

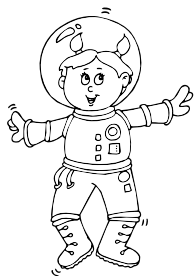
# Science News

CLASSROOM READY MONTHLY SCIENCE NEWS • SEPTEMBER 2010 • GRADES 8, 9 & 10



**Feature**

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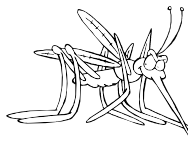
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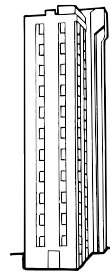
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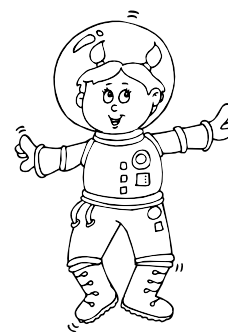
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# Profile: Dr. Roberta Bondar



**H**ave you ever dreamed of becoming an astronaut and flying into outer space? Or thought about the possibility that there could be life on other planets? If so, you have something in common with Canadian **neurologist** and astronaut Dr. Roberta Bondar.

Dr. Bondar was the first Canadian woman to fly into space. She was also one of the original six Canadians to be accepted into Canada's space program (which later became the Canadian Space Agency) in 1983. As a neurologist, Dr. Bondar has used her experience in space to make important discoveries regarding how the brain works in unfamiliar environments.

Born in 1945 in Sault Ste-Marie, Ontario, Dr. Bondar was interested in science from an early age. She often received items like chemistry sets as gifts, and she also used her radio to try to contact beings on other planets. Dr. Bondar

closely followed the historical events of the U.S. moon missions in the 1960s, and dreamed of becoming an astronaut herself one day.

This became a reality for Dr. Bondar in 1992 when she flew aboard the U.S. space shuttle *Discovery* for an eight-day voyage into outer space. Part of Dr. Bondar's reason for being aboard the shuttle was to study the human brain and how it reacts to weightlessness. When astronauts return from long journeys in space, they have a hard time re-adjusting to gravity. Dr. Bondar's research may help with this problem.

Dr. Bondar has also contributed to research on neurological conditions like **Parkinson's disease** and strokes. Victims of these illnesses often share similar symptoms with astronauts when they first come back to Earth, such as difficulty controlling their body movements.

Dr. Bondar continues

to be an important scientist, acting as an advisor to the federal government on health policies. She is a passionate environmentalist and speaks to businesses and organizations about social responsibility. She has written *Touching the Earth*, a book about her love for the planet, that includes photographs she took of Earth while she was in space.

For all of her contributions to space medicine, Dr. Bondar was given the NASA Space Medal and was also made an Officer of the Order of Canada. In 1998 she was inducted into the Canadian Medical Hall of Fame.

## Did You know?

The VSS Enterprise, owned by Virgin Galactic, is a spaceship that offers flights for space tourists. You can experience zero gravity for five minutes at 365,000 feet—all for just \$200,000. ★

**Neurologist:** A doctor who deals with diseases of the nervous system, including the brain, spinal cord, nerves, and muscles.

**Parkinson's Disease:** A brain disease that causes muscle shakiness and overall weakness.

Profile: Dr. Roberta Bondar

# Questions

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## FACTS

1. What historic distinction does Dr. Roberta Bondar have?

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2. What was Dr. Bondar's job aboard the space shuttle *Discovery*?

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3. What honours has Dr. Bondar received for her life's work?

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## IDEAS

1. What interests did Roberta Bondar have as a child? What can you gather from this article about her personality?

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2. Great personal achievements are often the result of a bright, interested person's life coinciding with interesting historic times. What historic period coincides with Dr. Bondar's growing-up years? What are the historic opportunities for a young person today?

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# Hands-On Science – Antigravity Environment

Gravity is the force that keeps our feet planted on the ground and everything else from floating in the air. Antigravity is the idea of creating a place or object that is free from the force of gravity.

## Materials:

1. Small glass jar (baby food jar)
2. Clear drinking straw
3. Food colouring (red or blue)
4. Marble-sized piece of clay
5. Water

## Procedure:

1. Press the clay against the inside of the bottom of the jar.
2. Fill the jar halfway with water.
3. Add three or four drops of food colouring to the water and stir.
4. Slowly lower the straw into the water, pushing the bottom end into the clay so that the straw can stand in a vertical position.
5. Turn the jar upside down over a sink or bucket, pouring out the water.
6. Turn the jar back right side up and place it on a table.
7. Try to look for any remaining liquid.

Did you observe any remaining liquid? \_\_\_\_\_

If there was any, describe the liquid that was remaining.

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Why do you think this liquid remained in the jar?

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# Superhuman Cyclists



The *X-Men* series of movies are all about a group of mutants with super-powers. The idea is that they were born with certain genetic mutations that enable them to do weird and wonderful things such as shoot ice rays and float metal objects.

In reality, this isn't totally farfetched. A genetic mutation is simply a change in our genes, to our DNA. Mutations happen all the time. Most of the time these changes are harmless and don't affect our bodies. Sometimes they can cause diseases, like cancer. And other times they can make something in our bodies better.

