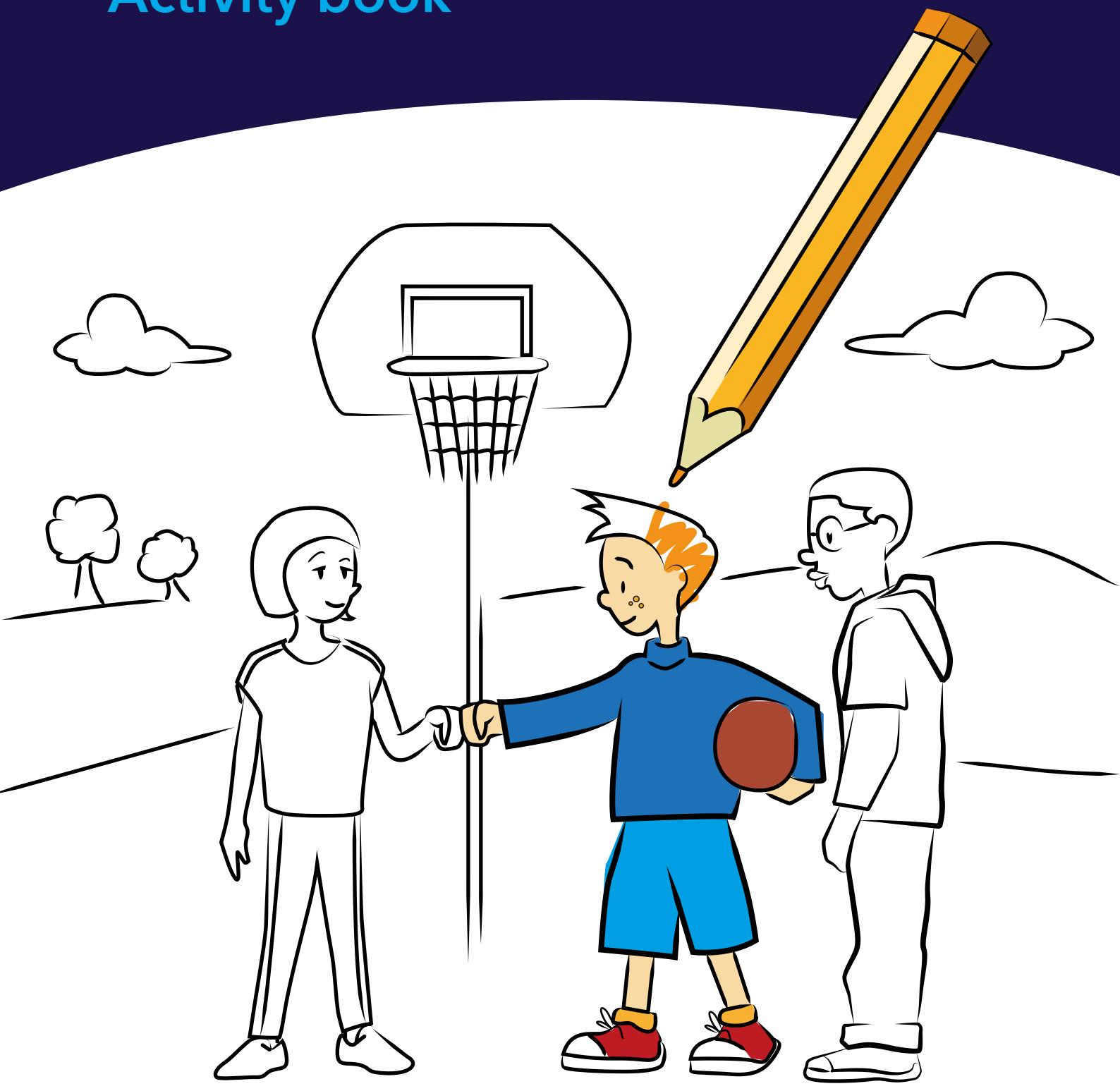
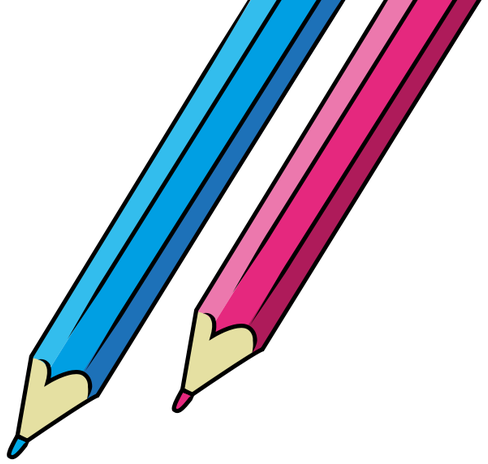
Medtronic
Engineering the extraordinary

Pacemaker

Activity book



About this book



This Colouring and activity booklet is for your child.

The story and activities help and encourage your child to:

- learn about how the heart works
- learn what a pacemaker is
- learn how a pacemaker works
- understand why their heart needs a pacemaker, defibrillator, or heart failure device
- learn about the first weeks after getting a pacemaker and follow-up visits with their doctor.

If you have specific questions about your child's heart device, please ask your child's heart doctor or nurse.

Oliver’s pacemaker helps his heart

Oliver loved riding bikes with his friends.

But last summer Oliver had a hard time keeping up with them. However hard he puffed, the wheels spun slowly.

To hide how he felt, Oliver would stop to tie his shoe. Or he would stop and look for glittery little critters to show his friends.

