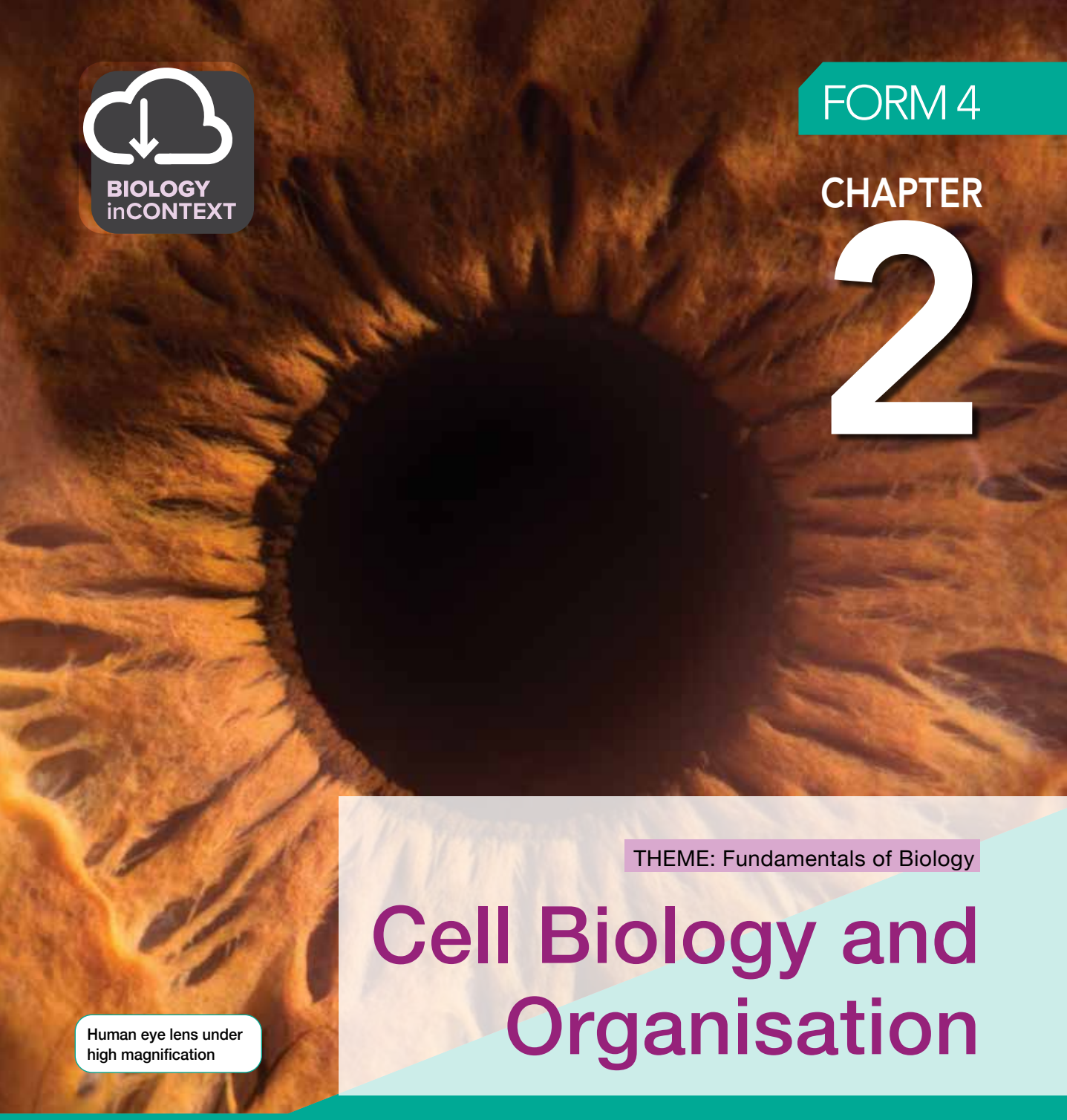
BIOLOGY inCONTEXT

FORM 4

CHAPTER

2



Human eye lens under high magnification

THEME: Fundamentals of Biology

Cell Biology and Organisation

Which human cell has the longest lifespan?

The different cells of the human body have different lifespans. Neutrophils have a lifespan of about two days but eye lens cells live throughout the lifespan of a person. The photograph shows the scanning electron micrograph of a human eye lens. The eye lens has a long structure without a nucleus.

BIOLOGY inCONTEXT

FORM 4

CHAPTER 3

THEME: Fundamentals of Biology

Movement of Substances Across a Plasma Membrane

How does a genetic defect in channel proteins leads to hyperkalemic periodic paralysis (HYPP) in horses?