Take the example of your average bicycle rider at the Tour de France. This race lasts for 21 days. Racers must cycle more than 3,600 kilometres and the race includes 23 gruelling mountain passes, some more than

2,000 metres high. It is one of the toughest tests of strength and endurance in the world, and for most people, simply completing the tour would be impossible.

It could be said that the cyclists who excel and win at the Tour de France are mutants. To do well at this sport requires superior hearts, lungs, and muscles—certainly quite different from those of average people. Competitors must have inborn genetic traits that allow their bodies to respond well to intense training and competition.

“The guys that win?” notes Hunter Allen, a cycling coach and writer. “They are genetic mutants. Truly mutants. There aren't many of them on the planet.”

For example, a 2007 study found that the fittest professional cyclists have hearts that are up to 40 percent larger than normal. They also have

leg muscles that are able to take in a larger proportion of the oxygen that reaches them. The amount of oxygen a muscle can absorb is called  $VO_2$  max and tour cyclists have some of the highest  $VO_2$  max scores in the world. A higher  $VO_2$  max means longer muscle endurance—an essential feature when climbing a mountain pass on a bicycle.

Of course training is essential as well. Through regular exercise and a good diet, anyone can improve his or her heart strength and  $VO_2$  max. Tour cyclists need good training habits as well as favourable genetics to get to the top.

## Did You Know?

Secretariat, one of the greatest racing horses in history, was found to have a heart more than twice the size of a normal horse's heart. ★

# Facts & Ideas

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## FACTS

1. What is a genetic mutation? Describe some that commonly occur in people.

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2. What makes the Tour de France one of the most difficult competitions in the world?

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3. How are the bodies of Tour de France winners different than other people's?

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## IDEAS

1. Write a sentence about the combination of genetics and training. Think about your possible genetic strengths. In what area could you excel if you put in the training? From where in your genetic heritage do the genes come that could help you in this?

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2. Do you have, or do you know anyone who has, a genetic mutation? In what ways can a mutation be an advantage or a disadvantage? If you had to have a mutation, and could choose, what would it be?

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# Superhuman Cyclists

Check the facts about genes you think are true.

**Genome:** The complete information about the genes in an organism.

- \_\_\_\_\_ 1. Almost every cell in our body contains a complete copy of our genome.
- \_\_\_\_\_ 2. Egg and sperm cells carry only half of our genes.
- \_\_\_\_\_ 3. Red blood cells have no genes.
- \_\_\_\_\_ 4. If unfolded, the DNA in each cell's nucleus would be two metres long.
- \_\_\_\_\_ 5. Humans have an estimated 100,000 cells.
- \_\_\_\_\_ 6. If all the DNA from every cell in a person's body were patched together they would form a strand 200 billion kilometres long, or more than 1,000 times the distance between Earth and the sun.
- \_\_\_\_\_ 7. The first complete human genome was decoded in 1952.
- \_\_\_\_\_ 8. A human genome is identical to 98 percent of a chimpanzee's genome.
- \_\_\_\_\_ 9. The genomes of two random human beings are on average 50 percent identical.
- \_\_\_\_\_ 10. Genetic mutation can cause a disease or offer resistance to a disease.

In 2004 news reports from Germany told of a five-year-old boy who was very strong. He could hold seven-pound weights with his arms extended, something many adults can't do. He has a mutant DNA segment that blocks production of a protein called myostatin which limits muscle growth.

The prize-winning race horse Secretariat had a heart that weighed 10 kg—nearly three times as much as the average racing thoroughbred. A book called *The X Factor* traces this huge heart to Secretariat's genetic heritage from a mare called Pocohontas, born in 1837.

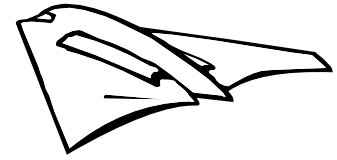
What is your opinion?



The news reports are talking about Lance Armstrong taking performance-enhancing drugs again.



# Unmanned Stealth Fighter Takes Off



Over combat zones in Afghanistan and Iraq, there is the familiar drone of UAVs high up in the sky. These unmanned aerial vehicles (or UAVs) are a relatively new form of technology—airplanes that are able to fly without any human crew aboard.

The latest form of this technology to take off is called the Phantom Ray. Looking like a smaller version of the U.S. military's stealth bomber, this aircraft takes UAV technology to a whole new level.

The aircraft is built by airplane manufacturing giant, Boeing. It is 11 metres long, flies at almost 1,000 kilometres per hour and operates at an altitude of 12,000 metres above the ground. The Phantom Ray is invisible to radar, and can carry bombs or equipment to spy on enemy targets on the ground. But what makes it really

special is that it is virtually **autonomous**.

Although UAVs don't have a pilot onboard, most still require someone to control them from the ground—a pilot who uses a joystick and computerized flight control equipment to tell the UAV where to go and what to do. This means someone has to be trained and available to operate the UAV, and it also makes the UAV vulnerable to jamming equipment (i.e., the enemy can interrupt the radio signals between the ground pilot and UAV, making it crash). Also, the need to pilot the UAV from the ground limits how far the aircraft can fly, because it must always be in range of the controlling radio signals.