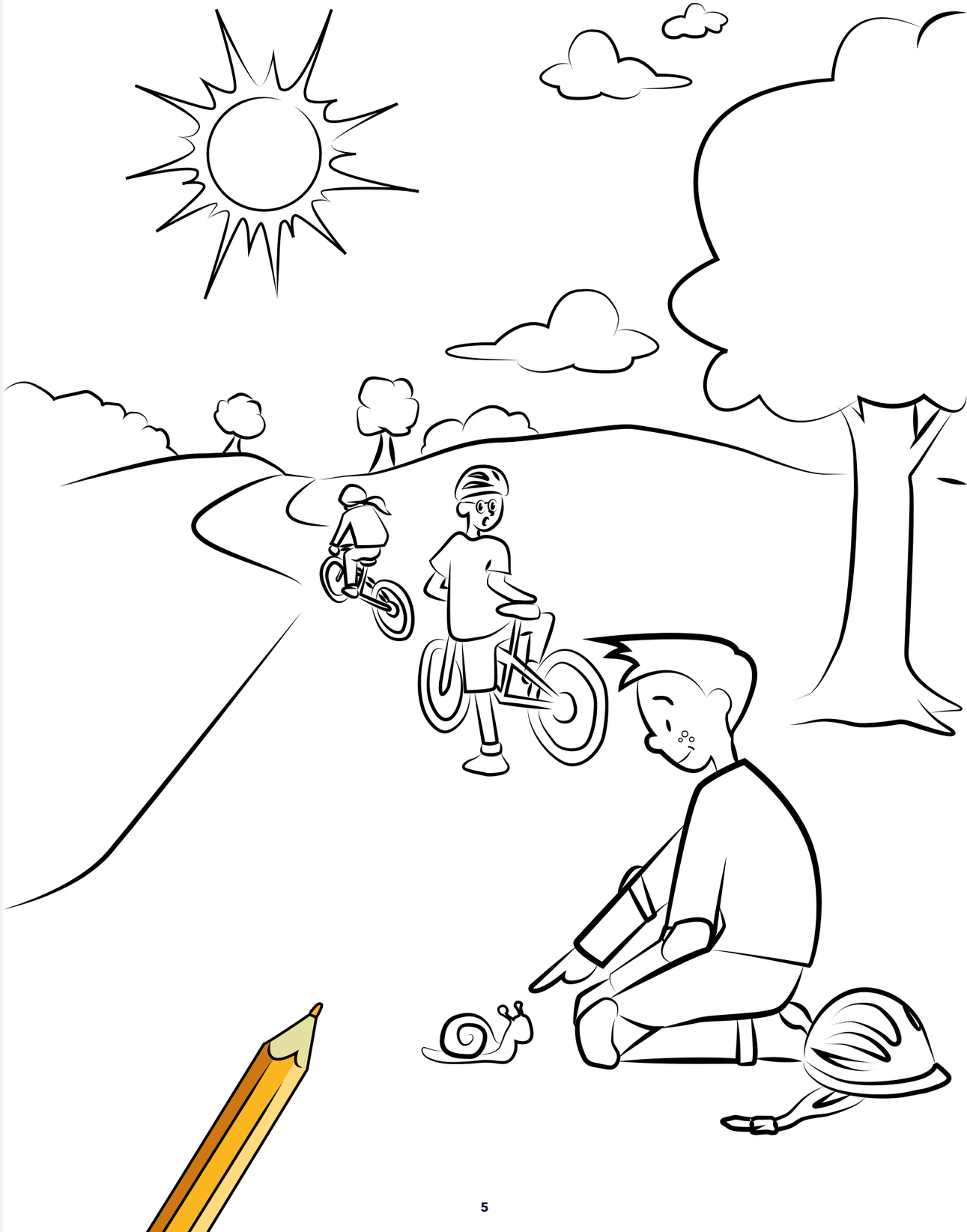
“Hey, Oliver. What are you looking at? Hurry up.”

“Ryan, you have to see this! Look at the cool shell on this snail.”

Even on short bike rides, he couldn’t keep up with his little brother Sammy. However much his feet whirred, Sammy hollered « hurry! ».

Oliver thought it was because his muscles were not strong enough. So Oliver asked his dad to teach him exercises to get stronger muscles. Oliver did the exercises every day, but they didn’t help. However hard Oliver heaved, his muscles felt frail.

Oliver thought he just wasn’t working hard enough. **Now he knows better: it was his heart making him feel tired.**



First Oliver saw the children's doctor, called a pediatrician. Then Oliver's mum and dad took him to see Dr. Winnie. She is a heart doctor. Another name for a heart doctor is cardiologist.

Dr. Winnie asked Oliver and his parents a few questions and then listened to Oliver's heart.

"Oliver, I need to see exactly how your heart is working. So, we are going to do an electrocardiogram (e-lek-tro-car-de-o-gram). Sometimes people call it an ECG or EKG. It is a test of how your heart is working."

"First, Sticker Steve will put some patches on your chest. Then you'll sit very still for a few minutes. That's all there is to it!"

said Dr. Winnie.

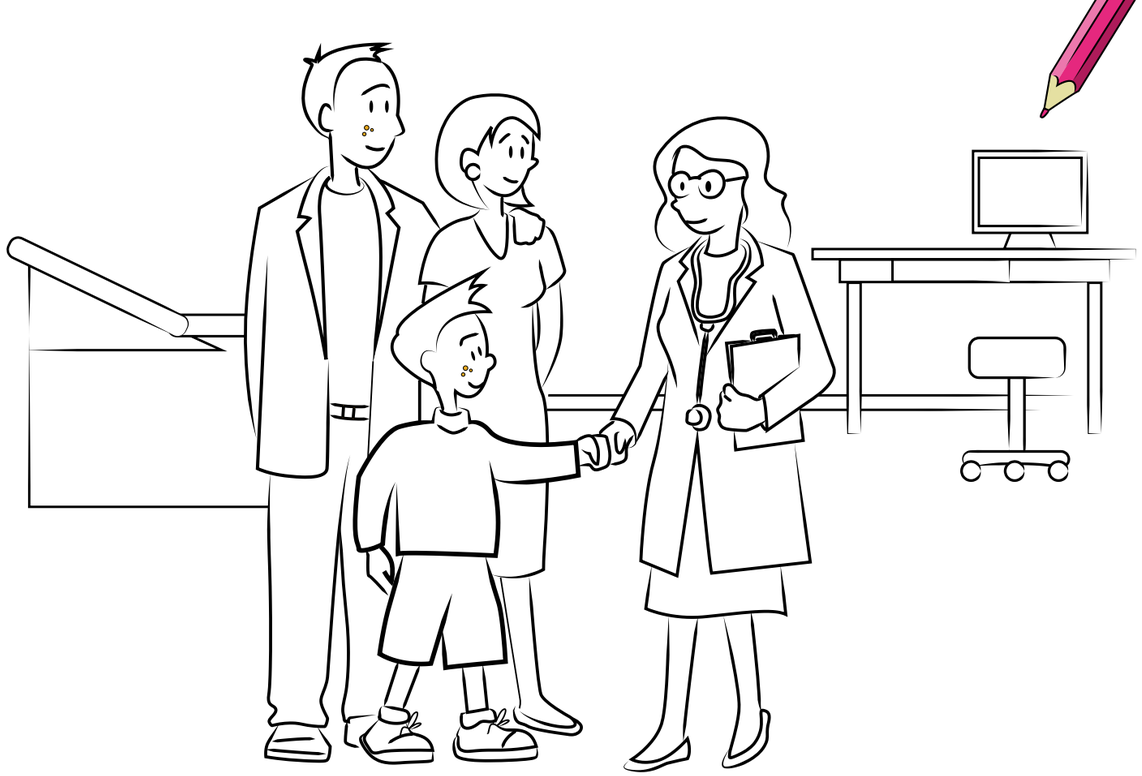
"Sticker Steve? Is that his real name?"

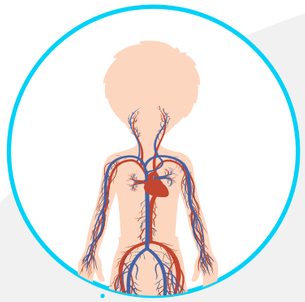
Oliver asked.

"No,"

laughed Dr. Winnie.