Hyperkalemic periodic paralysis (HYPP) is an inherited disease of the muscle which is caused by a genetic defect. In the muscles of affected horses, a point mutation occurs in the sodium channel gene and is passed on to offspring. Sodium channels are channel proteins in the plasma membrane of muscle cells. The presence of the defective sodium channel gene causes the channel to become 'leaky' which results in the fluctuation of potassium levels in the blood. Hyperkalemia describes the excessive amount of potassium in the blood that causes muscles in horses to contract involuntarily. As a result, the affected horse experiences sporadic muscle tremors or paralysis.

BIOLOGY inCONTEXT

FORM 4

CHAPTER

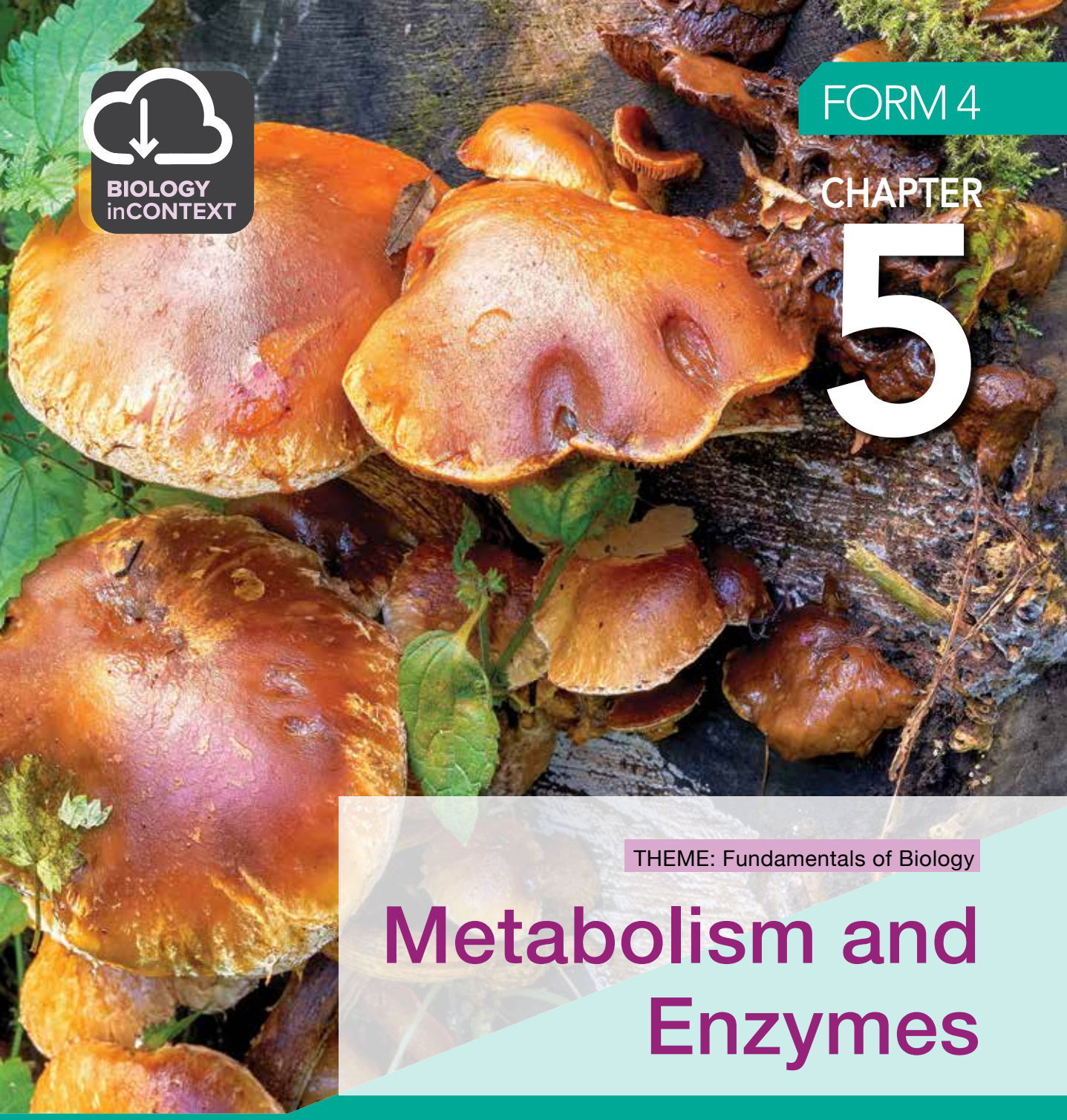
4

THEME: Fundamentals of Biology

Chemical Composition in a Cell

How do scientists apply the knowledge of biological elements and molecules in biological control of pests?

Saponins extracted by using nanotechnology from the plant *Furcraea selloa* is an effective biopesticide that can be used to control the population of freshwater snails. The extract known as nano-emulsion saponins is not dangerous to other organisms and is environmentally friendly. Saponins are organic substances that contain carbohydrates and steroid chains. Foam is produced when saponins are dissolved in the water. Foam disrupts the absorption of cholesterol into the intestine of freshwater snails and this causes them to die. The knowledge of elements and biological molecules enables scientists to produce this biopesticide.