The Phantom Ray, however, is able to fly entirely automatically. It is controlled by a sophisticated onboard computer. Prior to a mission, software is

loaded into the computer that allows it to take off, fly a mission, and land, all without the need for a ground pilot. While most UAVs are limited to a range of a few hundred kilometres, the Phantom Ray has a combat range of almost 2,000 kilometres.

The Phantom Ray is considered a prototype. It is the first of its kind and will be used to test how well the technology works before it is mass produced. Boeing first revealed the Phantom Ray in May and plans a series of test flights in December.

## Did You Know?

Most UAVs are used by the military. They are also being used for things like fighting forest fires and conducting scientific research in dangerous situations, like measuring weather data in hurricanes. ★

**Autonomous:** Not controlled by outside forces.

# Facts & Ideas

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## FACTS

1. Who builds the Phantom Ray and how does it look?

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2. What are the jobs the Phantom Ray is designed to do?

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3. Describe the development stage the Phantom Ray is in right now.

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## IDEAS

1. Explain the difference between the Phantom Ray and older styles of UAVs.

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2. How does the size, speed, range, and altitude of the Phantom Ray compare with those of a regular WestJet passenger plane?

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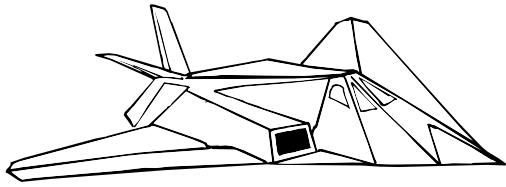
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# Virtually Autonomous

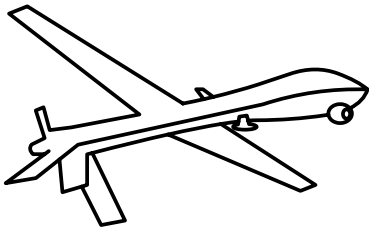
Compare the four aircrafts below by drawing lines between them and making notes on the lines or around the craft to clarify the similarities and differences between them. Use the information in the article or whatever other information you can find.



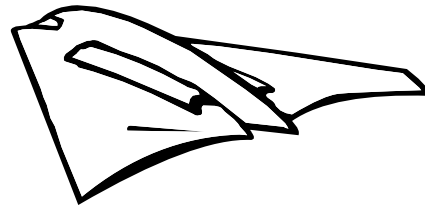
**Stealth**



**Boeing 737**



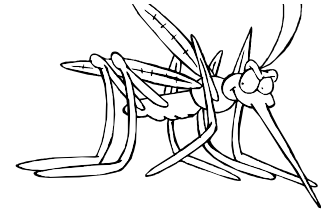
**Older-style UAV**



**Phantom Ray**

Are there reasons why a bomber should have a pilot onboard?

# Scientists Create Malaria-"proof" Mosquito



**M**alaria is a dreadful disease. It can cause fever, shivering, weakness, and vomiting. In extreme cases, and if untreated, it can cause **coma** and death—particularly in young children and pregnant women. Scientists, however, may have found a revolutionary solution to this illness.

You may not know much about malaria. That is because the disease is uncommon in temperate places like North America and Europe. It mainly exists in hot and humid tropical and sub-tropical climates. Every year there are between 350 and 500 million cases of malaria, and the disease kills between one and three million people.

The disease is caused by a microscopic parasite called *Plasmodium*. It is spread among humans by mosquitoes. A certain kind of mosquito called *Anopheles* can carry the *Plasmodium* parasite in its body. The parasite is trans-

ferred to humans when an infected mosquito bites them. Because mosquitoes are so widespread, it has been almost impossible to completely rid the world of this disease, despite the fact that there are treatments for it. Scientists, however, may have figured out a way of protecting humans by first protecting the mosquitoes.

A team of scientists in Arizona have created a genetically engineered mosquito in the laboratory. This mosquito is totally unable to pass the parasite on to humans even when infected by it.

The scientists were led by **entomologist** Michael Riehle at the University of Arizona. Riehle said they were “pretty shocked” by how successful they were at making their mosquitoes 100 percent safe from malaria. They aren’t even completely sure of how the immunity works. What they did was change a gene in the mosquito that affects its immune

system while also shortening its life span. One theory is that because the mosquitoes die at a younger age, the *Plasmodium* parasite isn’t given the 16 days in the mosquito gut it needs to mature.

The research is promising but hurdles remain. Scientists still need to figure out how to replace existing *Anopheles* mosquitoes in the wild with their genetically modified version. As well, more testing needs to be done to ensure there are no unexpected side effects should these malaria-proof mosquitoes be introduced into nature. Still, scientists are hopeful that their research could someday lead to the end of malaria.

## Did You Know?

Ninety percent of malaria deaths occur in Africa—partly because of the climate, but also because poverty and a lack of proper health care mean many of the disease’s victims go untreated. ★

**Coma:** Being unconscious for a long time.

**Entomologist:** A scientist who studies insects.

# Facts & Ideas

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## FACTS

1. How do people get malaria?

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2. What makes the newly-developed mosquito malaria-proof?

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3. What hurdles still remain before the new technology can be applied?

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## IDEAS

1. Take this method one step further. What other medical problem could be solved by genetically modifying the cause of a disease?

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2. What other steps—environmental, social, economic—could be taken to reduce or eliminate malaria in Africa?