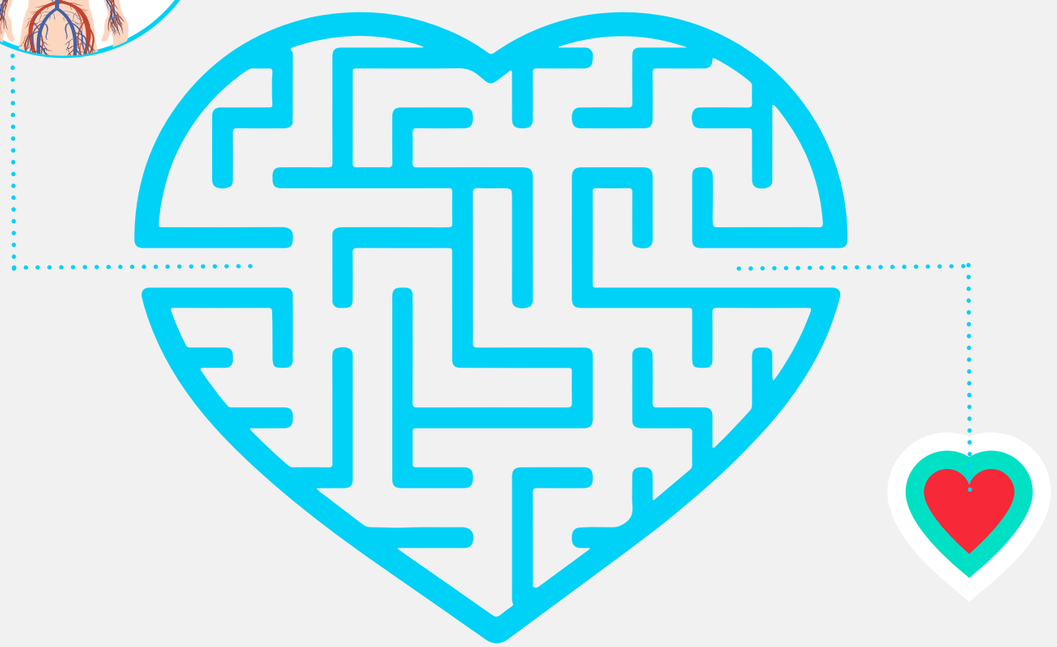
"That's just a nickname."





Activity:

Help Dr Winnie find Oliver's heart



Dr. Winnie called someone on the phone. A few minutes later, a man stuck his head inside the room.

"Hi Oliver! My name is Sticker Steve."

"Hi!" said Oliver. **"Dr Winnie told me how I have to sit still, but I forgot to ask why you have that name."**

"If you wait one minute, I think you'll be able to figure it out,"

said Sticker Steve.

Then he placed some round, foam patches on Oliver's chest and back.

"Oh, I know,"

said Oliver.

"These patches are sticky! They feel cool and chilly on my skin. They don't hurt one bit."

Sticker Steve turned on the ECG machine. A piece of paper with wavy lines on it began rolling out. It kept rolling, rolling, rolling… Oliver wanted to look at the drawing on the paper, but he remembered that he was supposed to keep still.

When Sticker Steve was finished, he took off the sticky patches.

"Can I see that?"

asked Oliver.

"Sure,"

said Sticker Steve.

"What do these wavy and jagged lines mean?"

asked Oliver.

Then Dr. Winnie knocked on the door and came back into the room. She looked at the paper and said,

"Oliver, this picture shows me how often your heart is beating."

"Do you know how your heart works?" Dr. Winnie asked.

Oliver shook his head.

"Let's talk a little bit about how your heart works. Then I can explain this drawing better," said Dr. Winnie.

"Your heart pumps to move your blood all around your body. It does this by relaxing to fill up with blood. Then it squeezes to pump the blood around your body."

"Your blood carries oxygen to every part of your body," Dr. Winnie told Oliver. **"This is the food your body needs to have energy so you can run and play."**

Oliver asked, **"So I'm tired because my arms and legs don't get enough oxygen?"**

"That's exactly right!" Dr. Winnie said.

Pumping takes work

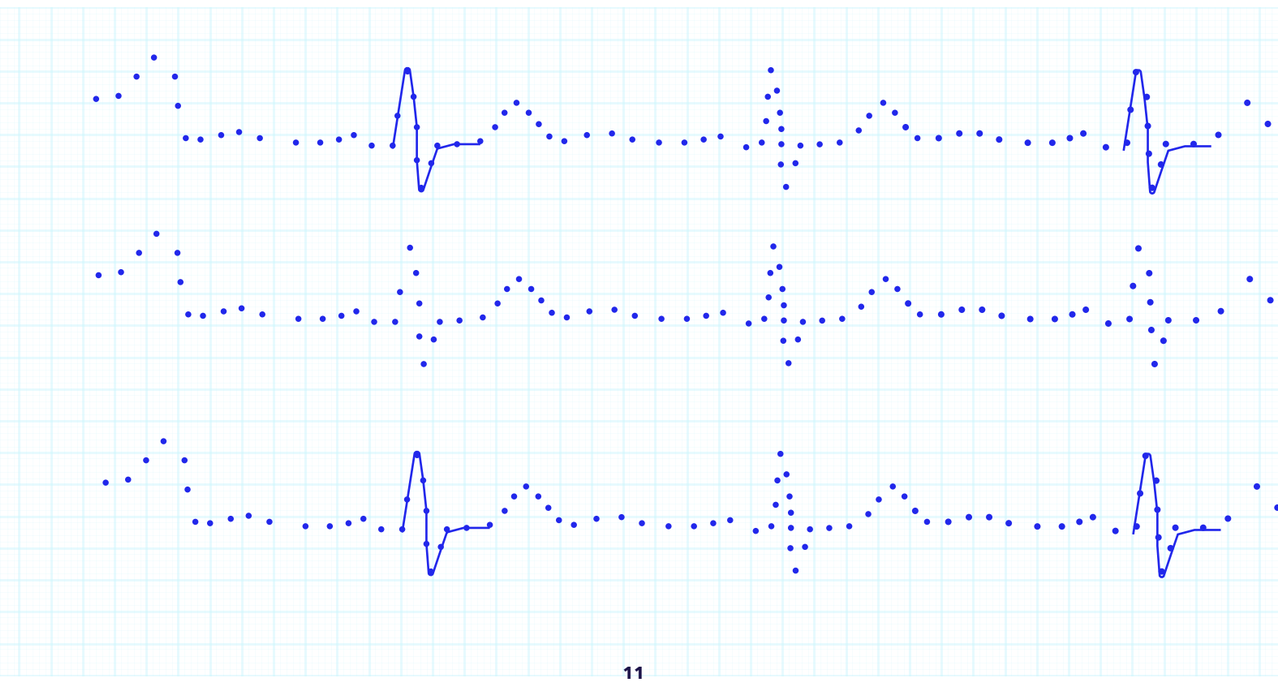
You will need a partner and a tennis ball.

Your partner will say "start" and time you for 5 seconds. See if you can squeeze a tennis ball 8 times before your partner says "stop."

If you can squeeze 8 times, that is about as fast as the heart beats for someone who is about 10 years old.

That's about 96 times in 1 minute!

Activity:
Join the dots



"Let's look at how blood flows through your heart,"
said Dr. Winnie.

"Your heart has four rooms, or chambers. Two upper chambers and two lower chambers."

"The lower chambers pump blood out to each part of your body."

