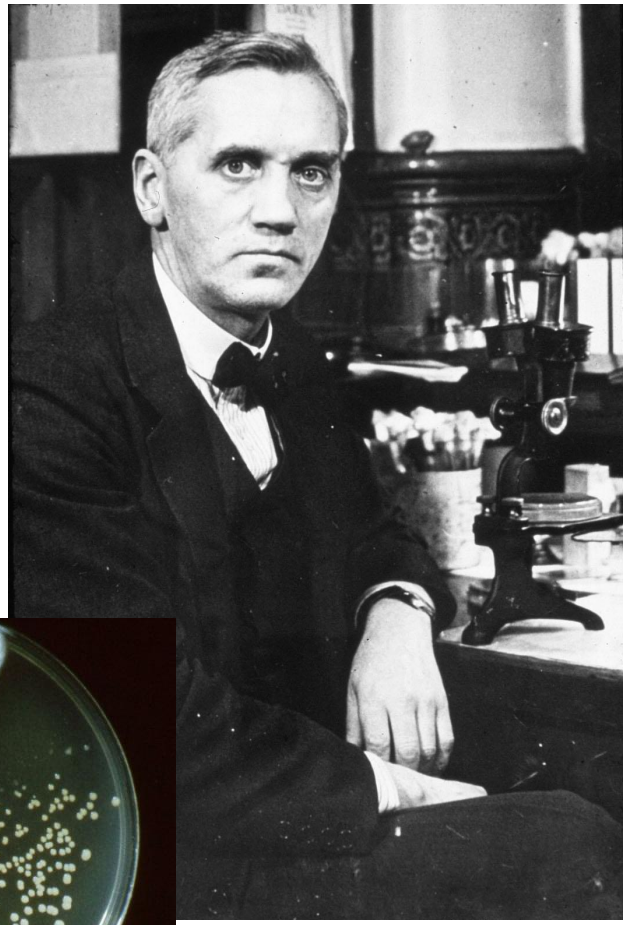
Discovery and development of antibiotics

Penicillin - the first antibiotic

- Penicillin was the first antibiotic to be discovered.
- It was discovered in 1928 by Alexander Fleming, a Scottish scientist working in St Mary's Hospital London.
- Fleming discovered that mould from a *Penicillium* fungus had antibacterial properties. The antibiotic was named penicillin after the fungus.



Penicillin - the first antibiotic

- Fleming could not extract enough penicillin from the mould to use for the treatment of patients
- In 1938, Howard Florey (an Australian microbiologist), Ernst Chain (a German chemist) and others at Oxford University pioneered the production of penicillin for human treatment. But they had to depend on pharmaceutical companies in the United States to produce penicillin on a large scale.
- Penicillin was first released for widespread use in the early 1940's and it saved many lives during World War II.

Howard Florey

Ernst Chain

Production of antibiotics

- Penicillins and cephalosporins are antibiotics derived from fungi
- Antibiotics can also be derived from other bacteria. These include aminoglycosides and carbapenems
- Newer antibiotics are synthetically made, usually by modifying the chemical structure of naturally occurring antibiotics
- Chemically synthesised antibiotics include quinolones and sulfonamides

Timeline of antibiotic discovery and development

The period from 1950 to 1960 is often called the golden age of antibiotic discovery. Since then, antibiotic discovery, development and release for widespread use has been in decline.