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Scientists Create Malaria-"proof" Mosquito

# Malaria-proofing the Mosquito

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Brainstorm in the spaces below on one or both of the suggested topics.

**If scientists can change a mosquito's DNA to shorten its life, can they do that to humans? What rules are needed? Who makes them?**

**How do you replace all the mosquitoes in the world with a new variety? Let your imagination go wild. Any idea is fair game when you are brainstorming.**

# The Oily, Black Sea



Imagine walking along a beautiful beach with bright sand, clear blue water, and birds hopping along the shore. Now imagine the same beach with black, tarry sand and dead fish washing up. In the southern United States along the Gulf of Mexico, people are beginning to see the terrible effects on the environment of the recent oil disaster, the Deepwater Horizon oil spill.

The crisis began on April 26, 2010, when an oil rig exploded, killing 11 workers and ripping a hole in a pipeline at the bottom of the ocean. Thousands of litres of oil began to pour into the Gulf of Mexico from the damaged pipeline. The leak was finally stopped in July by placing a cap on the well and later pumping heavy mud into the leak, but the damage had already been done. Experts believe that over 780 million litres of oil spilled out during the 107 days since the explo-

sion. About 75 percent of it has been cleaned up, but not before it killed many birds and other animals.

Oil can be deadly for plants, animals, and people. It reduces oxygen levels in the water, suffocating the animals that live there, or it is eaten by fish or coats their skin and prevents them from breathing. It gets into the feathers of birds so they can't fly, and when it gets onto plants, it harms the animals that eat them. Fish eggs can be destroyed, and scientists are already seeing the effects of the spill on the Atlantic bluefin tuna.

Even the methods used to clean up the oil can cause problems. Burning the oil has killed wildlife and spread poisonous fumes through the air. Also, the seven million litres of chemicals, called dispersants, used to break the oil up into smaller droplets, could harm plants and animals.

The many rare animals, such as alligators and shorebirds called piping plovers, that make their home in the spill area, are endangered. Serious damage is likely in the Delta National Wildlife Refuge in Louisiana, and many parts of the Florida coast are already affected. Breathing in deadly fumes from the burning oil and dispersants or eating polluted seafood are harmful to the humans in the area.

Cleaning up the mess left by an oil spill is never easy, but with so many animals and plants at stake in the areas around the Gulf of Mexico, it is essential that the cleanup be done as thoroughly and quickly as possible.

## Did You Know?

The spill could cost \$14 billion—\$23 billion to clean up. After a similar spill in Mexico in 1979, only \$1.3 billion was spent on cleanup. *(TIME, July 19, 2010)* ★

# Facts & Ideas

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## FACTS

1. What caused the leak and how was it stopped?

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2. How did wildlife in the area suffer from the spill?

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3. What cleanup methods are also harmful to the environment?

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## IDEAS

1. The cleanup from the spill has become a big industry. What other times in history has a disaster become an economic opportunity? Who suffers economically in this disaster? Who wins?

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2. The spill is another illustration that oil and gas are a “dirty” fuel. Besides spills, in what other ways do oil and gas harm the environment? Name some cleaner forms of energy.

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# Silver Linings

*One man's junk is another man's treasure. Every cloud has a silver lining. There are a lot of folk sayings and stories about turning a bad thing to your advantage. Try to determine the winners and losers in the following situations, and put in a few words of explanation if needed.*

Situation	Who Could Benefit	Who Loses
Oil platform explodes, causing spill		
Tourism drops along Gulf Coast because of oil spill		
Half the class fails a test		
Your dog gets sick		
Big storm causes a lot of lightning fires		

## Think About It:

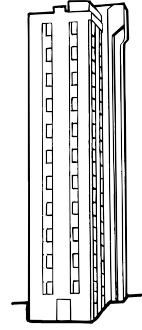
Are there disasters from which no one benefits?

Is it right to benefit from a situation that has hurt people or the environment?

*Descriptive and even inflammatory headlines abound in disasters. Of the headlines below, check the one you think is most descriptive or emotional. Underline effective verbs and highlight or circle nouns that help paint the picture.*

- Gulf Seafood Industry Tries to Shake an Oily Image
- Gulf Oil Spill Could Hit Alabama, Mississippi Coasts
- BP to Ramp up Oil Spill Collection
- Gulf Oil Spill May Have Killed Climate Change Bill
- Disaster in the Gulf
- Gulf Oil Spill Threatens Arctic birds
- Gulf Oil Spill 2010: America's Chernobyl
- BP Gulf Oil Spill Conspiracies Flourish

# Generating Electricity from the Top Down



**D**o you know where the electricity in your house comes from? If your home is like most buildings, power comes from a generating station through wires which connect with the electrical system in your house. But what if your house could generate its own electricity? A new machine called HighDro Power could help people in high-rise buildings produce electricity using only the force of falling water to generate power.

HighDro Power was invented by Tom Broadbent, an industrial design student at DeMontfort University in Leicester, England. Broadbent's inspiration for the device came when he emptied his bath and noticed that the water drained from his bathtub very quickly. He wondered if the force of that water could help create energy. He decided to build a machine that would use the water that drains

from toilets, sinks, bathtubs, and appliances like dishwashers to generate electricity. Water falling through waste pipes turns the four turbines in his HighDro Power machine, turning the gears and producing energy in the generator. The machine, which Broadbent believes could save about \$1,400 in electricity costs every year for a seven-storey building, can even filter out solid waste from the liquid.