"The upper right chamber takes the blood back after it has been around your body. The upper left chamber gets blood from your lungs."

Advanced

- Each upper chamber is called an atrium. (Weird spelling: The plural of atrium is atria.)
- Each lower chamber is called a ventricle.

Very advanced

- The two sides of the heart take and send blood to different parts of the body.
- The right atrium gets blood that has just come back from all the parts of the body. This blood has very little oxygen in it. So, the right ventricle pumps this blood to the lungs where blood picks up oxygen.
- The left atrium fills with blood coming back from the lungs, so this blood has lots of oxygen. The left ventricle pumps the blood with lots of oxygen to all the parts of the body.
- The two sides of the heart work together. The two atria squeeze at almost the same time. Less than half a second later, the two ventricles pump blood at almost the same time. When the ventricles pump, a lot of blood is pumped out, but some blood stays.

Activity:
Your heart pumps blood

Write the names of the chambers on the drawing.

A. Right upper chamber

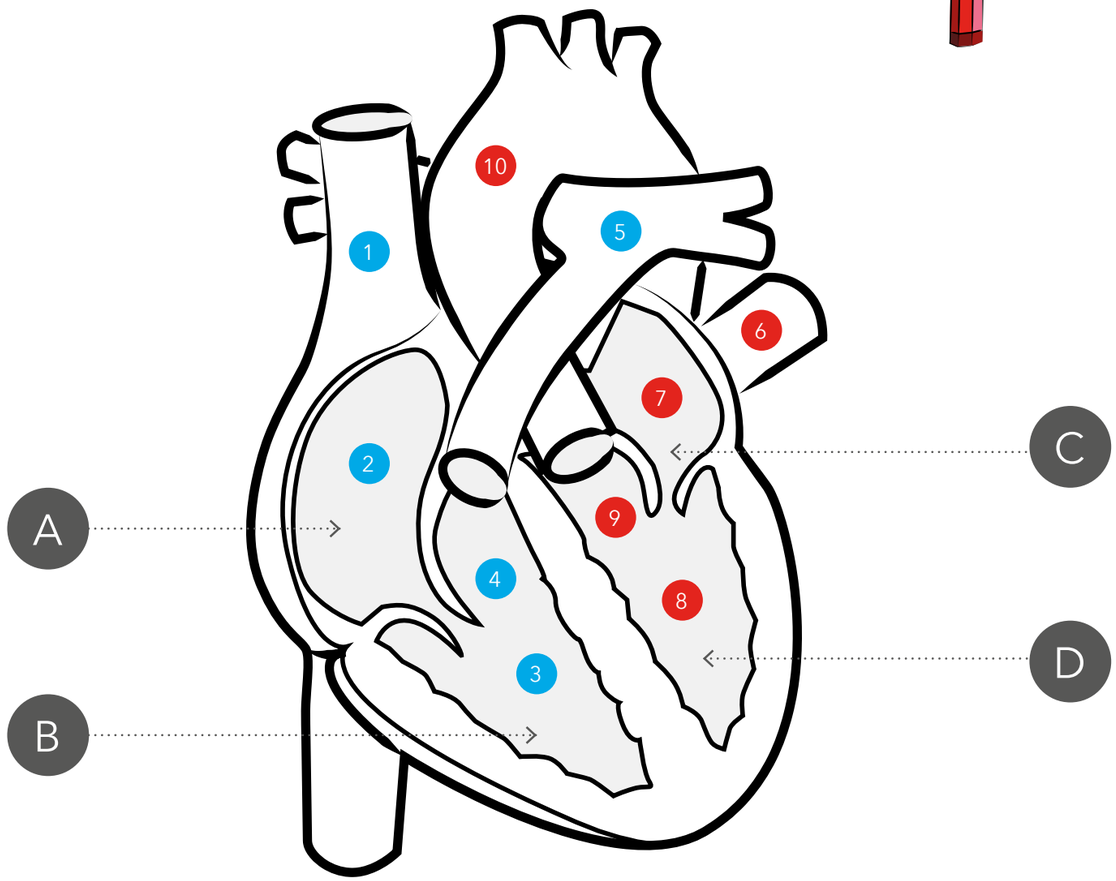
B. Right lower chamber

C. Left upper chamber

D. Left lower chamber

Draw how the blood flows.

- Use a **blue** marker to connect numbers 1 through 5.
- Use a **red** marker to connect numbers 6 through 10.



"I just told you your heart needs to pump blood,"

"To do this, the electricity in your heart must work well."
said Dr. Winnie.

"Electricity? In my heart?" asked Oliver.

"Yes, everyone's heart has electricity,"

"The heart only pumps when it's told to pump. The thing that tells your heart to pump is an electrical signal. Each heartbeat starts with one of these."

"The electrical signals move quickly through the upper chambers. This makes the upper chambers pump together. Now blood flows into the lower chambers."

"Then, the signals move around both lower chambers. This makes both lower chambers pump together. Now blood is pumped around the body."
said Dr. Winnie.

"All of this happens in less than one second. Isn't that amazing?"
asked Dr. Winnie.

Oliver nodded yes.

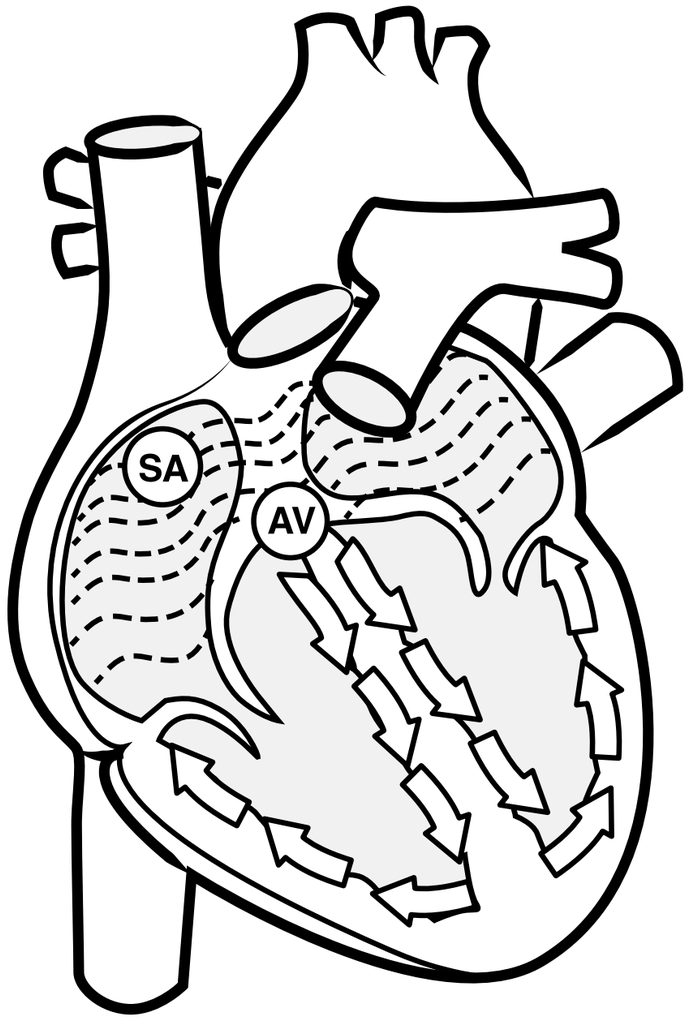
Activity: electricity makes your heart pump

Each heartbeat begins with an electrical signal. This electrical signal starts other signals. All the signals flow like ripples on a pond.

