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ASTRONOMY

1

A Giant Comet Is
Headed Our Way

INNOVATION

5

Using Geothermal
Energy to Make Wine

NEUROSCIENCE

7

Scientists Discover
Important Facts
about Epilepsy

ENVIRONMENT

11

Mushroom Leather

ZOOLOGY

14

Measuring the
Emotions of Animals

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ASTRONOMY

A Giant Comet Is Headed Our Way

Scientists have discovered the largest comet ever seen—and it is headed our way. Don't worry—it will miss Earth by a wide margin.

Astronomers have named the comet C/2014 UN271. It is also called Bernardinelli-Bernstein (BB) after its discoverers.

The comet is four billion years old and is travelling at 35,000 kilometres per hour. It is huge. At about 128 kilometres across, it is massively larger than an average comet. Many comets are only a few hundred metres in size. BB's mass is estimated at 500 trillion tonnes, which is equivalent to the mass of 2800 Mount Everests.

Comets are icy rocks that **orbit** the Sun. They often orbit at a very great distance where they can't be seen. Periodically, their orbits bring them closer to the Sun.

As a comet approaches the Sun, the icy material on the outside of the comet warms and turns into gases that reflect light. This produces a visible tail—the most distinctive feature of a comet. If the comet approaches close to Earth, we can see their long tails streaking across the

night sky.

It can take a comet as little as 20 years or as long as millions of years to complete an orbit. One of the most famous comets in history is Halley's comet. It appears approximately every 75 years.

You won't get a good look at the BB comet in the night sky, however—at least not without a telescope. The comet makes its closest approach in 2031, but it will miss Earth by 1.6 million kilometres. That is greater than the distance between Saturn and the Sun. At that distance, even this monster comet will only appear as a faint glow in the night sky.

As BB approaches, astronomers will be watching closely. The comet was first observed last year, but scientists recently got a good look using the **Hubble Space Telescope** (HST). They have made some interesting observations. For example, using computer enhancement, they determined the large size of the comet's **nucleus**, and the fact the comet is coloured black, like burnt toast.



Astronomers better get a look while they can. When the comet completes its orbit and heads back to the outer reaches of the solar system, it will be gone for a while. Astronomers estimate BB takes three million years to complete a single orbit of the Sun. ★



DID YOU KNOW

Halley's comet is named after English astronomer Edmond Halley who famously predicted the comet's return in 1758.

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WORD POWER

ORBIT: The curved path an object takes around a star, planet or moon. Orbits are often very predictable.

HUBBLE SPACE TELESCOPE: A large telescope that orbits Earth.

NUCLEUS: The solid, central part of a comet made up of rock, dust, and frozen gases.

ASTRONOMY**A Giant Comet Is Headed Our Way**

1. What have scientists discovered? What has it been named?

2. Describe the comet.

3. What happens when a comet approaches the Sun?

4. How close will the BB comet get to Earth?

5. When will BB return?

CRITICAL THINKING

1. What are your thoughts on the BB comet that is approaching Earth?

2. How do you think scientists can tell the difference between comets and other heavenly bodies, such as asteroids?

Comets

According to NASA, the current number of known comets is 3743.

Comets that pass by the Sun again and again are called periodic comets. Their orbits are often the same and we know when they will pass by Earth. Some comets only pass near Earth once. These are called non-periodic comets.

The letters in the designation tell us what type of comet it is. The letter P for periodic comets and D for periodic comets that were lost or which broke into pieces. Other letters are C for non-periodic comets, and X for comets where we do not know their orbits. It uses A for objects people say are asteroids.

Below is a list some comets that will be coming near to the Sun in the next 10 years.