BIOLOGY inCONTEXT

FORM 4

CHAPTER 5

THEME: Fundamentals of Biology

Metabolism and Enzymes

Can fuels be produced from enzymes extracted from fungi?

Lytic xylan oxidases extracted from wood-decaying fungi have the potential to change wood into biofuels that are more cost-effective and have the potential to replace petroleum.

BIOLOGY inCONTEXT

FORM 4

CHAPTER 9

THEME: Physiology of Humans and Animals

Nutrition and the Human Digestive System

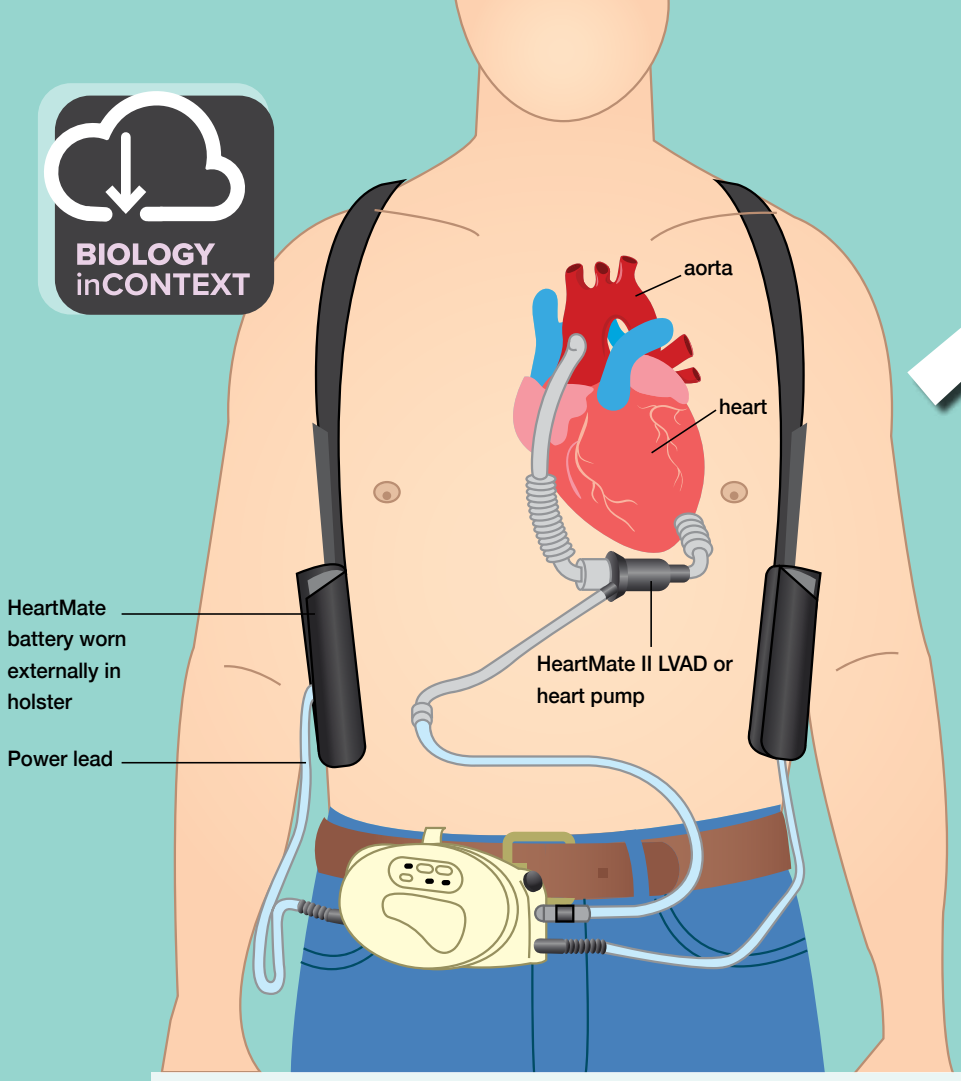
Future food can be designed to meet the nutritional needs of humans

In future, food can be tailored according to the nutritional needs of a person by using 3D food printing. 3D printing is the process of manufacturing food products using a variety of manufacturing techniques. Food grade syringes hold the printing material which is then deposited through a nozzle layer by layer. The food can be customised according to flavour, texture, colour and the nutritional needs of the individuals.

BIOLOGY inCONTEXT

FORM 4

CHAPTER 10



THEME: Physiology of Humans and Animals

Transport in Humans and Animals

What is a mechanical heart?

HeartMate dan HeartWare are mechanical hearts which help to pump blood in patients suffering from heart failure. These devices give freedom to patients to lead a normal life and continue to carry out their daily activities. The device can be easily carried because it weighs less than 1 kg.