- Colour the heart's pacemaker cells (SA) yellow.
- Use yellow to draw electrical ripples (wavy, dashed lines) in both upper chambers.
- Colour the spot between the upper and lower chamber (AV) orange.
- Use orange to colour the arrows from the AV spot, down between the two lower chambers, and then around the lower chambers.

Advanced

- The Specialised heart cells that begin a heartbeat are called the sinus node.
- The collection of electrical signals gathered together between the right atrium and right ventricle is called the atrioventricular node or AV node.



"Your ECG shows that your heart is beating too slowly. There are not enough electrical signals. So your blood is not bringing your body enough energy."

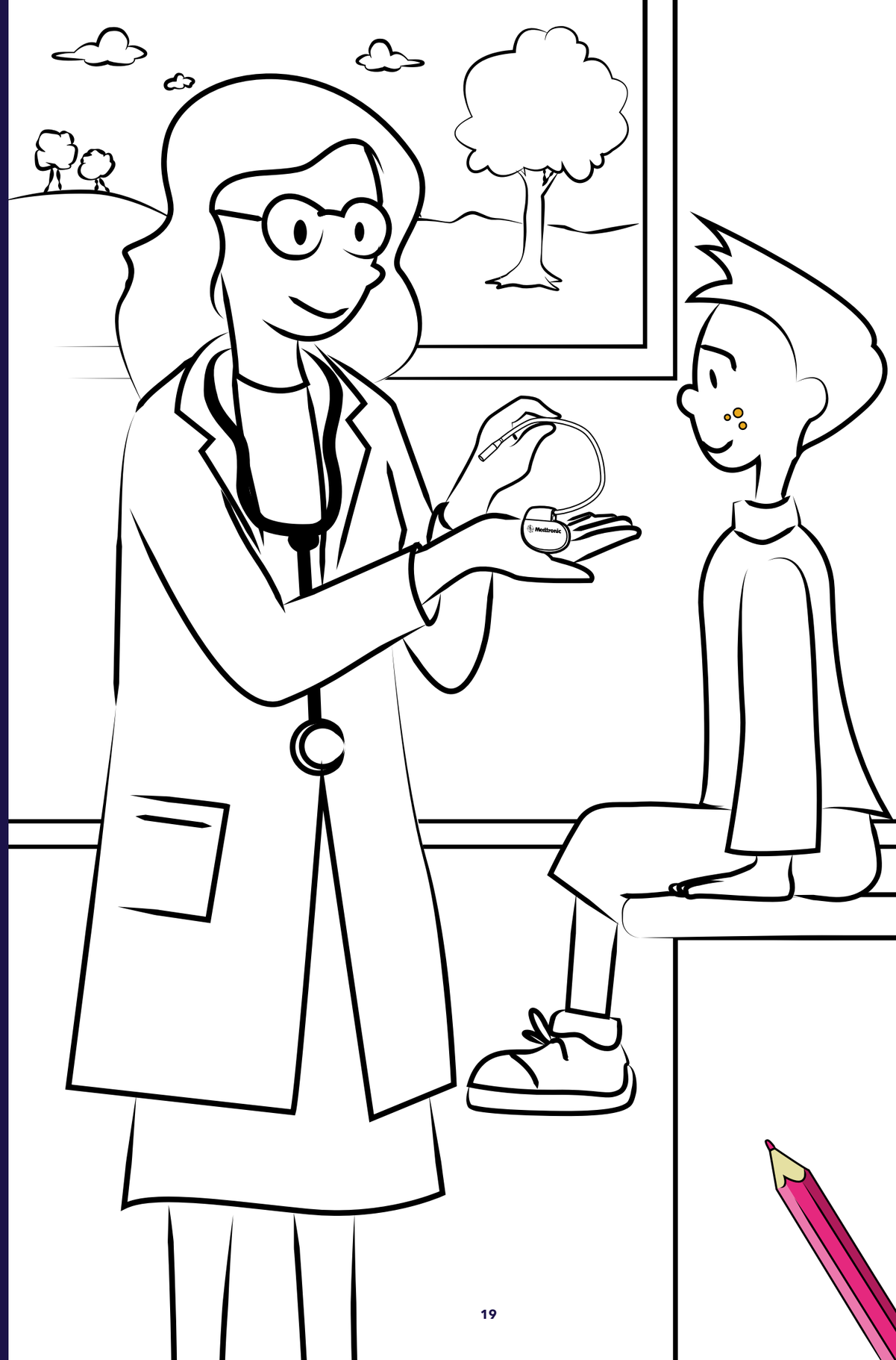
"When you ride your bike, you feel even more tired than when you are just sitting or walking," said Dr. Winnie.

"But, there is something to help your heart beat faster. Something to help your body get the oxygen it needs."

Dr. Winnie held up a small, silvery object.

"This is called a pacemaker.
Like your heart's natural pacemaker, it sends tiny electrical signals. These start a heartbeat."

"A tiny computer inside it knows when to send signals. There's also a battery to give it power.
See these long pieces? Feel how soft and squidgy but also strong and sturdy they are.
These are called leads (leeds). The outside is soft insulation. Inside are bendy wires.
A lead joins your heart to the pacemaker," said Dr. Winnie.



"Will the pacemaker hurt me"

asked Oliver.

"Not one little bit. In fact, you won't feel a thing!" said Dr. Winnie.

"Most kids can tell it's helping them because they feel better. They can run and play as much as their friends."

"Is there anything else you are curious about?"

asked Dr. Winnie.

"Not right now,"

Oliver answered.

"If you have any questions, just tell your parents to call me.

See you all next week at the hospital,"

said Dr. Winnie.

Activity:
Dr Winnie asks, "Do you remember..."

Circle the correct answer.

1. Your heart acts like a [**rocket**] or [**pump**].
2. Each heartbeat begins with [**an electrical signal**] or [**ripples on a pond**].
3. You need a pacemaker because your heart is beating too [**fast**] or [**slowly**].
4. When your heart beats like this, you often feel [**tired**] or [**full of energy**].
5. You feel this way because your body is getting [**too much**] or [**too little**] oxygen.
6. A pacemaker can help your heart by sending [**fewer**] or [**more**] electrical signals.
7. The [**computer**] or [**battery**] inside a pacemaker tells your heart when to begin a heartbeat.
8. The [**computer**] or [**battery**] inside a pacemaker gives the energy for the electrical signals.
9. When a pacemaker helps your heart, you may [**feel like sleeping all the time**] or [**feel better because your body is getting more oxygen**].