Comet designation	Comet name	Period (years)	Perihelion distance (AU)	Next perihelion
P/2001 Q6	NEAT	22.61	1.408179	2024/06/20
P/2002 T6	NEAT—LINEAR	21.17	3.387103	2024/08/28
P/2004 D029	Spacewatch—LINEAR	20.4	4.09475	2025/03/06
P/2003 QX29	NEAT	22.74	4.239	2025/07/21
P/2021 R8	Sheppard	5.24	2.131	2026
P/2005 T3	Read	20.58	6.202	2026/08/15
P/2004 A1	LONEOS	22.2	5.462544	2026/11/07
C/1942 EA	Väisälä	85.4	1.287079	2027/07/10
P/2004 V5-A	LINEAR—Hill	22.42	8.8	2027/07/31
P/2004 V5-B	LINEAR—Hill	22.42	9.2	2027/08/02
P/2006 HR30	Siding Spring	21.86	11.7	2028/11/12
P/2005 S2	Skiff	22.48	7.9	2028/12/22
P/2009 Q5	McNaught	20.4	10.5	2030/02/02
P/2015 B4	Lemmon—PANSTARRS	25.72	11.7	2030/12/04
P/2009 T2	La Sagra	20.94	14.2	2030/12/21
C/1921 H1	Dubiago	22		2031
P/2009 O3	Hill	21.89	12	2031/04/08
P/2008 Y3	McNaught	22.75	8.7	2031/10/12
P/2008 O3	Boattini	23.42	5.1	2031/11/03

A perihelion is when it is closest to the Sun.

One astronomical unit (AU) represents the average distance between the Earth and the Sun. An AU is about 150 million kilometres.

Use the information on the previous page to answer the questions below.

1. What is the designation of the next comet to come close to the Sun?

2. What is the period of the Spacewatch-LINEAR comet?

3. Which comet will come the closest to the Sun?

4. How many comets will pass by the Sun in 2031?

5. What is the comet designation of the Skiff comet?

6. Which comet has the shortest period?

7. Which comet on the list has the longest period?

8. What is the name of the C/1921 H1 comet?

9. What is the name of the comet that will pass by the Sun on 2026/08/15?

10. What is the period of the Hill comet?

INNOVATION

Using Geothermal Energy to Make Wine



When you think of a **vineyard**, you might think of rows of grapevines basking under a hot sun. However, grapes do grow in cold climates. In fact, B.C., Ontario, and Quebec are known for their wine-growing regions.

Still, cold weather is a risk. During the winter, many vineyards in Canada cover their grapevines with an insulating material called **geotextile**. Combined with a blanket of snow, it creates a little cocoon to keep the grapevines from freezing in the winter. However, a period of especially cold weather can cause problems, damaging or killing these valuable plants.

One vineyard in Quebec has an ingenious solution. The Vignoble du Ruisseau vineyard is located in Dunham, in Quebec's Eastern Townships. They have started using geothermal energy to add a layer of protection to their grapes.

Geothermal energy is energy from the Earth. There is actually a lot of energy within the Earth in the form of heat. The Earth has a hot, molten core. The deeper you go under the surface, the warmer

it gets.

Traditional geothermal energy works by digging a hole deep into the crust of the Earth. Water is pumped down the hole to between 500 metres and several kilometres below the surface. There, the Earth is hot enough that it superheats the water. Hot water rises back to the surface where it can be used to heat a building or be converted into steam that can power a generator.

This kind of geothermal energy is not easy to do. It requires a fair bit of money and expertise to dig so far below the Earth's surface. However, the team at Vignoble du Ruisseau realized you don't have to dig quite so deep.

Even two metres below the Earth, temperatures stay relatively warm—a constant 5 to 8 degrees Celsius throughout the year, including in winter. To tap into this source of heat, the owners at Vignoble du Ruisseau created a network of pipes that go underground, and then come up above ground and intertwine with the grape bushes. A material called **glycol** is pumped through the pipes. The glycol warms up

underground and carries that heat to the surface.

Sara Gaston is the general director of the Vignoble du Ruisseau. She says their vines can withstand cold down to -18 degrees Celsius. When temperatures drop down to the minus thirties, their geothermal heat system becomes invaluable. ★



DID YOU KNOW

Another example of geothermal energy at work is hot springs.

To view videos, go to:
<http://resources.dynamic-classroom.ca/books/erht>

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WORD POWER

VINEYARD: An area dedicated to growing grapes that are used to make wine.

GEOTEXTILE: A fabric material that allows air and water to pass through while holding soil and plants in place.

GLYCOL: A chemical compound that stays liquid even when temperatures are very cold.