HighDro Power could help solve energy problems for many people. Governments around the world are trying to decrease their countries' use of fossil fuels like oil and gas, which pollute the air with gases like carbon dioxide. One solution is hydro power. It is much cleaner than oil and uses water, a renewable resource readily available in streams and lakes.

People have used the power of water for hundreds of years, using waterwheels to help

them grind grain, but using water to produce electricity is still a fairly new idea. The first hydroelectric power plant was built in Appleton, Wisconsin, in 1882 and produced enough electricity to light three buildings. Hydroelectric plants now produce power for millions of people, saving billions of litres of oil and gas.

New micro hydro power projects like HighDro Power could provide good, reliable sources of renewable energy, even more useful than solar and wind power, which depend on the weather. If every high-rise building used the power of falling water for its source of energy, electricity could become cheaper, cleaner, and better for everyone.

## Did You Know?

Researchers believe that companies in the United States could save over \$41 billion in energy costs with more efficient use of energy. ★

# Facts & Ideas

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**FACTS**

1. Describe Tom Broadbent's invention.

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2. What makes hydro power better than power from oil and gas?

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3. In what way is the HighDro Power idea even better than solar and wind power?

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**IDEAS**

1. The technology is already available for most homes to be self-sufficient in energy with a combination of better insulation, solar, wind, and geothermal energy along with new ideas like HighDro Power. Why are homes still not being built with these innovations? What are the downsides?

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2. How could changing environmental conditions make HighDro Power less viable?

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# Generating Electricity from the Top Down

## Do the Math

Would the average high-rise building benefit from HighDro Power? Consider four suites per floor in a seven-storey building with an average electrical bill of \$50 per suite per month. If HighDro Power saves the building \$1,400 per year, what percentage of the total bill is being saved?

## Does He Make it?

Do you think Tom Broadbent could do well with this invention? Write a follow-up to this article which tells what you think he might be doing 40 years from now.

What questions does the story leave you with?

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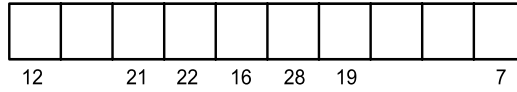
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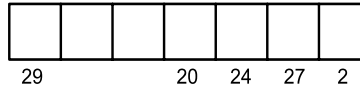
# Science Fun

Unscramble each word. Then use the marked letters to solve the second puzzle. All of the words have been used in the articles.

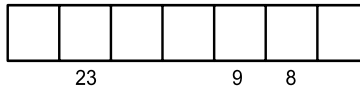
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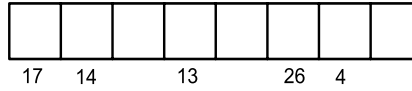
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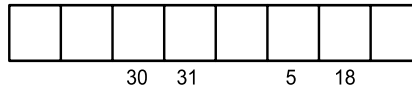
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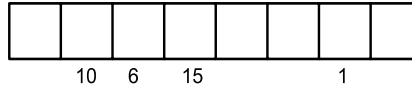
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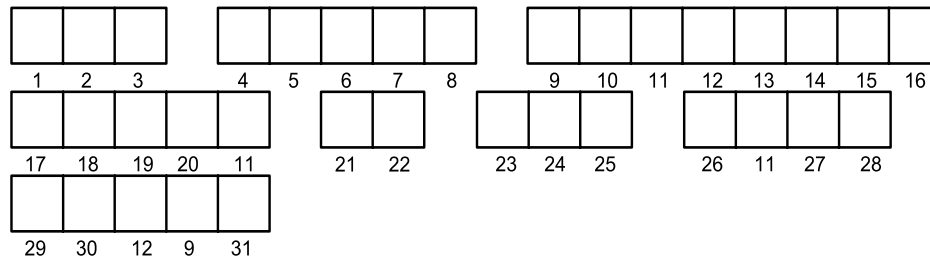
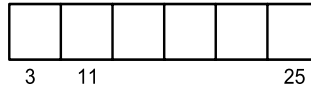
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Use each of the above words in a sentence.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

# Quiz

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## Fill in the Blanks (6 marks)

1. A new machine called HighDro Power could help people in \_\_\_\_\_ produce electricity using only the force of falling \_\_\_\_\_ to generate power.
2. Oil reduces \_\_\_\_\_ levels in the water, suffocating the animals that live there.
3. Malaria is spread among humans by \_\_\_\_\_.
4. The amount of oxygen a muscle can absorb is called \_\_\_\_\_.
5. The Phantom Ray is invisible to \_\_\_\_\_, and can carry bombs or equipment to spy on enemy targets on the ground.
6. Dr. Roberta Bondar was the first Canadian woman to \_\_\_\_\_.