Answers: 1. pump 2. an electrical signal 3. slowly 4. tired 5. too little 6. more 7. computer 8. battery 9. feel better because your body is getting more oxygen

At the hospital, Oliver was given a hospital bracelet and special pyjamas to wear.

"Good morning, Oliver."

said Nurse Sarah.

"Why do you have a shower cap on your head?"

said Oliver.

Sarah laughed, **"This mask and special hat make sure everything stays clean. Later, I will wear this mask over my nose and mouth, but you will still hear me talk."**

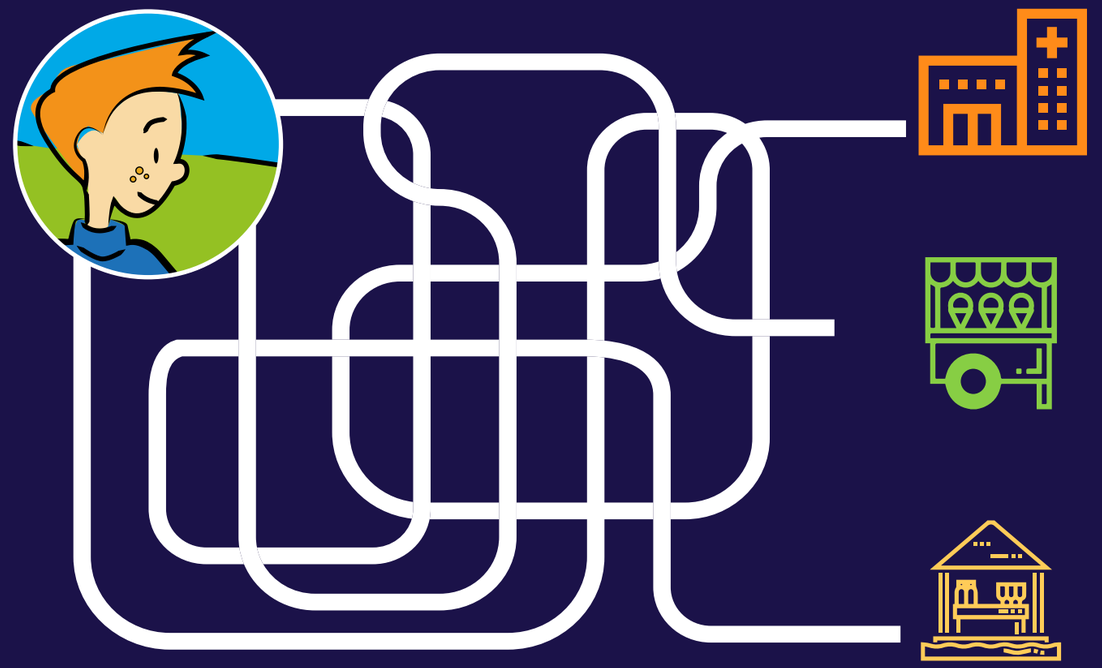
Nurse Sarah explained everything that would happen before and in the surgery.

She ended by telling Oliver, **"…then you'll close your eyes and take a nap. The next thing you know, you will see the nurses and your parents in the recovery room."**

Oliver's surgery took about an hour and everything went well. Later that afternoon, he went home with his parents.

Activity:

Help Oliver get to the hospital



That evening, Oliver's mum asked,

"How are you feeling?"

"Okay, I guess. I do feel sore under this bandage," said Oliver.

"Remember Jade's birthday party last year? When I tottered and tripped, and cut my head on the wall? It feels sore like those stitches, but I don't think I'll bawl!"

"Dr. Winnie said you should feel a lot better in several days," said Oliver's mum.

Oliver thought some more about the birthday party. **"Hey, that reminds me. Do you think I'll be able to go roller blading for Sammy's birthday next month?"**

Oliver's mum stopped for a second. She was thinking so much about helping Oliver that she almost forgot about the party. **"I'm so glad you mentioned your brother Sammy's party,"** replied Oliver's mum. **"I need to send those invitations soon. Oliver, can you help me remember to ask Dr. Winnie about skating?"** asked Oliver's mum. **"I won't forget!"** said Oliver. Oliver was almost as excited about the party as Sammy.

Activity:

How many words can you find?

A C P T A E B T R A E H B I C Y C L I N G E
F H V L M Q U W A T B D P A R T Y F H P Y I
K L E C H E S S M R N F A S T N O S Q L M R
B D N H S U N S H I N E T E R U F B F A N G
H I T A J L N P R U T V H S U R G E R Y A X
Y H R M Z S G N I M M I W S M S A E I B S C
D E I B F K G L I J U L A M P E N T E H T O
P A C E M A K E R P S P Y Q E R S L N O I U
U R L R W T X A U Y I I Z A T B C E D S C D
M T E E F I G D N H C A K E G I F T S P S J
P U P P Y N K G O L F N L E C N A D M I N D
O P Q R S G T U V C W O X Y C O M P U T E R
Z A D F H S I N N E T I R E T S I S J A K U
T R O M B O N E L S L O W M N O L P Q L S M
T R E H T O R B U W X A R C E G Y T L M O S
E L E C T R I C I T Y C B A S R E K C E H C

HIDDEN WORDS: ATRIUM, BEETLE, BICYCLING, BROTHER, CAKE, CHAMBER, CHECKERS, CHESS, COMPUTER, DANCE, DOCTOR, DRUMS, ELECTRICITY, FAMILY, FAST, FRIEND, GIFTS, GOLF, GYMNASTICS, HEART, HEARTBEAT, HOSPITAL, LEAD, MUSIC, NURSE, PACEMAKER, PARTY, PATHWAY, PIANO, PLAY, PUMP, PUPPY, RUN, SISTER, SKATING, SLOW, SUNSHINE, SURGERY, SWIMMING, TENNIS, TROMBONE, TRUMPET, VENTRICLE

ANSWERS ARE ON PAGE 39.

Oliver did the things Dr. Winnie told him to. He didn't take a shower for several days – that was easy. But he still had to take a bath! That was lovely and bubbly.

Dr. Winnie also told Oliver to:

- **Keep the bandage dry to help him heal.**
- **Keep his arm close to his body near the pacemaker. Oliver couldn't play cricket or tennis until Dr. Winnie said it was okay.**

Oliver remembered some toys with an antenna might stop his pacemaker working well. But he couldn't remember exactly what Nurse Sarah had said.

Then he remembered Nurse Sarah talking about **the friendly people at Medtronic**. She said they could answer almost any question about pacemakers.

"Hey, Mum! Do you have the phone number for Medtronic?

Let's ask them if I can play with Ryan's remote-controlled car."

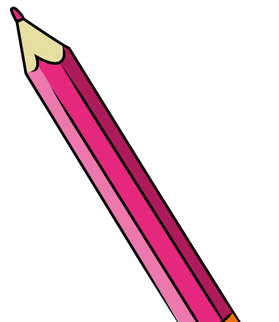
A few weeks later, Oliver's class at school was learning about the heart. He was excited when his teacher asked him to tell the class about his pacemaker.

Oliver showed the kids his Medtronic patient ID card.