BIOLOGY inCONTEXT

FORM 4

CHAPTER

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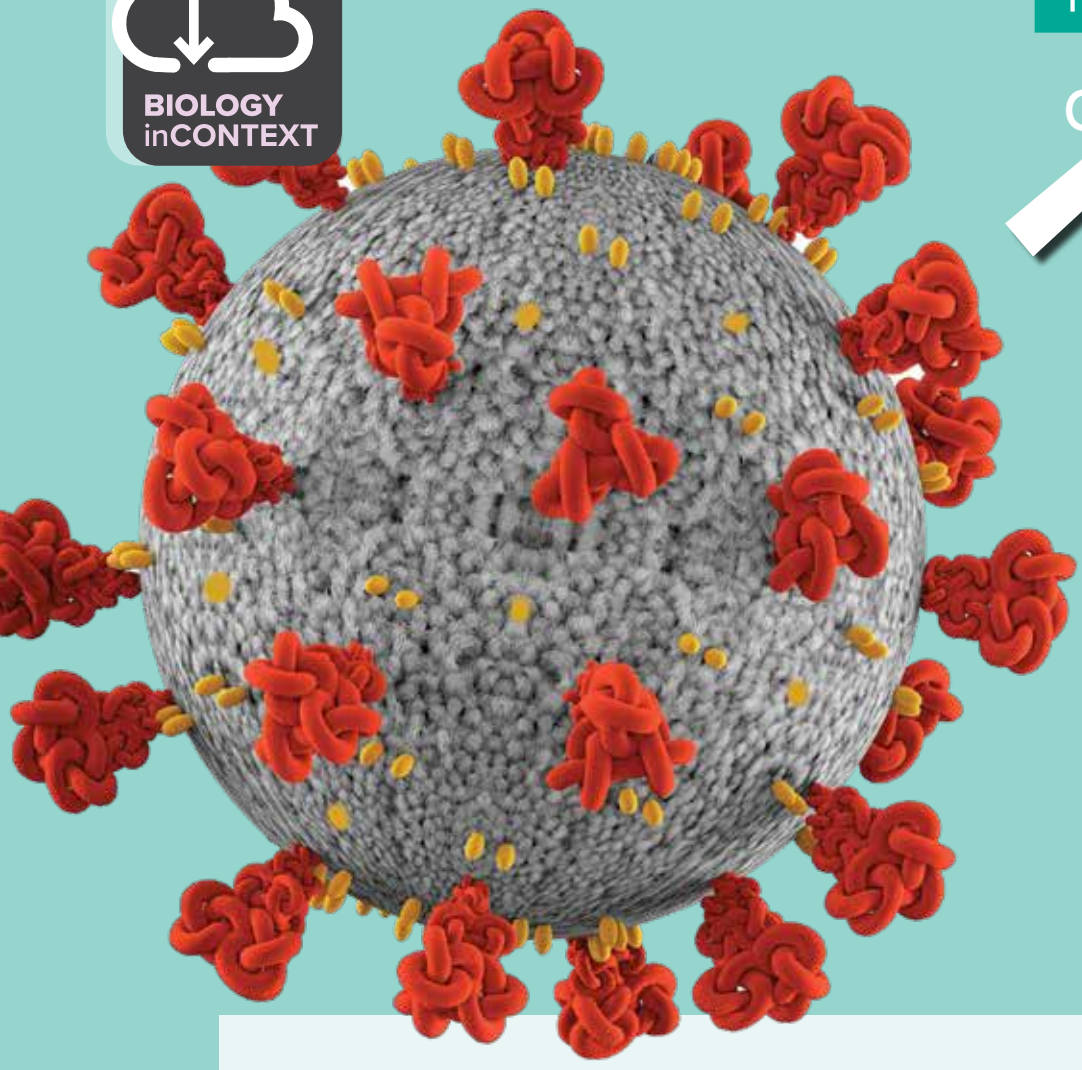


THEME: Physiology of Humans and Animals

Immunity in Humans

How do our bodies fight against viral infections?

During an infection, viruses invade cells in order to reproduce. After recognising an invading virus, B cells produce the specific antibody. Each B cell can produce about 2 000 antibody molecules per second. After 4–7 days, the antibody (IgG) is present in blood. Antibodies bind to viruses, marking them as invaders so that phagocytes can engulf and destroy them.

BIOLOGY inCONTEXT

FORM 4

CHAPTER

12

Sophia

THEME: Physiology of Humans and Animals

Coordination and Response in Humans

Can robots function like humans in the future?

A robot named Sophia is the first robot awarded citizenship by a country. Sophia's artificial intelligence is like that of a human brain. Sophia can process complex information, communicate and interact with humans. With the development in Industrial Revolution 4.0, robots like Sophia will one day possess similar emotions like humans.

