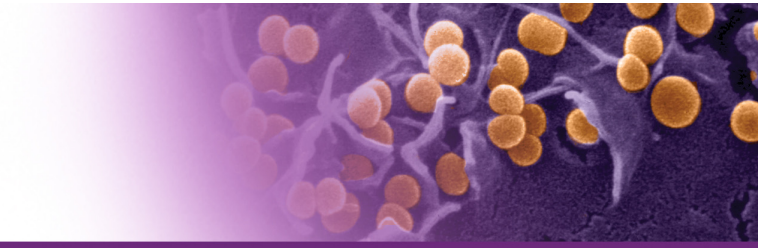
MRSA gene hunt

Gene ID cards

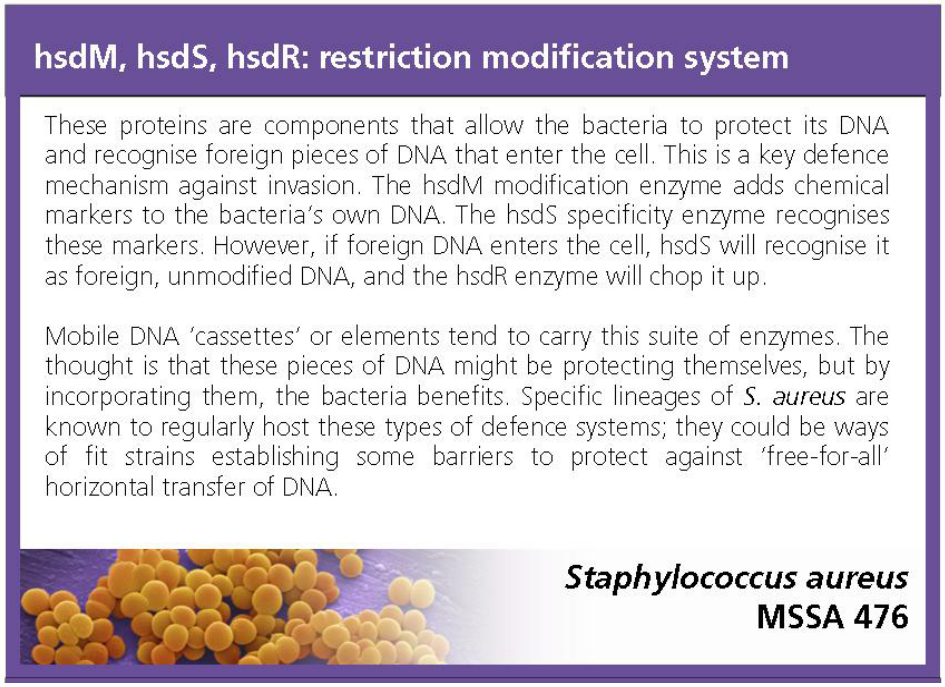


The activity

Using the gene ID cards you will research and classify key genes which play an important role in drug resistance and virulence for two strains of *Staphylococcus aureus* (MSSA 476 and MRSA MW2). The table (pages 3 and 4) lists 14 different genes which can be found in the genomes of the two bacterial strains, these can be found on the gene ID cards. Once you have completed the table, cluster the relevant cards into the five protein classification categories and answer the questions on page 5.

Understanding the gene ID cards

Each group has a set of 16 gene ID cards labelled with a gene name. On the back of each card is the name of the gene, a description of the protein product the gene encodes and the strain of bacteria it is found in.



Gene ID: gene name

Description of the protein product and function

Strain of bacteria

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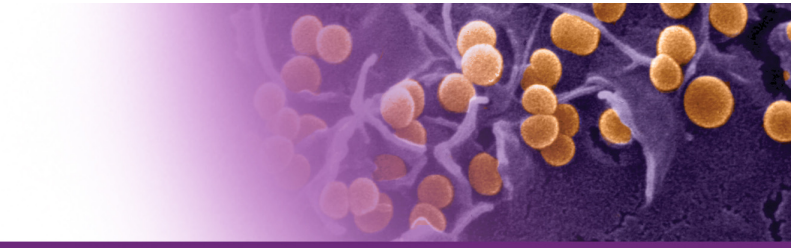

Background information on the pathogens

MSSA 476

This is a methicillin-susceptible strain of *S. aureus* that was isolated from a 9-year old boy with a community-acquired infection in 1998. This strain is resistant to penicillin and fusidic acid, but can be killed by many other antibiotics. After antibiotic treatment, this patient made a full recovery. The 2,799,802 bp genome of MSSA 476 was fully sequenced by staff at the Wellcome Trust Sanger Institute in 2004.