Then he explained, **"Before my pacemaker, I felt really tired. My body wasn't getting enough oxygen. That's because my heart didn't beat fast enough."**

"Now, the pacemaker tells my heart when to beat. So my body gets the oxygen it needs! It's amazing how much better I feel just doing simple stuff like walking," said Oliver.

"My doctor said that in a couple of months I might be able to try some of the fun things I used to do."



“I even gave my pacemaker a name. Zappy. Zappy, the pacemaker!” said Oliver. **Look, you can kind of see it,”** said Oliver as he pointed to his tummy.

One of Oliver’s classmates asked how a pacemaker worked. Oliver explained, **“The pacemaker has a computer that tells my heart when to beat. The battery inside it has the energy to make my heart beat. Like how a battery makes the hands of your watch go around!”**

Oliver then showed them how you can’t see electricity, but you can tell it is there. They tried the experiment on the next page. You can too!

Experiment: feeling static electricity

Just like the battery in a watch, the battery in a pacemaker is always working.

But static electricity only lasts for a short time. Try these experiments to see how static electricity feels!

1. Carpet and metal door handle

- Find a carpet.
- Put your shoes on and shuffle across the floor.
- Touch the handle of a metal doorknob. The spark that happens when you touch the doorknob is static electricity.
- This works better in winter, when the air is dry

2. Balloons and paper

- Only try this if no one in your class has an allergy to latex. Balloons are made of latex.
- Rip up tiny bits of newspaper.
- Blow up a balloon and rub it on your hair or shirt.
- Move the balloon close to the pieces of paper. The pieces of paper jump up to the balloon. This is because you made static electricity by rubbing the balloon with your hair or shirt.

About a month after his surgery, Oliver went back to the doctor's. Dr. Winnie made sure the skin under the stitches was healing properly.

Today is Oliver's second checkup. The doctor and nurse are going to see if Oliver's pacemaker is working the best that it can.

"It's good to see you, Oliver. How are you doing today?"
asks Nurse Sarah.

"I got to leave school early, so it's a great day!"

Nurse Sarah
laughs.

**"I meant how are you feeling?
When you walk up the stairs, do you get tired?
When you ride your bike, can you keep up with your friends?"**

"I can do those without getting too tired. I even kept up with my best friend when we biked to the shop!" exclaims Oliver.

"Good! That tells me that the pacemaker is helping your heart," says Sarah. **"Before Dr. Winnie comes in, I'm going to take an ECG. It will show how your pacemaker and heart are working."**

"Isn't Sticker Steve going to do that?" asks Oliver.

"Today I have the sticky patches. Do you think I should be nicknamed 'Sticker Sarah'?" teases Sarah.

"Only if you shave part of your head like Sticker Steve!" says Oliver.

"Then I guess I'll skip THAT nickname," Sarah says and laughs.

A few minutes later, Dr. Winnie knocks on the door. She looks at the ECG.

"Oliver, the ECG looks good. The pacemaker is working well."

"But I need to take a closer look at things. This special computer can talk with your pacemaker. It is called a programmer."

"First, I'll put this programming wand over your pacemaker. It will show me what your pacemaker has been doing since the last time I did this."

"I can send new instructions to the pacemaker using the programmer."

"You won't feel a thing. It's kind of like sending an instant message on your computer," says Dr. Winnie.

"Hey, can I use that programmer to talk to my friends?" asks Oliver.

"No!"

Dr. Winnie laughs.

"This programmer only talks with other Medtronic pacemakers and other Medtronic heart devices."

As Oliver leaves the office, he is surprised to see his friend Ryan with his sister, Carmen. Their grandma was with them.

"What are you doing here?" Oliver asks his friend.

"Well, I'll be doing my homework," explains Ryan. **"But Carmen will have her defibrillator (de-fib-ri-la-tor) checked."**

"What is a defibrillator?" asks Oliver.

Carmen answers,

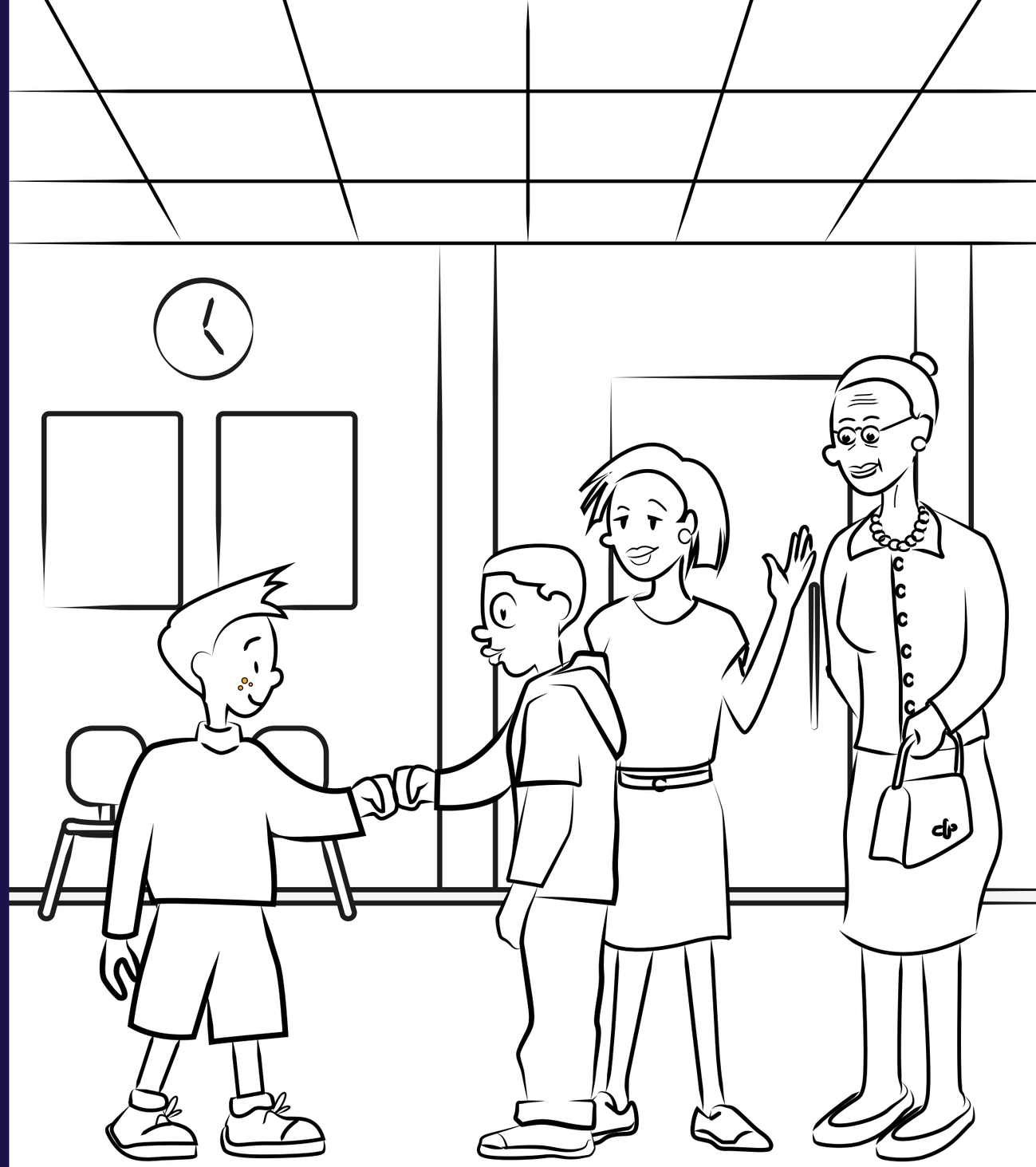
"I fainted in football practice a while ago.