BIOLOGY inCONTEXT

FORM 4

CHAPTER 13

THEME: Physiology of Humans and Animals

Homeostasis and the Human Urinary System

Can human organs be produced through 3D printing?

Laboratories and research centres are bioprinting human organs such as kidneys, liver and heart. The objective is to make these 3D printed organs suitable for transplantation to cope with the lack of organ donors. To develop fully functional bio-printed organs, scientists use cellular structures made from bio-inks loaded with stem cells. These biomaterials are deposited layer by layer to create the organ. After printing, the organ is transferred to an incubation chamber for cells to grow to become an organ before it is implanted into the patient.

BIOLOGY inCONTEXT

FORM 4

CHAPTER

14

THEME: Physiology of Humans and Animals

Support and Movement in Humans and Animals

How are the fibres of the spiderweb silk used to aid the support system?

Spiderweb silk is made from a substance stronger than steel but more flexible. It can stretch 40 times longer than its original length. Scientists created a composite that is biodegradable from the fibres of the material. The composite is very strong, elastic and can withstand heavy load like body weight. This composite can be used to treat fractured bones instead of using metals that can cause inflammation and pain to a patient.

BIOLOGY inCONTEXT

FORM 5

CHAPTER 1

THEME: Physiology of Flowering Plants

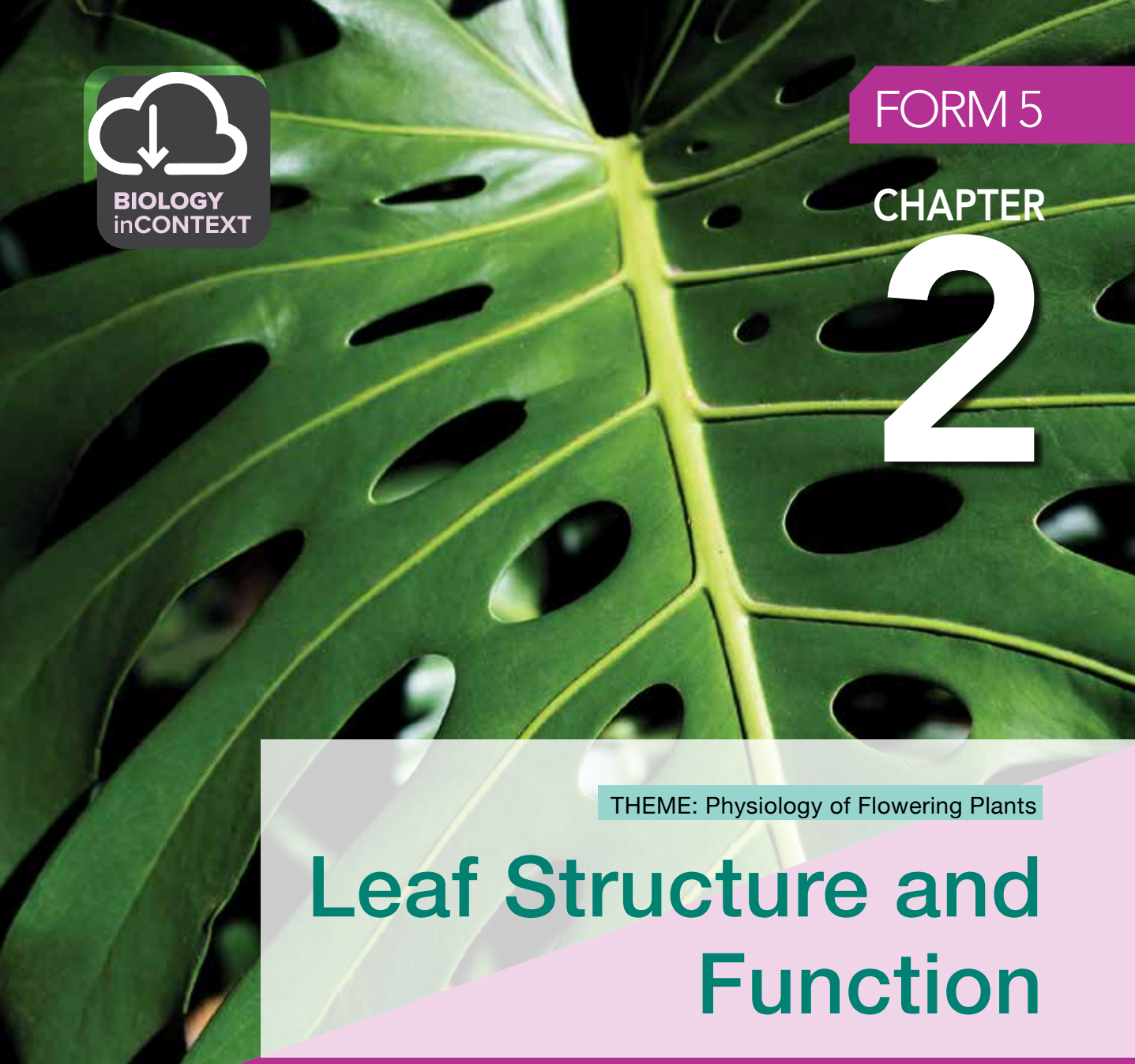
Organisation of Plant Tissues and Growth

Why was the *merbau* (*Intsia palembanica*) chosen as Malaysia's national tree?