INNOVATION**Using Geothermal Energy to Make Wine**

1. How do vineyards in Canada protect their grapevines during the winter?

2. How do vineyards in Canada protect their grapevines? Does this work?

3. What is geothermal energy?

4. How does traditional geothermal energy work?

5. How did the team at Vignoble du Ruisseau use geothermal energy?

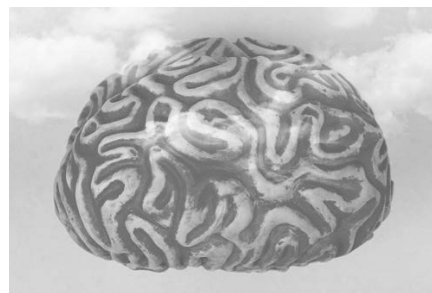
CRITICAL THINKING

1. Do you think this technology can be used for other crops? Explain your answer.

2. What are your thoughts on using geothermal energy to protect grapevines?

NEUROSCIENCE

Scientists Discover Important Facts about Epilepsy



Epilepsy is a brain illness that causes a person to have **seizures**. It can be a devastating disease. Seizures can happen at any time and without much warning. This can be dangerous if a person is in a vulnerable situation.

For doctors and scientists, epilepsy is a challenge. They don't fully understand what causes epilepsy or how to cure it. There are treatments, including anti-seizure drugs and surgery. However, medicines only work in about two out of every three people who have epilepsy. Surgery has risks and is also not guaranteed to be successful.

However, scientists at Trinity College Dublin may have a solution. The researchers believe they have discovered an important cause of epilepsy. It has to do with blood and the brain.

The brain is just two percent of a human's body mass, but it uses almost 20 percent of the body's energy. To keep up with this high energy demand, brain cells are nourished by a large network of **capillaries**. These capillaries

bring blood, packed with oxygen and nutrients, to brain cells.

To protect the brain from unwanted chemicals, viruses, and bacteria, there is a thin membrane that separates the brain from the capillaries. This membrane is called the blood-brain barrier (BBB). Its job is to ensure that only oxygen and desired nutrients make it into the brain.

The Trinity College scientists were led by Dr. Matthew Campbell, a **biochemist**. Campbell's team theorized epilepsy occurs when the BBB gets damaged and starts to leak. This would allow unwanted chemicals to enter the brain from the blood. Enough of those chemicals could trigger a seizure. The theory seems to be true.

Campbell and his team discovered that some people who have epilepsy are missing a protein called claudin-5. This protein is known to be important at helping the BBB work properly. To test this idea, the scientists removed the gene responsible for making claudin-5 in some lab mice. These mice soon developed

seizures.

The scientists also found a possible way to fix the problem. They used a medicine called RepSox on cells in the BBB. They found that RepSox helped these cells begin producing more claudin-5.

More work needs to be done to see if this approach results in fewer seizures in people. The researchers hope this is a step towards improving the lives of people with epilepsy. ★



DID YOU KNOW

It is estimated that about 260,000 Canadians have epilepsy.

To view videos, go to:
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Video



WORD POWER

SEIZURE: An abnormal state in which you become unconscious and your body moves in an uncontrolled and violent way

CAPILLARY: The smallest size blood vessels in the body that provide nutrients to cells.

BIOCHEMIST: A scientist who studies the chemical processes that occur in living organisms.