## Multiple Choice (6 marks)

1. What is the name of the parasite that causes malaria?  
A. *Proteus* B. *Aspergillus* C. *Plasmodium* D. *Staph*
2. Approximately how fast can the Phantom Ray fly?  
A. 1,000 km/h B. 1,200 km/h C. 2,000 km/h D. 1,600 km/h
3. A 2007 study found that the fittest professional cyclists have hearts that are up to how much larger than normal?  
A. 20 percent B. 60 percent C. 50 percent D. 40 percent
4. What was the name of the U.S. space shuttle Dr. Roberta Bondar flew aboard in 1992 for an eight-day voyage?  
A. *Challenger* B. *Discovery* C. *Atlantis* D. *Endeavour*
5. When was the first hydroelectric power plant built?  
A. 1906 B. 1875 C. 1923 D. 1882
6. Approximately how many litres of oil do experts believe spilled out?  
A. 780 million B. 120 million C. 550 million D. 690 million

# Answer Key

## Profile: Dr. Roberta Bondar (Page 1)

### FACTS

**1. What historic distinction does Dr. Roberta Bondar have?**

She was the first Canadian woman to fly into space and she was also one of the original six Canadians to be accepted into Canada's space program.

**2. What was Dr. Bondar's job aboard the space shuttle *Discovery*?**

She was a neurologist, and she was aboard the shuttle to study the human brain and how it reacts to weightlessness. Her research addresses the difficulties astronauts have in readjusting to gravity when they return from space.

**3. What honours has Dr. Bondar received for her life's work?**

She has been awarded the NASA Space Medal and was also made an Officer of the Order of Canada. In 1998 she was inducted into the Canadian Medical Hall of Fame.

### IDEAS

**1. What interests did Roberta Bondar have as a child? What can you gather from this article about her personality?**

She was interested in science from an early age. She often received items like chemistry sets as gifts, and she also used her radio to try to contact beings on other planets. Dr. Bondar closely followed the historical events of the U.S. moon missions in the 1960s, and dreamed of becoming an astronaut herself one day. She must be a very intelligent and hard-working person. Although she is already 65, she is still working as an advisor to the Canadian government and working for environmental causes. The article says she is a passionate environmentalist and speaks of her love for the planet; her book and the photos she took of Earth indicate a sensitivity to beauty.

**2. Great personal achievements are often the result of a bright, interested person's life coinciding with interesting historic times. What historic period coincides with Dr. Bondar's growing-up years? What are the historic opportunities for a young person today?**

Dr. Bondar was a teenager in the fifties and early sixties, the time of the Space Race between the U.S. and the Soviet Union. The Soviets launched Sputnik in 1957. Today the most obvious opportunities are in information technology and alternative energy, but there are many other social and technological opportunities, e.g. in genetics, disease control, and reducing world poverty.

## Hands-On Science – Antigravity Environment (Page 3)

Coloured water remained in the straw. The height of the water in the straw is the same as that of the water before it was poured out. Water molecules are attracted to each other. The air in the straw pushed up on the water when the jar is inverted and the water molecules pull each other from side to side. These forces are greater than the downward force of gravity. Thus an anti-gravitational force is created and the water remains in the straw.

## Superhuman Cyclists (Page 4)

### FACTS

**1. What is a genetic mutation? Describe some that commonly occur in people.**

A genetic mutation is simply a change in our genes, to our DNA. Most of the time these changes are harmless and don't affect our bodies. Sometimes they can cause diseases, like cancer. And other times they can make something in our bodies better.

**2. What makes the Tour de France one of the most difficult competitions in the world?**

This race lasts for 21 days. Racers must cycle more than 3,600 kilometres and the race includes 23 gruelling mountain passes, some more than 2,000 metres high.

**3. How are the bodies of Tour de France winners different than other people's?**

The fittest professional cyclists have hearts that are up to 40 percent larger than normal. They also have leg muscles that are able to take in a larger proportion of the oxygen that reaches them (a higher  $VO_2$  max).

### IDEAS

**1. Write a sentence about the combination of genetics and training. Think about your possible genetic strengths. In what area could you excel if you put in the training? From where in your genetic heritage do the genes come that could help you in this?**

Answers will vary. Every family has its strengths, whether in music, art, sports, memory, philanthropy, intellectual pursuits, etc.

**2. Do you have, or do you know anyone who has, a genetic mutation? In what ways can a mutation be an advantage or a disadvantage? If you had to have a mutation, and could choose, what would it be?**

Answers will vary. Example—two toes that are somewhat webbed, a condition shared by a grandfather and granddaughter, but skipping the whole generation in between.

**SUPERHUMAN CYCLISTS**

**5, 7, and 9 are false**

- 5. Our body has an estimated 100 trillion cells.
- 7. The genome was first decoded in 2007.
- 9. On average, human genomes are about 99.5 percent identical.

## Unmanned Stealth Fighter Takes Off (Page 7)

**FACTS**

**1. Who builds the Phantom Ray and how does it look?**

Boeing builds it. It is 11 metres long and looks like a smaller version of the U.S. military's stealth bomber.

**2. What are the jobs the Phantom Ray is designed to do?**

It can carry bombs or equipment to spy on enemy targets on the ground.

**3. Describe the development stage the Phantom Ray is in right now.**

It is still in the prototype stage and must be tested before it can be mass produced.

**IDEAS**

**1. Explain the difference between the Phantom Ray and older styles of UAVs.**

Older styles require someone to control them from the ground. This means someone has to be trained and available to operate them, and it also makes the UAV vulnerable to jamming equipment and limits its range because it must be within radio range. The Phantom Ray is completely autonomous, controlled by onboard computers, with a range of 2,000 km.