On 23 August 2019, Tun Dr Mahathir Mohamad announced that the *merbau* tree is chosen as the national tree and a symbol of national pride. The *merbau* is a hardwood tree that can grow to a height of 50 meters, with a girth of 1.5 meters and its buttress roots can reach 4 meter high. How does the *merbau* tree grow to this size?

What is the effect of music on plant growth?

Scientists have shown that some plants grow more quickly after being exposed to musical stimulation. Seeds that are exposed to music will also germinate faster. Vibrations from sound waves seem to stimulate the secretion of growth factors. Research has shown that vibrations from sounds such as music can turn genes on and off, indicating that plants may listen to their surroundings to know when to express certain genes, especially genes that control growth.



BIOLOGY inCONTEXT

FORM 5

CHAPTER 2

THEME: Physiology of Flowering Plants

Leaf Structure and Function

Why are there holes in the leaves of *Monstera deliciosa*?

Plants usually have lots of small leaves, or fewer larger ones to increase the surface area to absorb as much sunlight as possible. However, for the *Monstera deliciosa* that lives below the canopy of thick tropical rainforests, having many small leaves does not help the plant to absorb the maximum amount of sunlight. By having large holes that puncture its leaves, the plant can spread out its leaves over bigger areas to receive sunlight that filters down through the thick canopy but at the same time does not need to expend more nutrients and energy to fill up the entire space.

