

# Routine methods for susceptibility testing of staphylococci to beta-lactam antibiotics

Kees Veldman

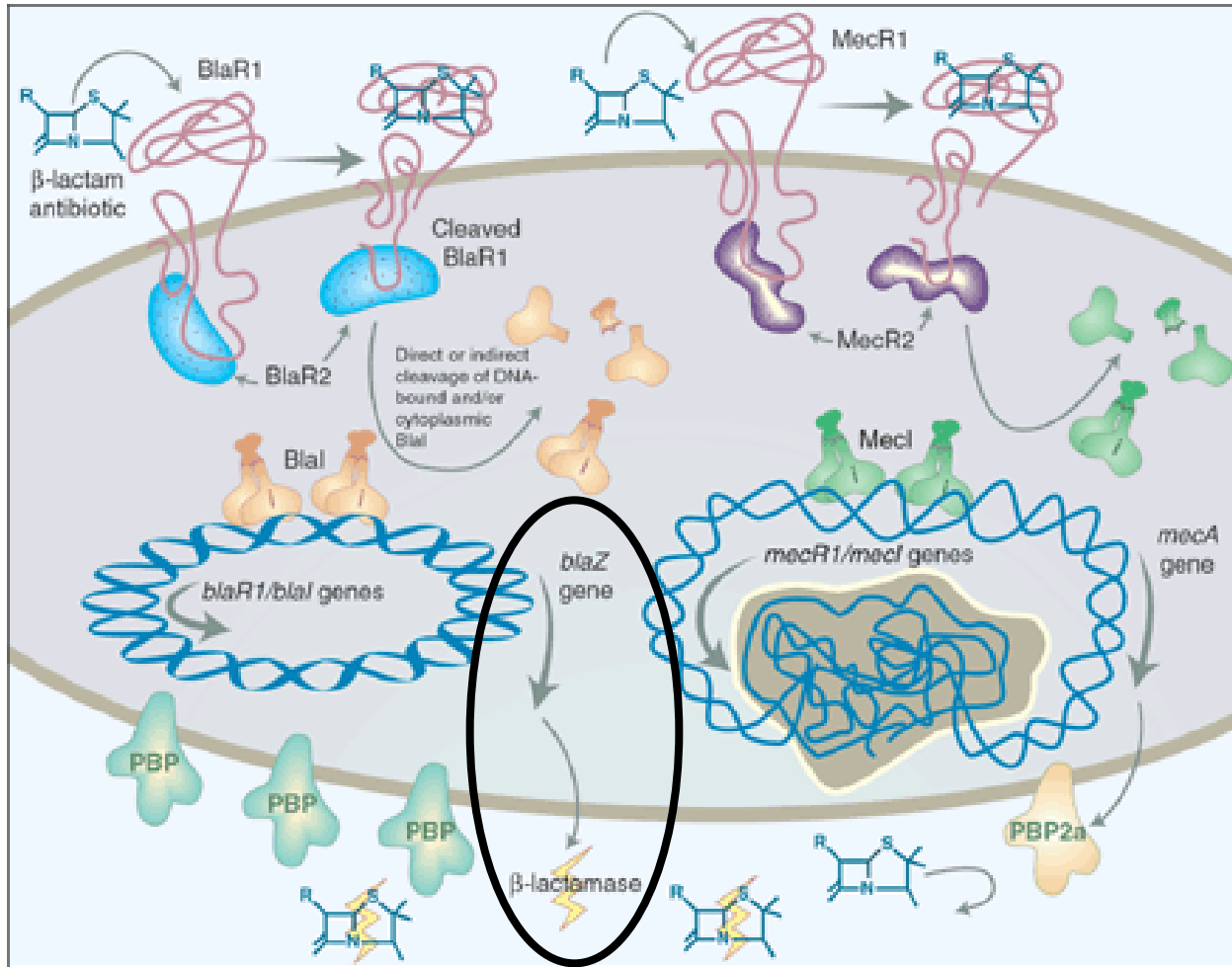


# Aim:

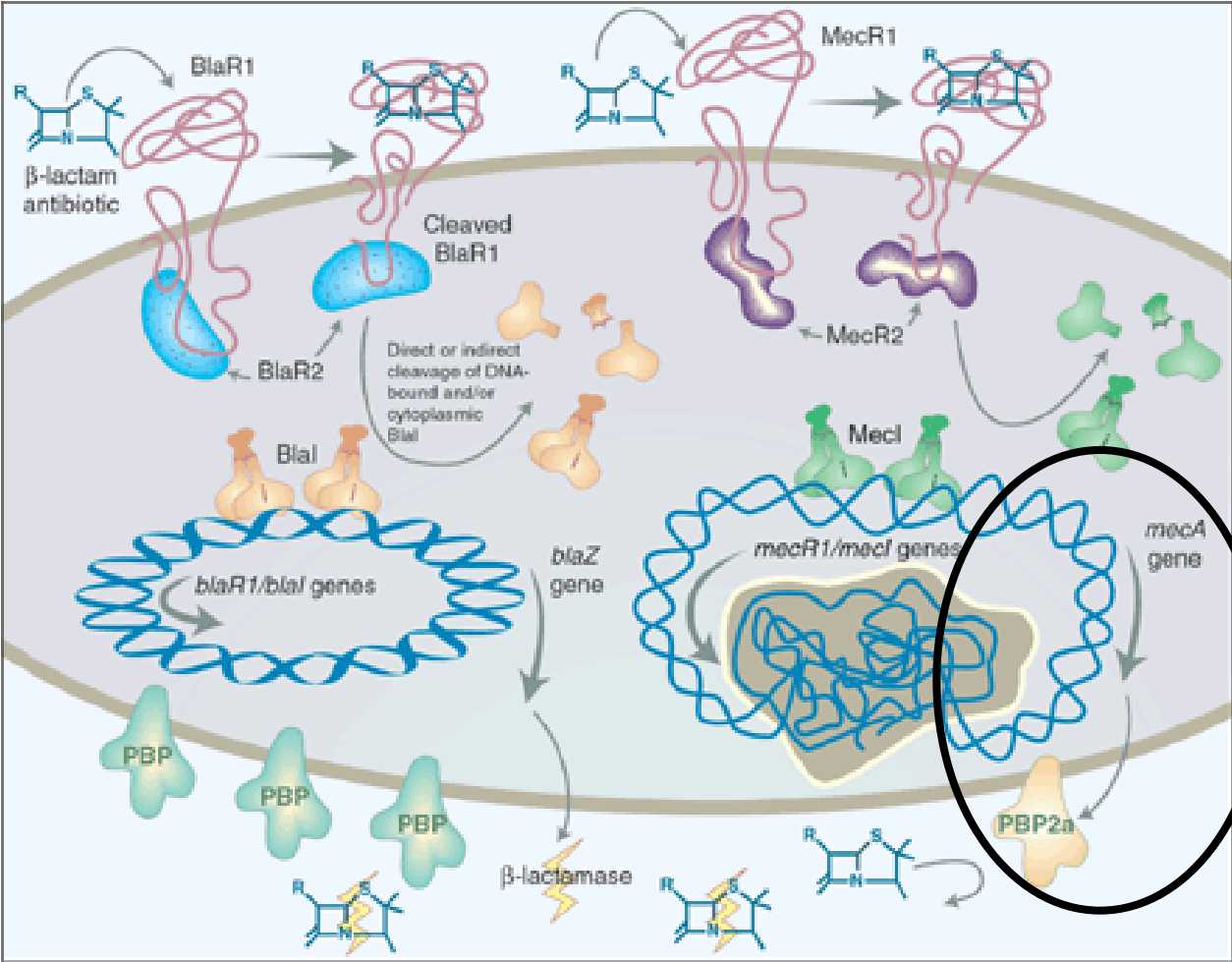
To harmonize test methods and interpretation



# Beta-lactam resistance in Staphylococci



# Beta-lactam resistance in Staphylococci



# Routine methods for testing beta-lactam antibiotics for staphylococci

You only need to test 3 things:

- (1) Susceptibility to penicillin (*blaZ*)
- (2) Production of beta-lactamases (*blaZ*)
- (3) Susceptibility to cefoxitin (*mecA*)



# Susceptibility to penicillin

- Susceptible to penicillin:
  - Always test for production of beta-lactamases! (especially with borderline MICs or inhibition zone diameters).
- Resistant against penicillin (cefoxitin S):
  - Resistant against all “penicillinase-labile” penicillins such as penicillin, amoxicillin and ampicillin.
  - Susceptible to:
    - (A) semi-synthetic (“penicillinase-stabile”) penicillins such as nafcillin and oxacillin
    - (B) inhibitor combinations such as amox/clavulanic acid
    - (C) first generation cephalosporins such as cefalexin and cefaperine.



# Testing of $\beta$ -lactamase production

*Test for induced beta-lactamase production by using bacterial growth from the border of the inhibition zone of a penicillin disk.*

- **Beta-lactamase negative:** bacteria penS, amoxS and ampiS