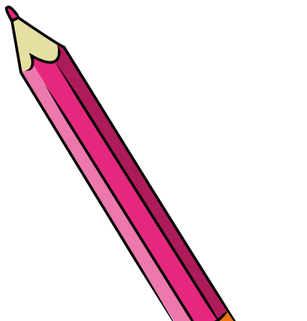
Dr. Winnie looked at my ECG. My heart sometimes beats way too fast. That's why I fainted.

A defibrillator stops that from happening."

"How would a heart beating too fast make you faint?" asks Oliver.

"Did Dr. Winnie tell you that when the heart relaxes, it fills with blood? And when it squeezes, it pumps blood?" Oliver nods yes. **"Well, if it beats way too fast, only a little bit of blood gets in the heart,"** explains Carmen. **"So not enough oxygen is sent around my body. Then I faint."**





"Does a defibrillator work like a pacemaker?" asks Oliver.

"Kind of," explains Carmen.

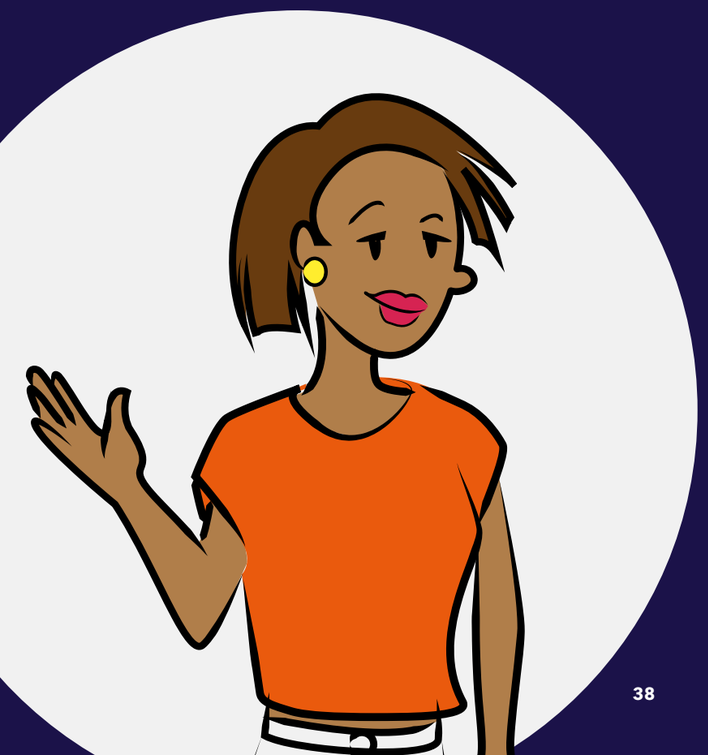
"If my heart beats too slowly, then it works like your pacemaker."

"But mostly my heart beats too fast. Then my defibrillator sends some tiny electrical signals. Kind of like your pacemaker. I don't feel them."

"Then it checks if the tiny signals worked. If my heart is still being weird, the defibrillator sends a big electrical shock."

"This makes my heart start beating the way it should. Dr. Winnie said I'd feel that if it happens. But it hasn't yet."

"It's like having a paramedic in my heart. You know, like the people in an ambulance. The people who come when you call 999/112." Says Carmen.



"That's so cool!" Says Oliver.

Experiment: hearts that pump way too fast

You can see what happens when a heart beats too fast by using the bulb from a cooking baster.

1. Take the bulb off.
2. Fill a sink or a bowl with plenty of water. Enough to put the bulb under water while still holding it. (Put the bowl in the sink or the bathtub because you'll splash water.)
3. Push the bulb under the water, with the opening facing up.
    - Squeeze the bulb eight times in five seconds.
    - Now squeeze the bulb as fast as you can in five seconds, about 20 times if you can.

Did you see that when you squeezed the bulb eight times, the bulb filled up with water? But when you squeezed it as fast as you could, not much water got in?

This is like a heart beating way too fast. Not enough blood gets into the heart - so not enough blood goes around the body.

WORD FIND ANSWERS

A	C	P	T	A	E	B	T	R	A	E	H	B	I	C	Y	C	L	I	N	G	E
F	H	V	L	M	Q	U	W	A	T	B	D	P	A	R	T	Y	F	H	P	Y	I
K	L	E	C	H	E	S	S	M	R	N	F	A	S	T	N	O	S	Q	L	M	R
B	D	N	H	S	U	N	S	H	I	N	E	T	E	R	U	F	B	F	A	N	G
H	I	T	A	J	L	N	P	R	U	T	V	H	S	U	R	G	E	R	Y	A	X
Y	H	R	M	Z	S	G	N	I	M	M	I	W	S	M	S	A	E	I	B	S	C
D	E	I	B	F	K	G	L	I	J	U	L	A	M	P	E	N	T	E	H	T	O
P	A	C	E	M	A	K	E	R	P	S	P	Y	Q	E	R	S	L	N	O	I	U
U	R	L	R	W	T	X	A	U	Y	I	I	Z	A	T	B	C	E	D	S	C	D
M	T	E	E	F	I	G	D	N	H	C	A	K	E	G	I	F	T	S	P	S	J
P	U	P	P	Y	N	K	G	O	L	F	N	L	E	C	N	A	D	M	I	N	D
O	P	Q	R	S	G	T	U	V	C	W	O	X	Y	C	O	M	P	U	T	E	R
Z	A	D	F	H	S	I	N	N	E	T	I	R	E	T	S	I	S	J	A	K	U
T	R	O	M	B	O	N	E	L	S	L	O	W	M	N	O	L	P	Q	L	S	M
T	R	E	H	T	O	R	B	U	W	X	A	R	C	E	G	Y	T	L	M	O	S
E	L	E	C	T	R	I	C	I	T	Y	C	B	A	S	R	E	K	C	E	H	C

Oliver turns to Ryan and asks, **"Want to go biking after dinner?"**

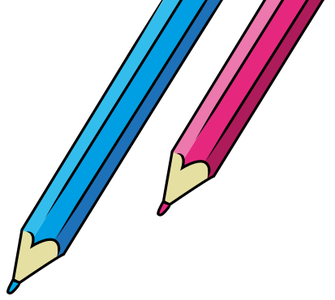
"Sure! Meet me at the park at 6:30," says Ryan.

Oliver can't believe how much better he feels now with his pacemaker.

He dreams one day he might even be able to race his friends.

But for now, Oliver is happy to just ride with them.

Notes



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