment revealed 283 mannitol positive colonies and of those 16.25% were presumed to be MRSA. Our data are presented in Table 1.

**Presumptive *S. aureus* Tests.** Presumptive test results for isolates are shown in Table 2. All isolates were determined to be gram positive cocci and possess the enzyme catalase. Two isolates did not possess coagulase and protein A. The remaining four isolates possessed both.

**Antibiotic Resistance Test.** Antibiotic resistance results are presented in Table 2. All isolates were resistant to oxiccillin but exhibited varying degrees of resistance. Four isolates showed multiple resistances. Isolate 8 has yet to undergo MIC testing.

Table 1. Sample Results From Various Sources

Sample Source	Total Colonies (MSA)	Mannitol Positive (MSA) (% of Total)	Oxiccillin Resistant (% of mannitol positive)
General Student Population	2640	428 (16.2%)	22 (5.1%)
General Student Athletic only Population	2376	142 (6.0%)	38 (26.7%)
Athletic Team only equipment	1862	283 (15.2%)	46 (16.2%)
<b>Total</b>	<b>6878</b>	<b>853 (12.4%)</b>	<b>106 (12.4%)</b>

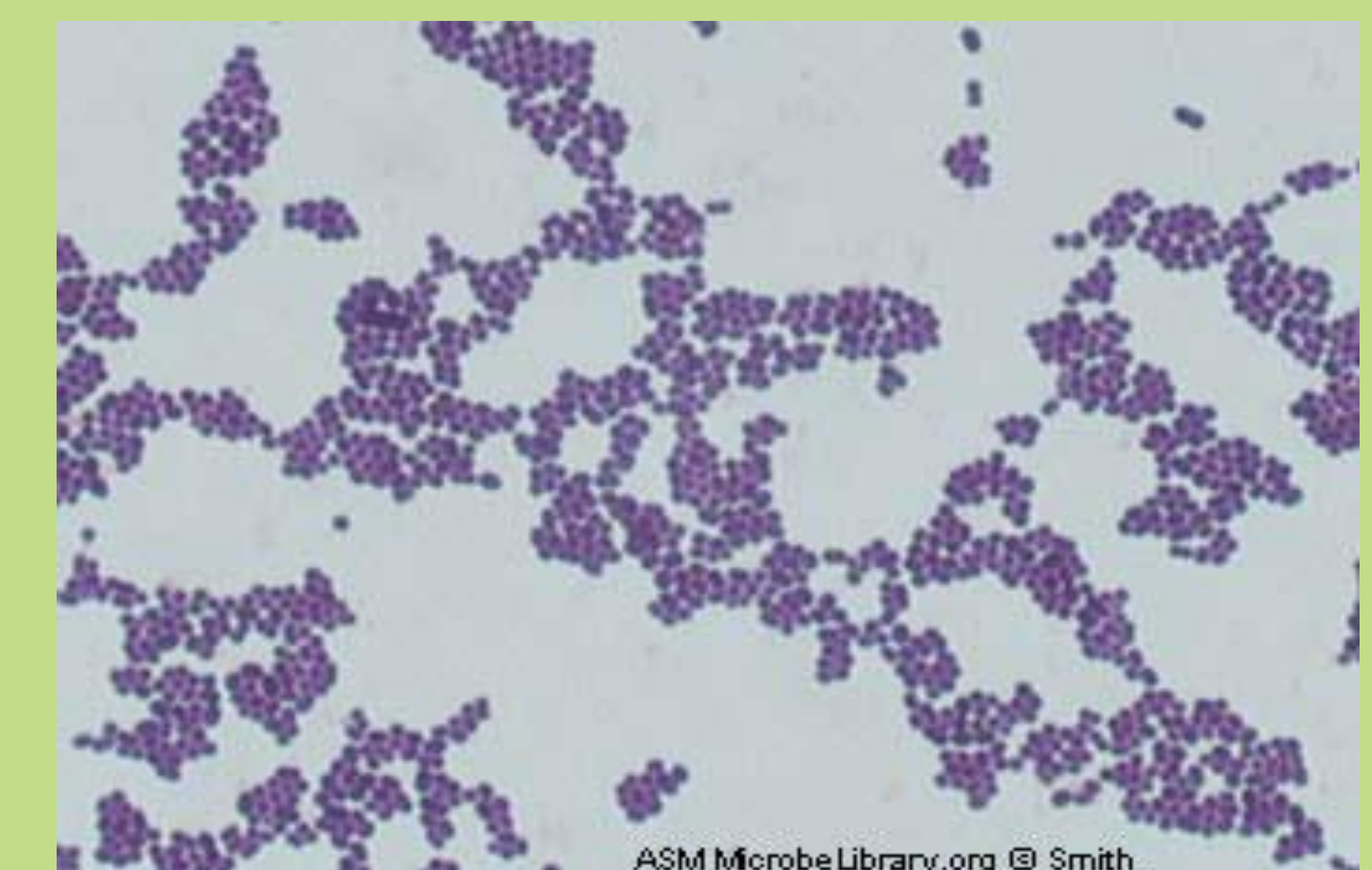


Fig 5. Gram positive cocci.

## References

- Centers for Disease Control and Prevention [CDC]. Healthcare-associated methicillin resistant *Staphylococcus aureus* (HA-MRSA). CDC; 2005 June. Available at: [http://www.cdc.gov/ncidod/dhqp/ar\\_mrsa.html](http://www.cdc.gov/ncidod/dhqp/ar_mrsa.html).
- Fitzgerald JR, Sturdevant DE, Mackie SM, Gill SR, Musser JM. Evolutionary genomics of *Staphylococcus aureus*: insights into the origin of methicillin-resistant strains and the toxic shock syndrome epidemic. Proc Natl Acad Sci U S A. 2001 Jul 17;98(15):8821-6.
- Institute for International Cooperation in Animal Biologies. Methicillin Resistant *Staphylococcus aureus* (MRSA). 2006.



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