**2. How does the size, speed, range, and altitude of the Phantom Ray compare with those of a regular WestJet passenger plane?**

	Boeing 737 (approx)	Phantom Ray
Size	30 - 40 m	11 m
Speed	800 km/h	1,000 km/h
Range	5,600 km	2,000 km
Cruising Altitude	12,000 m	12,000 m

**VIRTUALLY AUTONOMOUS**

Answers will vary, but could include some of the following:

	Boeing 737 (approx)	Phantom Ray	Stealth	Older-style UAV
Size	30 - 40 m	11 m	23 m	Often 1 - 4 m
Speed	800 km/h	1,000 km/h		Often 100 - 150 km/h
Range	5,600 km	2,000 km	4,000 km	Varies up to 9,000 km

Cruising altitude	12,000 m	12,000 m	15,000 m	Varies widely
Guidance	Two pilots	Onboard computer	Two pilots	Radio controlled by controller on the ground
Purpose	Passenger, freight	Bombing, surveillance	Military, bombing	Surveillance, weather, fires, military

## Scientists Create Malaria-"proof" Mosquito (Page 10)

**FACTS**

**1. How do people get malaria?**

The disease is caused by a microscopic parasite called *Plasmodium*. A certain kind of mosquito called *Anopheles* can carry the *Plasmodium* parasite in its body. The parasite is transferred to humans when an infected mosquito bites them.

**2. What makes the newly-developed mosquito malaria-proof?**

The mosquito is genetically engineered. Scientists changed a gene in the mosquito that affects its immune system while also shortening its life span. One theory is that because the mosquitoes die at a younger age, the *Plasmodium* parasite isn't given the 16 days in the mosquito gut it needs to mature. For whatever reason, the engineered mosquito is totally unable to pass the parasite on to humans even when infected by it.

**3. What hurdles still remain before the new technology can be applied?**

Scientists still need to figure out how to replace existing *Anopheles* mosquitoes in the wild with their genetically modified version. As well, more testing needs to be done to ensure there are no unexpected side effects should these malaria-proof mosquitoes be introduced into nature.

**IDEAS**

**1. Take this method one step further. What other medical problem could be solved by genetically modifying the cause of a disease?**

There are lots of possibilities, e.g. genetic modification of the amoeba that causes dysentery, bees or snakes so their venom wasn't toxic, microbes like staph that would take over harmful types of staph and be benign to humans.

**2. What other steps—environmental, social, economic—could be taken to reduce or eliminate malaria in Africa?**

A public relations campaign to encourage people to get treatment, donations from other countries to be sure the treatment could be offered free, mosquito nets for sleeping, draining swampy places where mosquitoes breed, teaching people not to have water standing outside, better economies and more jobs so people could afford treatment, etc.

**MALARIA-PROOFING THE MOSQUITO**

1. Both Canada and the U.S. have laws banning or regulating all kinds of cloning. But most regulation about genetic engineering is still a matter of testing and debate and few

laws exist. Legislators see the potential good in genetic engineering that could make us immune to diseases etc. But little is known about the side effects or long-term consequences of such engineering. Europeans are adamant about not eating any genetically-engineered food. In Canada and the U.S., much of our food comes from genetically-modified crops.

## The Oily, Black Sea (Page 13)

### FACTS

**1. What caused the leak and how was it stopped?**

An explosion on the oil rig Deepwater Horizon caused the leak, and it was finally stopped with a cap put on the well at the ocean floor, and later pumping heavy mud into the leak.

**2. How did wildlife in the area suffer from the spill?**

Oil reduces oxygen levels in the water, suffocating the animals that live there, or it is eaten by fish or coats their skin and prevents them from breathing. It gets into the feathers of birds so they can't fly, and when it gets onto plants, it harms the animals that eat them. Fish eggs can be destroyed, reducing future stocks.

**3. What cleanup methods are also harmful to the environment?**

Burning the oil has killed wildlife and spread poisonous fumes through the air. Also, the seven million litres of chemicals, called dispersants, used to break the oil up into smaller droplets, could harm plants and animals.

### IDEAS

**1. The cleanup from the spill has become a big industry. What other times in history has a disaster become an economic opportunity? Who suffers economically in disasters? Who wins?**

War sometimes becomes an economic opportunity, with arms factories and other suppliers ramping up production. World War II catapulted Canada and the U.S. out of the Great Depression. Even hurricanes and tornadoes can benefit manufacturers and cleanup specialists. The people who lose are those who lose their homes and livelihoods. Fishermen and tourism operators in this disaster may get some compensation, but likely it will take years to rebuild their businesses.

**2. The spill is another illustration that oil and gas are a "dirty" fuel. Besides spills, in what other ways do oil and gas harm the environment? Name some cleaner forms of energy.**

Oil and gas are generally expensive and messy to extract—e.g. resulting in "sour gas" burnoff; massive stripping of the surface, as in the tar sands; huge amounts of water being used; and some natural ponds, rivers and lakes polluted by effluent. Burning fossil fuels also creates atmospheric pollution. Cleaner energy: bicycle pedaling, hydroelectricity, solar, wind, geothermal.