BIOLOGY inCONTEXT

FORM 5

CHAPTER 6

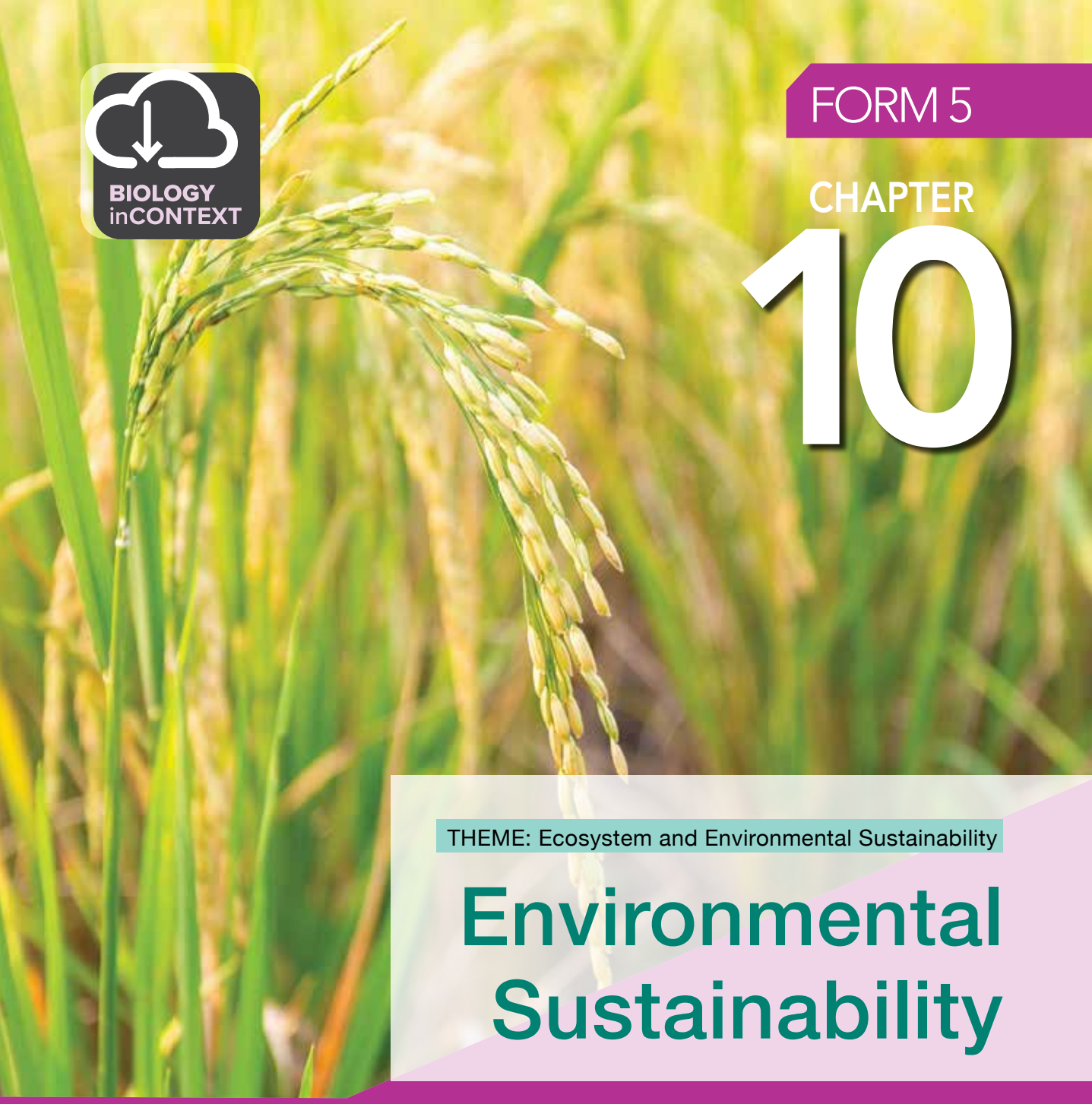
THEME: Physiology of Flowering Plants

Sexual Reproduction in Flowering Plants

Bats are important pollinators for durian flowers. As they feed on the nectar of the flowers, they help to pollinate the stigma.

When fruit bats feed on fruits, they help to disperse seeds as they carry the seeds and drop them elsewhere. Sometimes these bats swallow small seeds and defaecate them while in flight

Bats also provide important pest control services by feeding on the insects that damage farmers' crops such as paddy, and help reduce the populations of disease-carrying vectors such as mosquitoes.



BIOLOGY inCONTEXT

FORM 5

CHAPTER

10

THEME: Ecosystem and Environmental Sustainability

Environmental Sustainability

Increasing food security in Malaysia

Two new varieties of paddy recently developed by the Malaysian Agricultural Research and Development Institute (Mardi) are able to produce 9 metric tonnes of rice per hectare. These new varieties are set to increase rice yields and food security in Malaysia. The two new varieties are the MR315 or *Seri Waja* and MRQ104 or *Kembang Sari*. MR315 and MRQ104 are more disease resistant, tolerant to weather changes and the soil conditions of our country.

Star online 28 Feb 2021

BIOLOGY inCONTEXT

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CHAPTER

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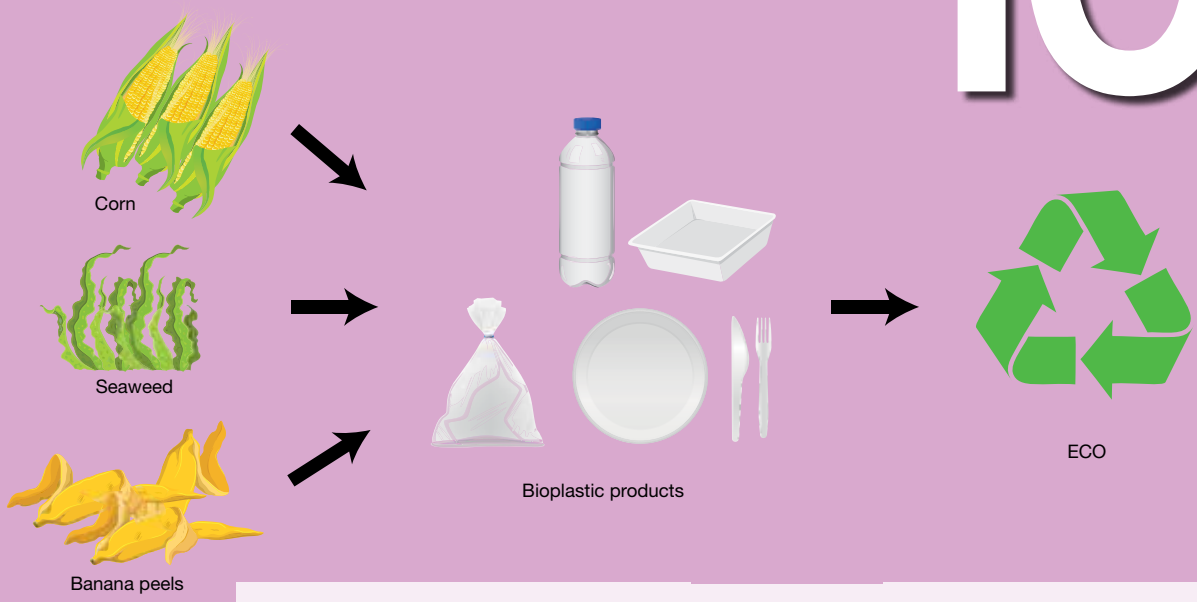


THEME: Ecosystem and Environmental Sustainability

Green Technology

Bioplastic, the new plastic

AS public awareness of plastic pollution and climate change increases, there is a great need to find replacement for fossil-fuel plastics which are derived from petroleum or natural gas. Now bioplastic is set to replace fossil-fuel plastics.