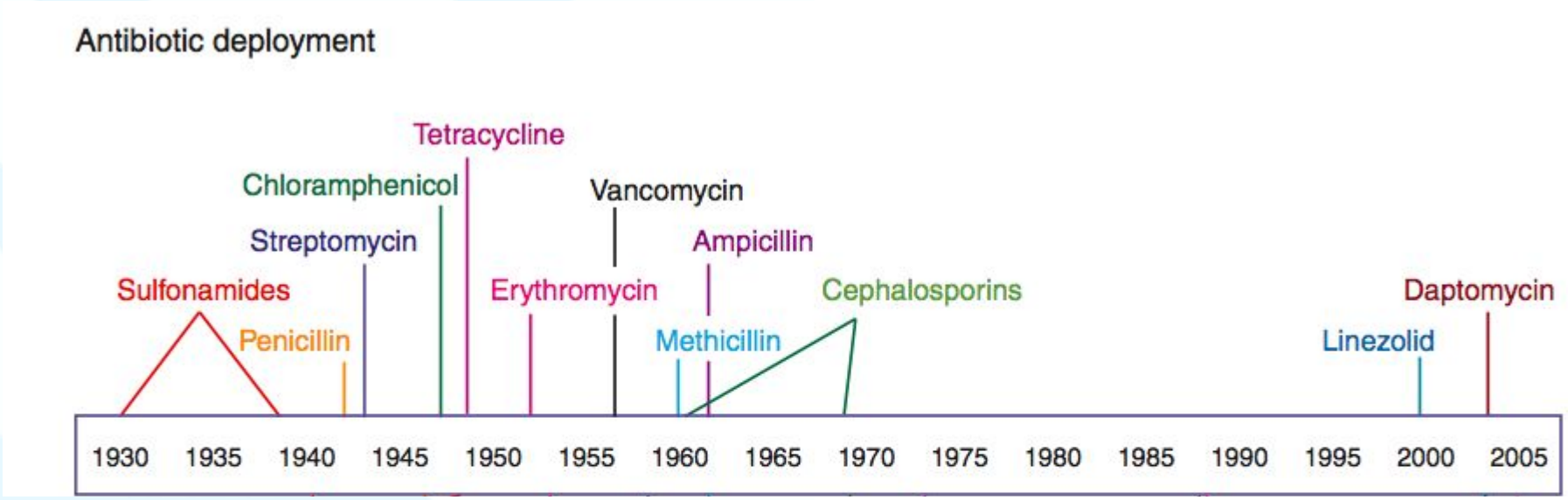
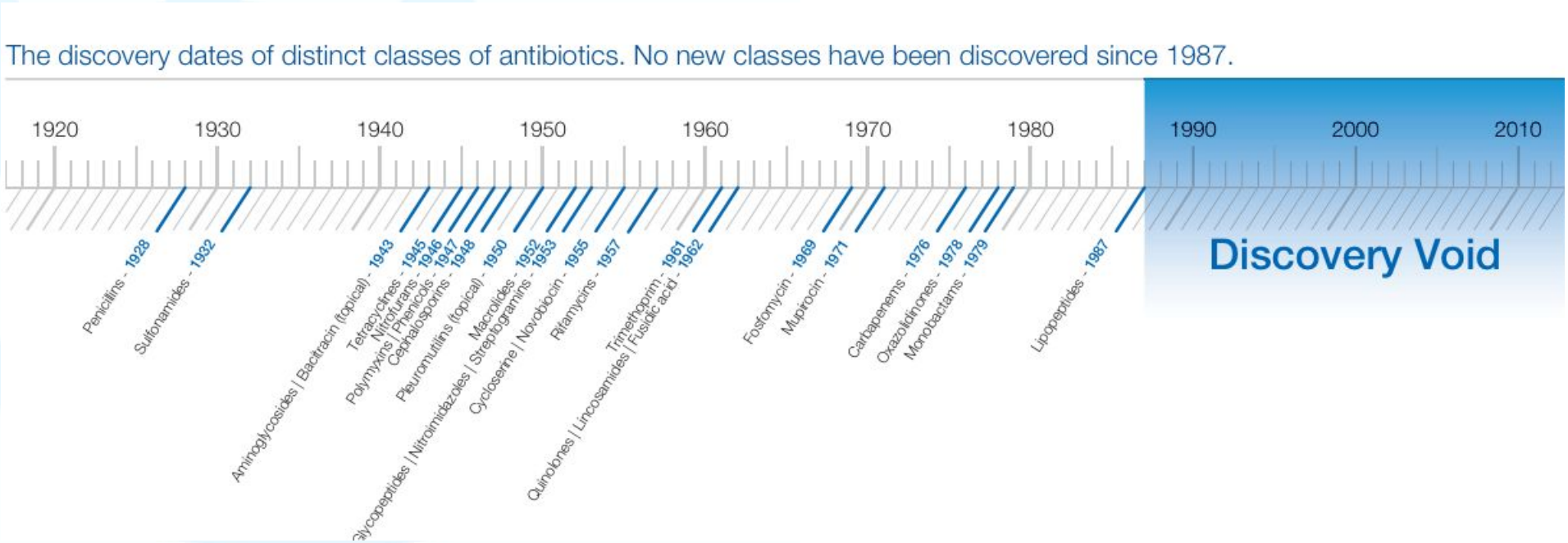