### SILVER LININGS

Situation	Who Could Benefit	Who Loses
Oil platform explodes, causing spill	Cleanup crews	The people who died, the people who worked on the rig, consumers who use oil and gas, BP, creatures and the environment
Tourism drops along Gulf Coast because of oil spill	Tourism operators in others areas	Tourism operators on the Gulf Coast, tourists who may have booked a holiday there
Half the class fails a test	The half who passed end up looking pretty smart, those who failed could start studying harder, the teacher might try a new approach	Those who failed, the rest of the class might have to sit around while the material is reviewed again
Your dog gets sick	Vet, dog in the long run, if the owner can figure out what made him sick and prevent a worse occurrence	The dog, the owner, if it is communicable—other dogs
Big storm causes a lot of lightning fires	Fire crews get work	
If lots of crews come to help, local motel and service operators benefit, aircraft and helicopter maintenance crews	Anyone living in or near a fire zone, users of the forest areas, animals	

### Headlines

Gulf Seafood Industry Tries to Shake an **Oily** Image  
 Gulf Oil Spill Could Hit Alabama, Mississippi Coasts  
 BP to Ramp up Oil Spill Collection  
 Gulf Oil Spill May Have Killed Climate Change Bill  
**Disaster** in the Gulf  
 Gulf Oil Spill Threatens Arctic birds  
 Gulf Oil Spill 2010: America's **Chernobyl**  
 BP Gulf Oil Spill **Conspiracies Flourish**

## Generating Electricity from the Top Down (Page 16)

### FACTS

**1. Describe Tom Broadbent's invention.**

His machine uses the water that drains from toilets, sinks, bathtubs, and appliances like dishwashers to generate electricity. Water falling through waste pipes turns

the four turbines in his HighDro Power machine, turning the gears and producing energy in the generator.

**2. What makes hydro power better than power from oil and gas?**

It is much cleaner than oil and uses water, a renewable resource readily available in streams and lakes. Hydro provides sustainable energy, unlike oil and gas which are expensive to remove from the ground, and burning them pollutes the atmosphere.

**3. In what way is the HighDro Power idea even better than solar and wind power?**

Solar and wind power depend on the weather whereas HighDro Power will work as long as people have water to drain.

**IDEAS**

**1. The technology is already available for most homes to be self-sufficient in energy with a combination of better insulation, solar, wind, and geothermal energy along with new ideas like HighDro Power. Why are homes still not being built with these innovations? What are the downsides?**

Most of the technologies are still relatively expensive. The article mentions that HighDro Power could save a building \$1,400 annually in electricity costs, but this would only be a small percentage of the total and doesn't account for the cost of buying and maintaining the machine. Geothermal energy still costs about five times as much to install as a conventional furnace, and although subsequent energy costs are less, it is the investment that deters most people who are building houses for an already great price.

**2. How could changing environmental conditions make HighDro Power less viable?**

North Americans use a huge amount of water compared to most other countries, and in parts of North America, it is uncertain that there will be enough water to sustain the demand, as the population increases and especially if the weather warms. A warmer climate could melt glaciers and dry up lakes and rivers, meaning everyone might eventually have to use less water, with the result being less water to drain and run HighDro Power.

**GENERATING ELECTRICITY FROM THE TOP DOWN**

Twenty-eight suites at \$50 per month would be \$1,400 per month, so the device would save one month's worth of electricity, or about 8 percent.

**Some questions might be:**

What happens to the solid waste? How is the whole system kept sanitary? How much does the device itself cost? Is there one device that covers the whole building or one for each suite that generates wastewater? Has Tom had investor interest? What is the future of micro-hydroelectricity projects. Will our houses eventually be self-sufficient in energy?

## Science Fun (Page 19)

1. AUTONOMOUS
  2. STEALTH
  3. EFFECTS
  4. WILDLIFE
  5. SUPERIOR
  6. PARASITE
  7. ENERGY
- THE FIRST CANADIAN WOMAN TO FLY INTO SPACE

## Science Quiz (Page 20)

**FILL IN THE BLANKS (6 MARKS)**

1. A new machine called HighDro Power could help people in **high-rise buildings** produce electricity using only the force of falling **water** to generate power.
2. Oil reduces **oxygen** levels in the water, suffocating the animals that live there.
3. Malaria is spread among humans by **mosquitoes**.
4. The amount of oxygen a muscle can absorb is called **VO<sub>2</sub> max**.
5. The Phantom Ray is invisible to **radar**, and can carry bombs or equipment to spy on enemy targets on the ground.
6. Dr. Roberta Bondar was the first Canadian woman to **fly into space**.

**MULTIPLE CHOICE (6 MARKS)**

1. What is the name of the parasite that causes malaria?  
**C. Plasmodium**
2. Approximately how fast can the Phantom Ray fly?  
**A. 1,000 km/h**
3. A 2007 study found that the fittest professional cyclists have hearts that are up to how much larger than normal?  
**D. 40 percent**
4. What was the name of the U.S. space shuttle Dr. Roberta Bondar flew aboard in 1992 for an eight-day voyage?  
**B. Discovery**
5. When was the first hydroelectric power plant built?  
**D. 1882**
6. Approximately how many litres of oil do experts believe spilled out?  
**A. 780 million**