

Fighting malaria

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Learning objectives

- Understanding what challenges scientists face when tackling malaria
- Linking innovations to solving these challenges



Curriculum links

- Science (Biology)
 - Cells and organisation
 - Health
 - Interdependence
 - Gender and evolution
- Design and technology
 - Using research and exploration, such as the study of different cultures, to identify and understand user needs
 - Identifying and solving their own design problems and understand how to reformulate problems given to them
 - Developing specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations

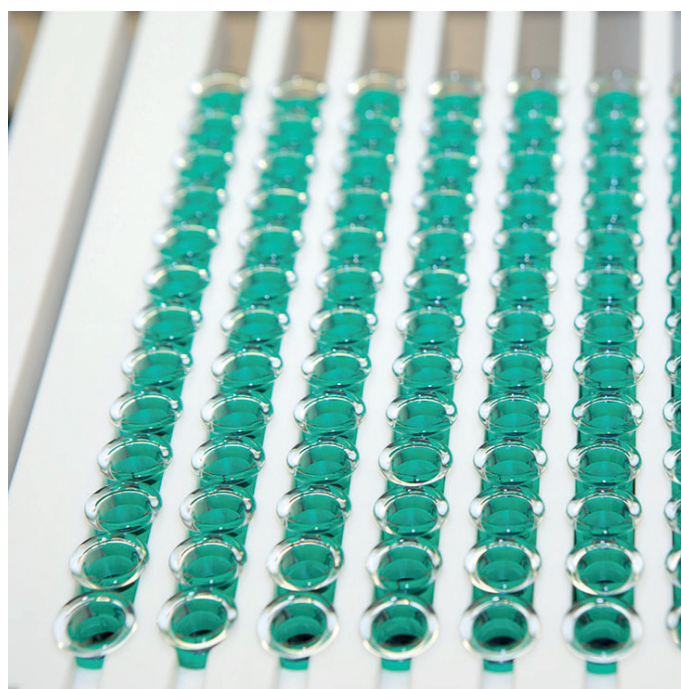


Resources required

- Fighting malaria presentation slides
- Quiz sheets (or Kahoot quiz, if preferred)



Time needed: 45 minutes



Contents

Page

Introduction (1 min)

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Activity 1: Find the lesson theme (10 mins)

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Innovations in malaria (30 mins)

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Video (1 min)

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Slides 1-2

Introduction

- Let the class know they are going to play a game to reveal today's lesson theme
- This game is designed to get students thinking about the wider challenges that need to be considered when developing a new treatment - in this case an anti-malarial treatment



Activity 1

Find the lesson theme

10 mins

- Distribute the **quiz sheet** and use this as an icebreaker activity, encouraging students to try and guess what the rest of the lesson is going to be about as you go
 - Make sure you don't tell them the lesson name before you do the quiz
 - If you prefer using Kahoot (or similar), you could set this up ahead of time instead of printing the quiz sheet
 - The questions are below with answers, which are also on **Slide 2**:
- 1. What is a specific quantity of medicine to be taken at one time?**
A: Dose
 - 2. If you have the XX chromosomes, you are...?**
A: Female
 - 3. Name something you might get from an insect that's itchy?**
A: Bite
 - 4. Name something made from a mesh fabric that can be used to catch fish?**
A: Net
 - 5. What is the name of an injection given someone to prevent them from getting a disease?**
A: Vaccine
 - 6. What do we call the act of working with others on a joint project?**
A: Collaboration
 - 7. When something is quiet and inactive (such as a volcano) it is said to be?**
A: Dormant
 - 8. Medicines can become less effective when microorganisms change and build up r _____**
A: Resistance
 - 9. The application of medicine to a patient to help manage a disease is called a is called a _____ment?**
A: Treatment

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Slide 4

Specific carriers

- Ask students what they think the lesson is about (if they haven't already guessed) - **Slide 3** will reveal the answer
- Tell students during the lesson they're going to learn more about malaria, and the development of anti-malarial treatment through 30 years of innovation history
- Explain to students that infection only occurs when the person is bitten by a mosquito which is carrying the malaria parasite. Only female mosquitoes bite humans, as they require our blood for egg production. You can only get malaria if the mosquito has the infective stage of the malaria parasite present in the salivary glands



Top tip

Use the thought bubbles on each slide to create class discussion. This can be done either:

- As an open Q&A in class
 - By dividing the class into groups and giving each group one discussion point to prepare and present
- Emphasise that it is key to get all the information about how an infection is passed on, because it helps to design and target the medicine
 - Explain that knowing a disease is gender specific, whether it's in parasites, mosquitos or humans, helps medicine to be targeted and effective



Slides 5-6

An in-depth look at parasites

- Reiterate to students that the mosquito doesn't actually cause the infection itself – it's a parasite inside the mosquito that does. This parasite enters the person's blood stream and causes the malaria
- Medicine would therefore be more successful if it targeted the parasite, rather than the mosquito
- **Discussion questions:** What is a parasite? Are they all bad? Can you think of any examples?

Potential answers:

A parasite is an organism that lives in or on another organism (which we call the host) – examples include:

- | | |
|-------------|-----------|
| ▪ Tapeworm | ▪ Fleas |
| ▪ Head lice | ▪ Scabies |
| ▪ Bed bugs | ▪ Leeches |
- Move to **Slide 7** and explain to students that when the parasite enters the person's blood stream, it has an exceptional ability to hide in the person's liver
 - In some malaria species, it can reawaken weeks or even years after the first infection, causing a relapse. This relapse can cause sickness and, in some cases, even death
 - Go on to explain that because of this, a treatment needs to target the parasite even when it is dormant

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Slides 5-6

An in-depth look at parasites Continued...