Image credit: Clatworthy *et al.* 2007 Nat Chem Biol 3, 541-8

Discovery of new antibiotics

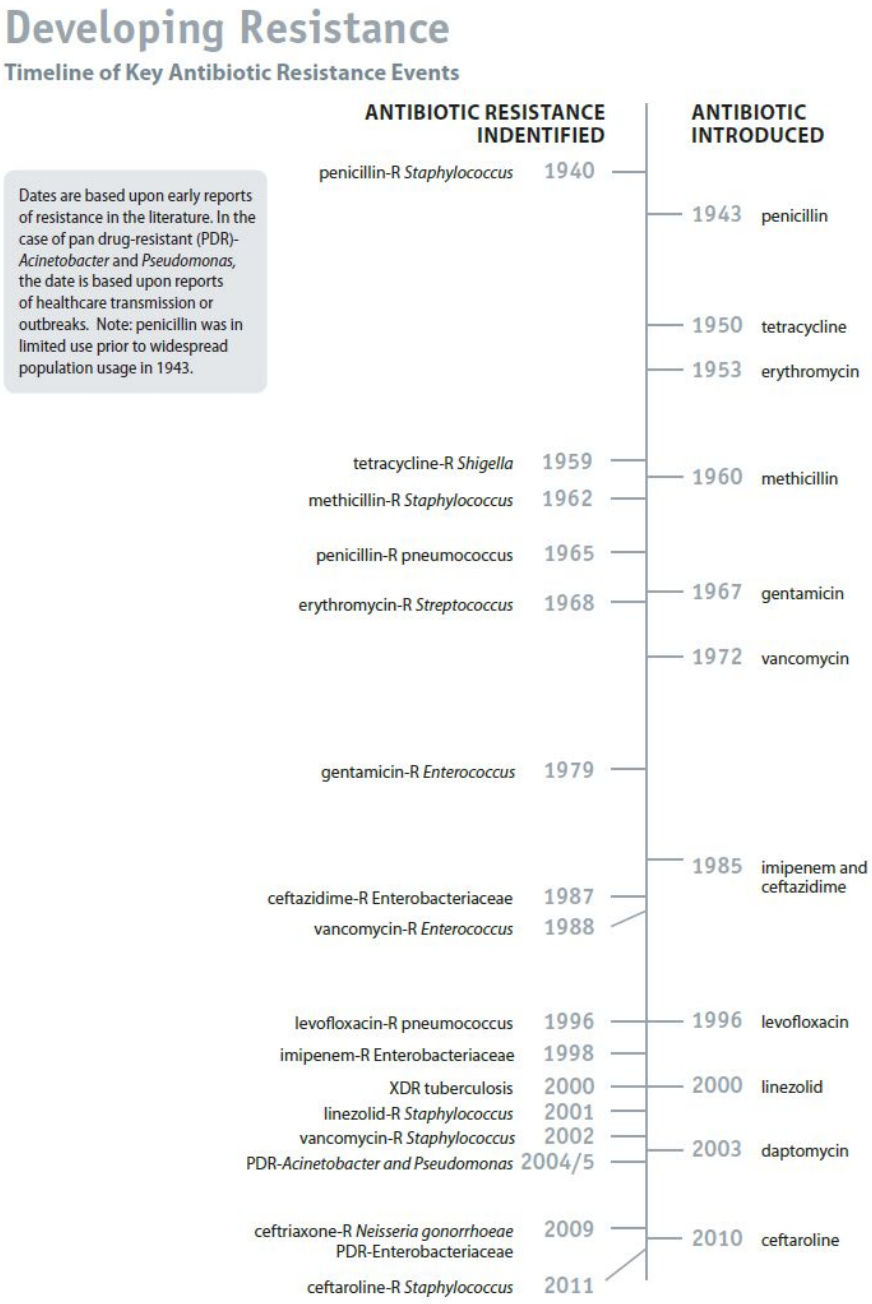


No new classes of antibiotics have been developed since 1987.

Since this time, a few new antibiotics have been introduced, but these are modifications and adaptations to existing antibiotics.