NEUROSCIENCE**Scientists Discover Important Facts about Epilepsy**

1. Why is epilepsy a challenge for doctors and scientists?

2. How does the brain get energy?

3. What is the blood-brain barrier?

4. What theory did the team of scientists have?

5. What did the team discover?

CRITICAL THINKING

1. What are your thoughts on the possible connection between the BBB and epilepsy?

2. Do you think that this research could help to improve the lives of people with epilepsy? Explain your answer.

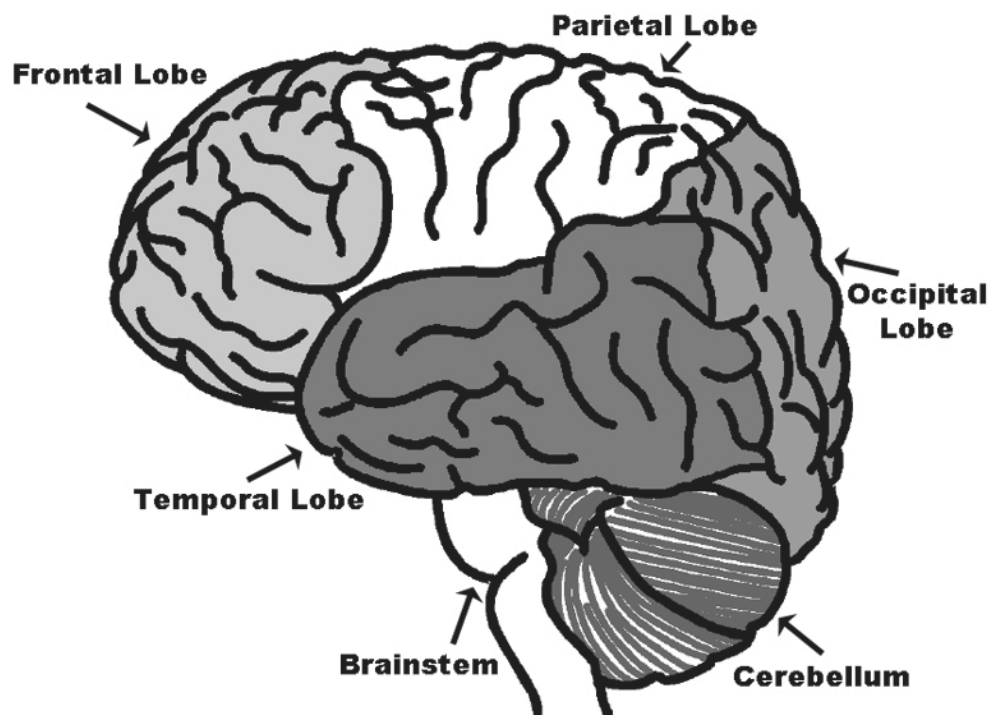
This Is Your Brain

The brain is the most complex part of the human body. Although the blood may be responsible for some functions, this three-pound organ controls just about everything you do, even when you are asleep. The brain is also the location of all reason and intelligence, and has parts that are responsible for perception, concentration, memory, and emotions.

The **brainstem** controls basic survival functions, such as heart rate, breathing, digesting food, and sleeping. The cerebellum is responsible for balance and muscle coordination.

The **cerebrum** is the largest part of the brain. It holds memories and allows you to plan, imagine, think, recognize friends, read books, and play games. It controls your voluntary muscles. It is divided into two hemispheres and each hemisphere is divided into sections (lobes).

- The **parietal lobe** receives and processes sensory information from the body, including touch, pain, and calculating location and speed of objects.
- The **occipital lobe** processes images from the eyes and links that information with images stored in memory.
- The **frontal lobe** is involved in motor skills (including speech) and cognitive functions. When you plan a schedule, imagine the future, or use reasoned arguments, the frontal lobe does most of the work.
- The **temporal lobe** controls memory storage area, emotion, hearing, and language.



Connect each description with the correct part of the brain.

1. Controls memory storage area and emotion

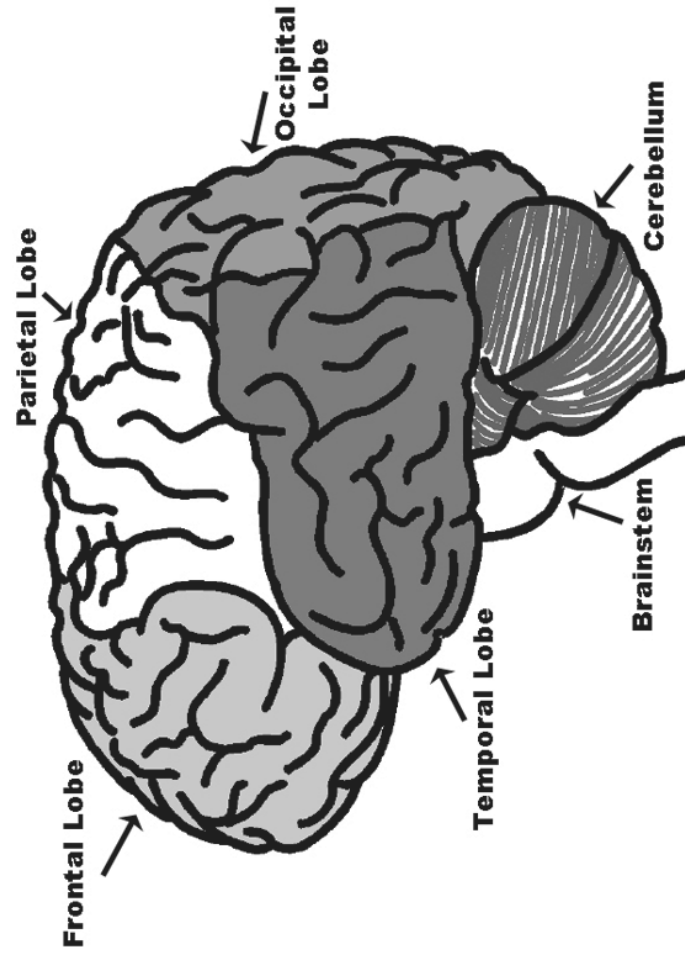
2. Receives and processes sensory information

