

## B5.7 Bacterial diseases

### Learning objectives

After this topic, you should know:

- some examples of plant and animal diseases caused by bacteria, including *Salmonella* food poisoning and gonorrhoea.

### Synoptic link

You can learn more about orders of magnitude in Maths skills MS2.

You will learn more about antibiotics in Topic B6.2, and more about antibiotic resistance in Topic B15.8.



**Figure 1** Handling raw poultry, undercooked food, or salads contaminated with raw meat through poor kitchen hygiene are all common sources of the *Salmonella* bacteria that can cause food poisoning.

Bacterial diseases affect animals and plants. In the early 20th century, more than 30% of all deaths in the USA were due to infectious diseases. That is now an order of magnitude lower, and most of the infectious diseases that cause death are viral. Improved living standards and vaccinations have had a major effect on the incidence and death rate of communicable diseases in countries such as the USA and UK.

The development of antibiotics is the other key factor in combating bacterial diseases. Antibiotics kill bacteria or stop them growing and cure bacterial diseases. Unfortunately, bacteria are becoming resistant to many antibiotics and more people are dying from bacterial diseases again.

### Salmonella food poisoning

*Salmonella* are bacteria that live in the guts of many different animals. They can be found in raw meat, poultry, eggs, and egg products such as mayonnaise. If these bacteria get into our bodies, they disrupt the balance of the natural gut bacteria and can cause *Salmonella* food poisoning. One common cause of infection is eating undercooked food, when the bacteria have not been killed by heating. Another is, eating food prepared in unhygienic conditions where food is contaminated with *Salmonella* bacteria from raw meat.

The symptoms develop within 8–72 hours of eating infected food. Fever, abdominal cramps, vomiting, and diarrhoea are caused by the bacteria and the toxins they secrete. For many people *Salmonella* infections are unpleasant but don't last many days and no antibiotics are given. In very young children and the elderly it can be fatal, usually because of dehydration. In countries where there is malnutrition, *Salmonella* is more serious. The World Health Organisation estimates that globally around 2.2 million people, mainly children under 5 years old, are killed by sickness and diarrhoea each year, including *Salmonella* food poisoning.

In the UK, poultry are vaccinated against *Salmonella* to control the spread of the disease. *Campylobacter*, another bacterium found in chickens, still causes around 280 000 cases of food poisoning each year. To prevent food poisoning, keep raw chicken away from food that is eaten uncooked, avoid washing raw chicken (it sprays bacteria around the kitchen), wash hands and surfaces well after handling raw chicken, and cook chicken thoroughly.

### Gonorrhoea

Gonorrhoea is a **sexually transmitted disease (STD)**, which are also known as sexually transmitted infections (STIs). It is spread by unprotected sexual contact with an infected person. Like many STDs, gonorrhoea has symptoms in the early stages but then becomes relatively symptomless. The early symptoms include a thick yellow

or green discharge from the vagina or penis and pain on urination. However, about 10% of infected men and 50% of infected women get no symptoms at all. Untreated gonorrhoea can cause long-term pelvic pain, infertility, and ectopic pregnancies. Babies born to infected mothers may have severe eye infections and even become blind.

Gonorrhoea is bacterial, so it can be treated with antibiotics. Originally it was easily cured using penicillin but now many antibiotic-resistant strains of gonorrhoea have evolved so it is increasingly difficult to treat. All sexual partners of an infected individual must be treated with antibiotics to prevent the disease spreading in the community. The spread of gonorrhoea can also be prevented by using a barrier method of contraception such as a condom and by reducing the number of sexual partners.

### Bacterial disease in plants

There are relatively few bacterial diseases of plants and these diseases are usually found in tropical and sub-tropical regions. *Agrobacterium tumefaciens* is a bacterium that causes crown galls – a mass of unspecialised cells that often grow at the join between the root and the shoot in infected plants (Figure 2). It infects many different plant types including fruit trees, vegetables, and garden flowering plants. The bacteria insert plasmids into the plant cells and cause a mass of new undifferentiated genetically modified cells to grow. For this reason, these bacteria have become a key tool for scientists when genetically modifying plant cells. Scientists make use of the way the bacteria naturally infect plant cells and give them new added genes. They manipulate the bacteria so they carry desirable genes into the cells they infect.



**Figure 2** The bacteria that cause galls like this one on a chrysanthemum plant are also widely used in genetically modifying plants

### Synoptic link

You will find out more about the use of bacteria in the production of genetically modified plants in B14.4 and B14.5.

### Key points

- Salmonella* is spread through undercooked food and poor hygiene. Symptoms include fever, abdominal cramps, diarrhoea, and vomiting caused by the toxins produced by the bacteria. In the UK, poultry are vaccinated against *Salmonella* to control the spread of disease.
- Gonorrhoea is a sexually transmitted disease. Symptoms include discharge from the penis and vagina and pain on urination. Treatment involves using antibiotics, although many strains are now resistant. Using condoms and limiting sexual partners prevents spread.
- There are relatively few bacterial diseases of plants but *Agrobacterium tumefaciens* causes galls.

- State one way that antibiotics work to cure bacterial infections. [1 mark]
- Describe how people become infected with food poisoning caused by *Salmonella*. [2 marks]
  - Doctors in the UK rarely treat *Salmonella* food poisoning with antibiotics. Suggest reasons for this. [3 marks]
- Gonorrhoea is an STD. Explain what this means. [2 marks]
  - Until recently gonorrhoea was relatively easy to treat. Explain this statement. [2 marks]
  - Suggest three ways of preventing the spread of gonorrhoea. [3 marks]
  - Discuss the implications of increased antibiotic resistance in the bacteria causing gonorrhoea for the 106 million people who are infected with the disease each year. [4 marks]
- Write a paragraph for your local newspaper on food preparation for summer barbeques to help people avoid *Salmonella* and other forms of food poisoning. [6 marks]