Bioplastic is plastic materials produced from renewable biomass sources, for example agricultural by-products such as starch from palm, corn, potatoes, cellulose and lactic acid, straw, woodchips, sawdust, and recycled food waste.

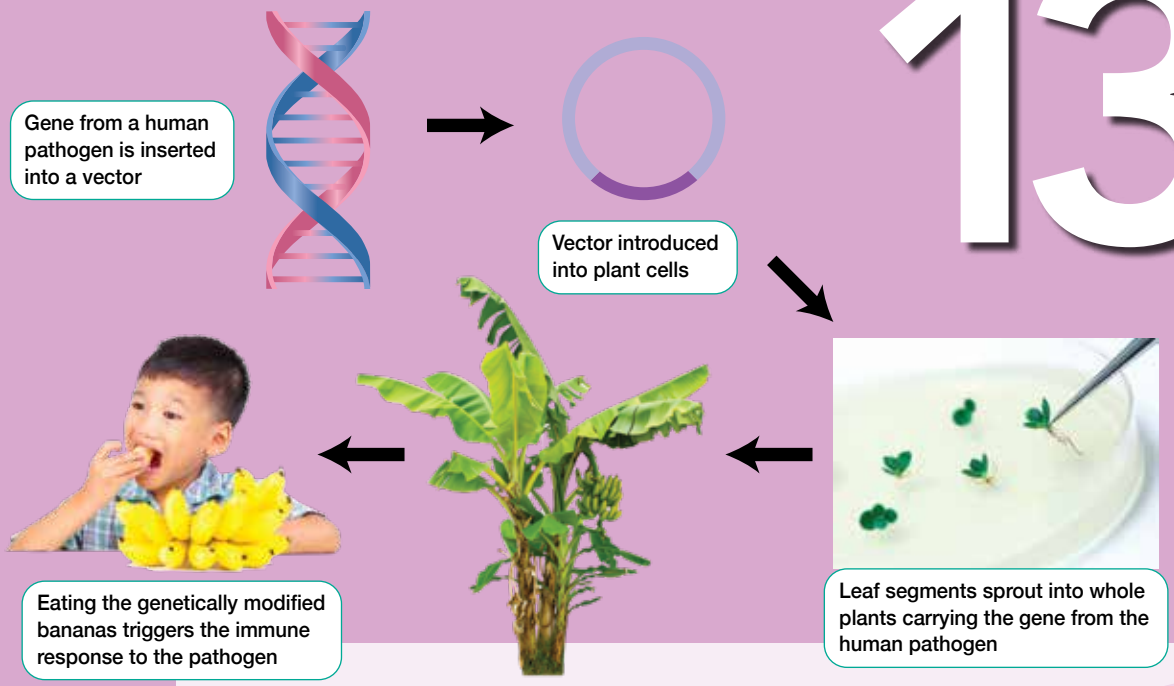
Bioplastic breaks down faster, with a minimum amount of harmful carbon dioxide emissions. Hence, it is a more environmentally friendly alternative.

BIOLOGY inCONTEXT

FORM 5

CHAPTER 13

Recombinant technique used in producing edible vaccine

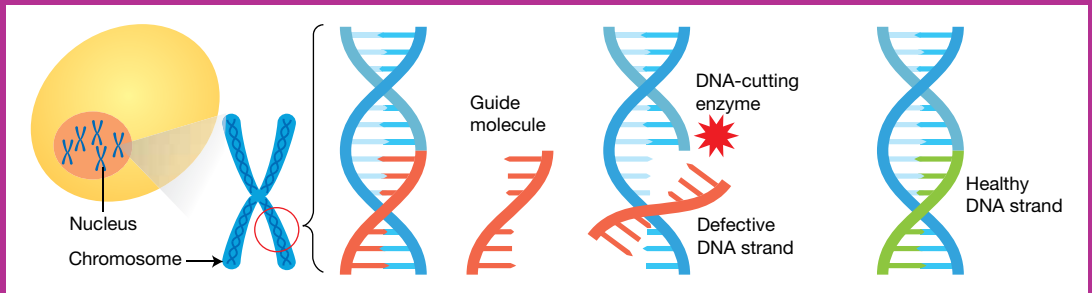


THEME: Inheritance and Genetic Technology

Genetic Technology

How is the CRISPR technique carried out

CRISPR is a DNA editing technique which has a function of finding and replacing a gene



A cell is transfected with an enzyme complex containing a guide molecule, a healty DNA copy and a DNA-cutting enzyme.

A specially designed synthetic guide molecule finds the target DNA strand.

An enzyme cuts off the target DNA strand.

The defective DNA strand is replaced with a healthy copy.