3. Responsible for balance and muscle coordination

4. Controls basic survival functions

5. Processes images from the eyes

6. Involved in motor skills and cognitive functions



ENVIRONMENT

Mushroom Leather

Leather is a highly desirable material. It is used to make everything from jackets and handbags to couches. It is tough, fashionable, and distinctive.

Real leather is made from the skin of animals. Most commonly, it comes from animals like cows, buffalo, pigs, and alligators.

Leather has its critics. Animal rights groups protest the killing of animals to make leather. Also, the cattle industry—one of the main sources of leather—has come under fire. Raising cows requires large amounts of water and land. Cows also produce a fair amount of methane—a greenhouse gas that contributes to climate change. In fact, it is estimated that cows and other farm animals produce about 14 percent of human-caused greenhouse gas emissions.

This has sent innovators searching for new ways to make leather-like materials. A California-based **biotech** company may have a solution. Mycoworks has developed a process that uses mushrooms to make a material that closely imitates the look and feel of leather.

To make their mushroom leather, Mycoworks grows mycelium cells. These are the thin thread-like cells that make up a mushroom. In this case, the cells aren't grown into a mushroom shape. They are grown in a 3-D structure that is specially engineered to make the mycelium threads become densely intertwined. This causes them to form a tough material that has the strength and durability of traditional leather. Mycoworks calls their product Fine Mycelium.

Fine Mycelium can be grown in trays in a matter of weeks. It can be grown into different shapes and sizes as desired. Once the Fine Mycelium has finished growing, it is **tanned** to make it look and feel like animal leather. It has a flexible grainy surface like real leather.

The product is so good that luxury fashion brand Hermès has made a line of expensive handbags using Fine Mycelium. Mycoworks also points out their product is sustainable and won't contribute to climate change because it is **carbon-neutral**.

One problem with Mycoworks



mushroom leather is that it is currently still very expensive. It is used mainly in high-fashion products like handbags that cost over a thousand dollars.

Mycoworks isn't the only company looking to create useful materials from plants. Lululemon recently announced a line of yoga mats and bags also made from mycelium. Other companies have begun creating their own leather-like materials from things like pineapple leaves and cactuses. ★



DID YOU KNOW

Leather making has been around for more than 7000 years.

To view videos, go to:
<http://resources.dynamic-classroom.ca/books/erht>

Video



WORD POWER

BIOTECH: The combining of biology and engineering, using organisms or parts of organisms to create or improve products and services.

TANNING: A process using chemicals that help make leather stronger, more flexible, and longer-lasting.

CARBON-NEUTRAL: A process that removes as many greenhouse gas emissions as it produces.

ENVIRONMENT**Mushroom Leather**

1. Why is leather a highly desirable material?

2. What do critics say about the use of leather?

3. What has Mycoworks developed?

4. How does Mycoworks make their mushroom leather?

5. What are some of the benefits of Fine Mycelium?

CRITICAL THINKING

1. What are your thoughts on using “leather” made from mushrooms?

2. Do you think that we need to find replacements for leather? Explain your answer.

Uses of Leather

Leather is used for many products. Do some research. See how many products you can list that are made from leather.

ZOOLOGY

Measuring the Emotions of Animals



You get home and your pet dog is wagging his tail. He is happy to see you, or is he?

We often attribute emotions to animals. A cow moos in contentment. A pig squeals in fear. A squirrel chatters in excitement. Exactly what animals feel—and whether they have emotions at all—has been a debate among scientists for centuries.

For much of human history, most Western thinkers have assumed animals don't have emotions. They have assumed emotions are a product of **sentience**, and therefore a distinctly human experience.