- **Discussion questions:** What extra challenges might scientists, doctors and patients face with a dormant disease?

Potential answers:

- It makes it harder for scientists to know exactly where to target the medicine
- We don't know exactly when it will resurface, so it's difficult to be ready for it when it awakes
- How do you know if a patient has malaria? They could have it but show no symptoms as it is dormant – sometimes for years



Slide 7

How to prevent malaria

- Explain to students that you are going to look at methods of preventing malaria now, such as a mosquito net
- A mosquito net stops the bite in the first place, and this has significantly reduced the number of infections in a lot of affected areas
- The majority of bed nets that are distributed to people in malaria endemic regions are treated with insecticide. However, mosquitoes may begin to develop insecticide resistance
- Explain that a lot of companies are working to combat the disease from all angles, not just with medicine, including charities like Save the Children to ensure bed nets are distributed
- Ask students if they know that malaria carrying mosquitoes typically bite between 10pm – 2am? This means that night time bed nets are very effective

- **Discussion questions:** Getting nets to people in remote areas is a complicated problem. How could you overcome this?

Potential answers:

- Delivering via drones
- Giving them out at school
- Collaborating with local bodies like councils, hospitals and schools (this is vital)
- Building links with charities who work locally and could help with distribution
- Employing local people to distribute nets

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Slide 8

Treatments and management

- Share that there are several types of malaria, and several different treatment options
- One type of treatment needs to be taken for 14 consecutive days. Patients can forget to take pills, which means they don't work
- Explain to students that bug spray contains something called insecticide, which is toxic to mosquitos (and other insects). Reducing the number of mosquitos, which could be carrying the parasite, is another common and useful way of managing malaria
- **Discussion questions:** What other treatments or medicines can you think of that need to be taken for several days to be effective?

Potential answers:

- Antibiotics
- Chemotherapy
- Anti fungals e.g. for athlete's foot



Slide 9

Resistance

Explain to students that antimalarial drug resistance can develop for a number of reasons. These include:

- Unregulated or poorly administrated drug use (i.e. people not taking full courses of medicine)
- There is a condition called sickle cell anemia, where sufferers' red blood cells are a different shape, which means they are resistant to malaria
- Mosquitoes can develop insecticide resistance, from measures like bug spray and mosquito nets
- This is called resistance and new medicine must be developed which target these resistant strains of malaria
- **Discussion point:** Resistance can be hard to get your head around; can you think of an analogy or model to help explain it?

Potential answers:

- Imagine the malaria is a jigsaw piece, and the treatment is another piece that fits to it, and when it does, the treatment can combat the malaria. But if the malaria changes the shape of its jigsaw piece, the treatment no longer works as it cannot fit
- Imagine the treatment is a sword that can kill the malaria. But if the malaria builds a shield, the treatment sword can no longer attack the malaria



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Slide 10

Vaccinations

- Explain to students that finding a vaccine for malaria is incredibly hard, because:
 - the malaria parasite is very resilient and genetically complex
 - there are several species of malaria to tackle
 - cost of vaccine development, production and delivery
 - a lack of vaccine developers
- A lot of people have been working on a vaccine for a long time. Once one is developed, it will be used alongside other tools such as bed nets and medicines
- Discussion point:** Have you had any vaccinations? How do they work?

Potential answer:

- Vaccines contain either a tiny (but not harmful) amount of the disease, or a fake version of the disease. When this enters your body, your white blood cells fire out antibodies - they need to find the correctly shaped antibody to combat the disease. Once the white blood cells find the right antibody, they will remember which antibody is required to better combat that particular disease
- This means that if you contract the real disease, your white blood cells can immediately fire out the correct antibody (as they have remembered) combating the disease before it has a chance to do any harm



Slide 11

Side effects

- Explain that some medicines can effectively treat a problem, but can also have some side effects like fever and dizziness
- To combat this, global health experts like "PATH" (a team of experts who are working towards global health equity), help develop tests for patients which can predict if they will suffer these side effects before they take the medicine
- Discussion point:** Many medicines have side effects, so why do we still often take them?

Potential answer:

- The risk/hindrance of a side effect is outweighed by the benefit of treating the disease. For example, if there is a treatment for malaria which may cause nausea, patients are advised to take it as the benefits of treating the malaria to avoid high fevers, and even death, outweigh the side effects. For any potential new medicines, the pros (effective benefits) are weighed up against the cons (side effects)

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Slide 12

A global health problem

- Sum up by reiterating to students that malaria is a global problem
 - Many different types of organisation have collaborated in the fight against malaria to share knowledge and expertise. Ask students if they can think of or know of any examples
 - Explain that collaboration is key to efforts in fighting a problem like malaria
 - **Discussion point:** Many teams of people are helping the fight against malaria, but not all in making medicine or a vaccine. What role might these teams play in the fight against malaria?
- Potential answers:**
- Teams who collect data on patients who already have malaria, so research for a treatment can be more efficient
 - Sponsors and fundraisers to support the research financially. Remember the scientists need paying, equipment is pricey, and distribution of resources costs money
 - Teams who work with communities to educate them on what symptoms to look for, and the benefit of nets, so malaria can be treated as early as possible
 - Charities which distribute nets, particularly in high malaria zones
 - Schools which educate children on how to lower chances of getting malaria and what symptoms to look out for
 - Leaders of community groups or religious organisations like churches and mosques, to spread the message that treatments are available, and the importance of spotting the disease early
 - Charities like Comic Relief which ensure people can access diagnosis, so they know if they have malaria or not and Save the Children help children access basic healthcare and medicines they need to fight disease
 - The World Health Organisation to coordinate research efforts and make sure research or work is not conducted twice by two different countries; this ensures everyone is working together and pooling knowledge so faster progress can be made

