Science Connections 8 Topic 1.5: Checking Your Understanding Questions (pg 55)

1. A sneeze is certainly nothing to sneeze at. One sneeze can eject a cloud of microbe-filled, microscopic droplets at speeds of more than 300 km/h.
    a. List at least three science-related questions that you have, based on this information.
    b. Choose one of your questions, and describe how you would plan an investigation to answer it.

Answers may vary.

2. What is the function of the human immune system?

To defend and protect against pathogens (disease-causing microbes, often viruses and bacteria).

3. Identify three examples of the first line of defence of the immune system. Choose one and describe how it works.

Skin – protective barrier; also has things like sweat and body acids which make the surface of the skin less hospitable to bacteria that might want to live there; is waterproof which makes it easy to clean and wash

Digestive system – contains mucus to trap pathogens, and acid to kill them. Also, vomiting helps to get rid of pathogens.

Respiratory system – contains mucus to trap pathogens, and hairs to sweep them out. Also, coughing, sneezing, swallowing helps to get rid of pathogens.

4. Explain what inflammation is, which line of defence it is part of, and the role it plays to protect you from microbes.

Inflammation is when a wound becomes red, swollen and itchy. Usually this happens at the site of an open wound (cut, scrape), though it can happen elsewhere there is an infection. Inflammation is caused by an increase in blood flow to an area. It brings more white blood cells to an area, which directly engulf and destroy pathogens.

5. Explain how some people in a population might be immune to a disease. Use an example to help demonstrate your understanding.

The third line of defense involves specialized white blood cells which retain a 'memory' of diseases that have been fought before. Thus, if a population experiences the same disease enough times, their immune systems will have such a strong memory of that disease that

future reinfections of that disease will cause individuals to barely become sick or not at all. E.g. European populations had high immunity to smallpox and measles because these diseases circulated in these populations many times, reinfecting the same individuals multiple times; over time, immunity built as the white blood cells in these populations became trained to more effectively fight these diseases.

Fun fact: some elements of the immune system (e.g. antibodies) can be passed from mothers to children during pregnancy and birth.

6. If you were to build a castle with the best possible defence system, what would you include? Why? How is a castle's defence system like your immune system?

Answers may vary.

7. There were three flu pandemics during the 20th century. The number of deaths is shown in the table below.
    a. Which pandemic was the most deadly?

Spanish flu. It resulted in the most deaths.

    b. For which pandemics was a flu vaccine likely available? Why do you think so?

A vaccine was most likely available for the Asian flu and Hong Kong flu. During these pandemics, very few people died globally compared to the Spanish flu, even though the global populations would have been substantially greater.

    c. Why might a flu pandemic eventually stop on its own, instead of eliminating all human life?

Eventually, if enough people are infected and build up immunity to the flu, then the chances of reinfection are lower even if exposed to the pathogen again.

8. Engineers often design systems so that important parts or functions are duplicated. This is called redundancy. It helps make a system more secure and reliable. If a part or a function fails to work, there is a backup to protect the whole system.
    a. In what ways is the immune system a redundant system?

There are three lines of defense of the immune system. The second line of defense is only used when the first line of defense fails (e.g. if there is a cut in the skin); the third line of defense is most relevant when the second line of defense is insufficient.

There is redundancy in the sense that elements of all three lines of defense can be involved in killing pathogens directly. E.g. stomach acid in the first line of defense, white blood cells in the second line of defense, white blood cells in the third line of defense.

b. Do you find it helpful for your own understanding to compare the biological immune system to a technological system? Give reasons why you do or don't find it helpful.

Answers may vary.