Timeline taken from the World Economic Forum, Global Risk Report 2013

- Antibiotic resistance was first identified in the 1940's.
- Resistance can develop within a short space of time.
- The first Meticillin-Resistant *Staphylococcus Aureus* bacterium was identified only 2 years after meticillin was introduced.
- In the case of penicillin, resistance was identified even before the antibiotic was released for widespread use, although this was not a problem until antibiotics began to be used intensively.



Timeline taken from the CDC report: 'Antimicrobial Resistance Threats in the United States', 2013

Resistance rates in Europe

Antimicrobial resistance rates vary across Europe.

This figure shows the percentage of invasive *Staphylococcus aureus* isolates resistance to meticillin (MRSA), by country in 2012

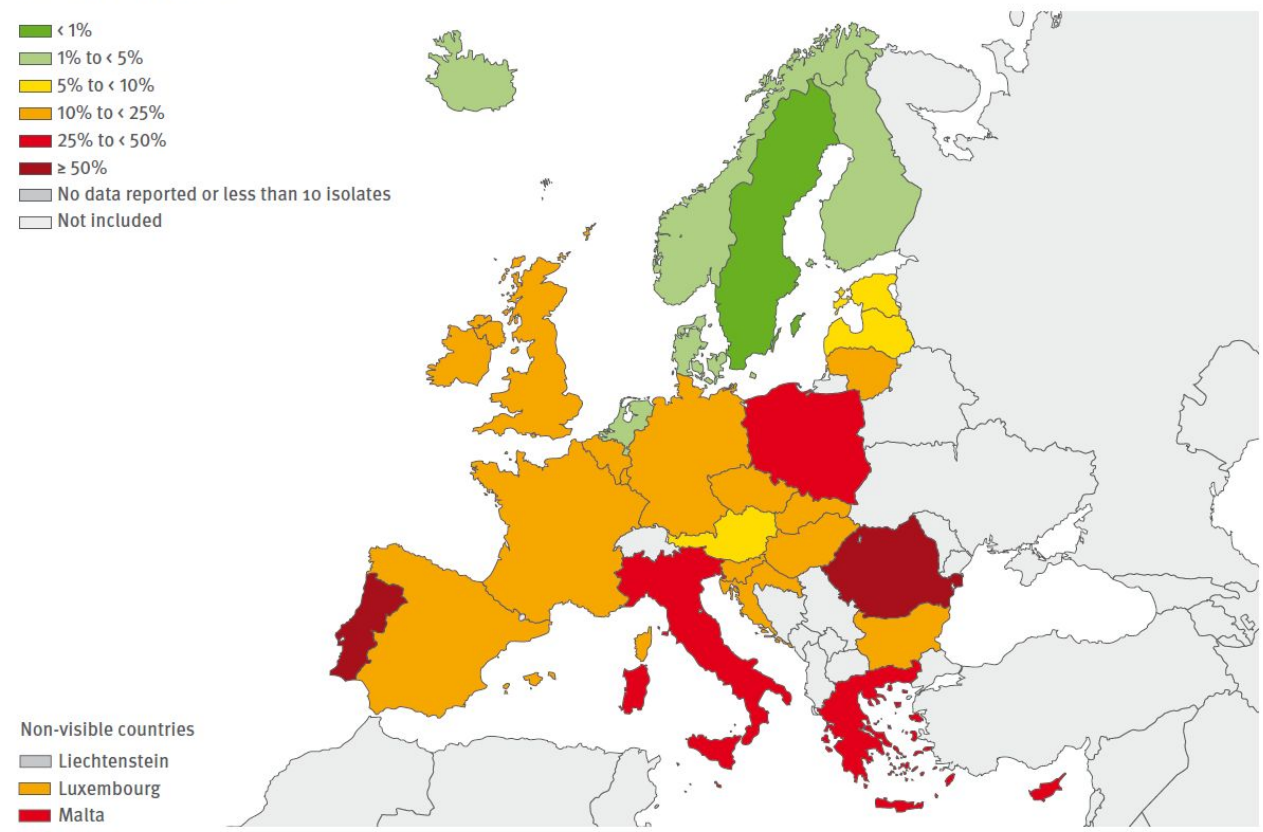


Figure taken from ECDC Surveillance Report: 'Antimicrobial Resistance Surveillance in Europe', 2012.