MRSA MW2

This strain of *S. aureus* is resistant to methicillin. It was isolated in 1998 from a 16-month old girl with severe septicaemia (blood poisoning). MW2 is sensitive to some types of antibiotic, but is extremely virulent; this patient died within two hours of arriving in hospital. The genome of MW2 was fully sequenced in 2002 by staff at Juntendo University in Japan.

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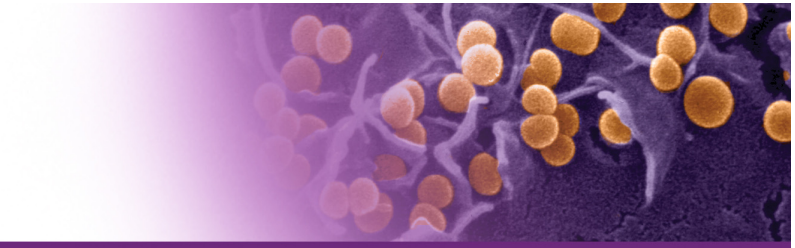

Gene	Protein product	Role/Function	MSSA 476	MRSA MW2	Classification
ccrA & ccrB					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
ear					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
int (region 3)					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
fusB1					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
hsdR, hsdS, hsdM					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐

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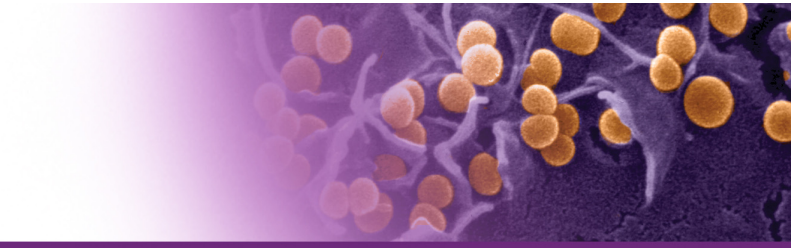

Gene	Protein product	Role/Function	MSSA 476	MRSA MW2	Classification
orfX					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
lukS & lukF					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
mecA					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
sec4					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐
sel2					Antibiotic resistance ☐ Enzyme ☐ Surface protein ☐ Toxin ☐ Mobile genetic element ☐

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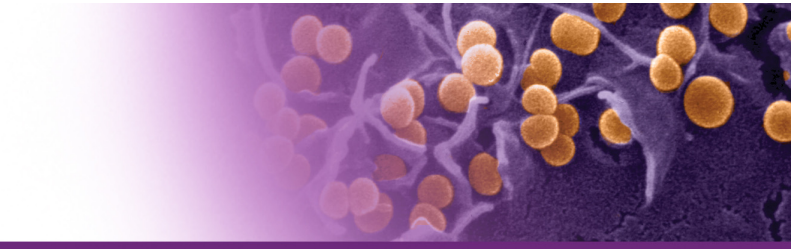

Using the flipchart paper, classify the genes into five categories: antibiotic resistance, enzyme, surface protein, toxin, mobile genetic element. Stick the cards under their correct corresponding headings. Feed back the results to the class and be prepared to discuss the following questions:

Q1a) Which genes are found in MSSA 476?

Q1b) Which genes are found in MRSA MW2?

Q1c) Which genes are found in both strains?

Q2. Which genes could be termed as virulence factors, i.e. factors that give the bacterium a greater capacity to cause disease?

Q3. Which genes might give one strain an advantage over other strains?

Q4. What processes do you think underlie the evolution and spread of antibiotic-resistance in bacteria?