- **Beta-lactamase positive:** bacteria penR, amoxR and ampiR, but susceptible to semi-synthetic penicillins, inhibitor combinations and cephalosporins.



# Susceptibility to cefoxitin

- Susceptible to cefoxitin (disk test) or oxacillin (MIC-test): *mecA*-gene not present
- Resistant against cefoxitin (or oxacillin): *mecA* probably present (should be confirmed by PCR)
- Resistant against cefoxitin or oxacillin: resistant against all beta-lactam antibiotics, including all semi-synthetic penicillins, inhibitor combinations and all cephalosporins.
  - Except for ceftobiprole and ceftaroline (anti-MRSA cephalosporins)





# Summarizing

## 3 possibilities

- Penicillin S,  $\beta$ -lactamase negative and cefoxitin S:
  - Bacteria susceptible to all beta-lactam antibiotics
  - *blaZ* and *mecA* negative
- Penicillin R and or  $\beta$ -lactamase positive and cefoxitin S:
  - Bacteria resistant to penicillins, but susceptible to semi-synthetic penicillins, inhibitor combinations and all cephalosporins.
  - *blaZ* positive and *mecA* negative
- Cefoxitin R (regardless of *in vitro* penicillin resistance):
  - Bacteria resistant to all beta-lactam antibiotics, except for anti-MRSA cephalosporins.
  - *mecA* positive (and *blaZ* positive or negative)



# Advise for routine testing

- Use **penicillin**, a test for  **$\beta$ -lactamase production** and **cefoxitin** (or oxacillin) for routine testing of staphylococci.
- No other beta-lactam antibiotics need to be tested



# Questions?

