

How bacteria become resistant to antibiotics

Wageningen development biologists and German physicists have mapped the various evolutionary paths bacteria take in developing resistance to antibiotics.

The researchers placed the bacterium *E.coli* in 24 large test tubes and 74 smaller ones and added nutrients and an antibiotic. The bacterial populations in the large test tubes were 100 times bigger than the populations in the smaller test tubes. The bacteria started dividing and the researchers measured the mutations in the DNA and the resistance of the bacteria. Their first conclusion was that the small populations had about the same number of mutations as the large populations, but the large populations achieved levels of resistance that were about ten times higher.

Bladder infection

The researchers discovered this was because the type of mutation differed between the small and large populations. *E.coli* bacteria have two types of mutation that can make them resistant to antibiotics, says professor of Evolutionary Genetics Arjan de Visser. The first type is the point mutation, where a single letter in the bacterium's DNA changes. The second type consists of mutations in which pieces of DNA are deleted or copied in the genome. Most of the mutations in the large population were point mutations whereas the other type was more com-

mon in the small populations. Point mutations lead to much greater adaptation to the antibiotic.

The German physicists who De Visser collaborates with found an explanation for this difference with the help of machine learning. 'It is now clear that point mutations offer more advantages to bacteria but they are slow to occur and are therefore only seen in large populations,' reports De Visser in the journal *Nature Ecology & Evolution*. The large populations De Visser studied had 200 million bacteria, compared with two million in the small populations. By way of comparison, a urinary tract infection in humans involves billions of bacteria. ^{AS}



E.coli-bacteria • Photo Shutterstock