In 1872, **Charles Darwin** was one of the first scientists to propose that animals do have emotions. The debate continued into the 20th century. Part of the problem is that emotions are **subjective** and difficult to measure. Since most animals don't have the ability to speak—at least in any way humans can understand—they can't tell us what they are feeling. More recently, some scientists are coming up with new scientific

methods to **objectively** assess and measure animal emotions.

For example, Martine Hausberger is an animal scientist at the University of Rennes in France. She led a team of scientists who investigated the emotional states of horses. They used electroencephalography (EEG), a method for measuring brain waves. They attached a simple EEG headset device onto horses' heads so their brain waves could be measured as they went about their day.

They found that horses that roamed freely with their herd outdoors had more brain waves called theta waves. In humans, theta waves are believed to reflect calm and well-being. Horses that lived in stalls and had little contact with other horses had more gamma brain waves. These waves are associated in people with anxiety and stress.

Other research has found that picking up a mouse by its tail can make it unhappy for the rest of the day, while an unexpected sugar treat can improve a bee's mood.

The research is important for

people who support animal rights. Knowing that animals have emotions could drive changes in how we treat animals in our care. An example is a proposed law in the U.K. that would make it illegal to boil lobsters alive. The law would require swifter, less painful methods of killing lobsters to avoid their suffering. ★



DID YOU KNOW

EEGs are used in humans to check the brain for problems like epilepsy, stroke, or sleep issues.

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Video



WORD POWER

SENTIENCE: The ability to be aware of oneself and to experience the world around us with feelings and sensations.

CHARLES DARWIN: An English scientist who developed the theory of evolution in the 1800s.

SUBJECTIVE: Based on or influenced by personal feelings or opinions.

OBJECTIVE: Not influenced by feelings because it is factual and can be measured.

ZOOLOGY**Measuring the Emotions of Animals**

1. What have Western thinkers assumed about animals?

2. What is part of the reason that it is difficult to determine whether animals have emotions?

3. How did Martine Hausberger and her team investigate the emotional states of horses?

4. What did they discover?

5. Why is the research important?

CRITICAL THINKING

1. Do you think that animals have emotions? Give reasons for your answer.

2. In your own words, explain the difference between something being subjective versus objective.

Science News Quiz

A GIANT COMET IS HEADED OUR WAY

1. How big across is the comet?
A. A few hundred metres B. 2800 metres C. 128 kilometres D. 500 trillion kilometres
2. As a comet approaches the Sun, the icy material on the outside of the comet warms and turns into gases that reflect light, producing a visible _____.

USING GEOTHERMAL ENERGY TO MAKE WINE

1. Geothermal energy is energy from what?
A. The Sun B. Wind C. Water D. The Earth
2. To tap into this source of energy, the vineyard created a network of _____ that go underground, and then come up above ground and interwine with the grape bushes.

SCIENTISTS DISCOVER IMPORTANT FACTS ABOUT EPILEPSY

1. Epilepsy is a brain illness that causes a person to have _____.
2. To protect the brain from unwanted chemicals, viruses, and bacteria, there is a thin membrane that separates the brain from the capillaries.
True False

MUSHROOM LEATHER

1. Real leather is made from what?
A. The skin of animals B. Cotton C. Oil D. Mushrooms
2. Fine Mycelium can be grown in trays in a matter of _____.

MEASURING THE EMOTIONS OF ANIMALS

1. For much of human history, most Western thinkers have assumed that animals have emotions.
True False
2. Knowing that animals have emotions could drive changes in how we _____ animals in our care.

Science News Answer Key

A Giant Comet Is Headed Our Way

1. What have scientists discovered? What has it been named?

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2. Describe the comet.

The comet is four billion years old and is travelling at 35,000 kilometres per hour. It is huge. At about 128 kilometres across, it is massively larger than an average comet. BB's mass is estimated at 500 trillion tonnes, which is equivalent to the mass of 2800 Mount Everests.

3. What happens when a comet approaches the Sun?

As a comet approaches the Sun, the icy material on the outside of the comet warms and turns into gases that reflect light. This produces a visible tail—the most distinctive feature of a comet. If the comet approaches close to Earth, we can see their long tails streaking across the night sky.

4. How close will the BB comet get to Earth?

The comet makes its closest approach in 2031, but it will miss Earth by 1.6 million kilometres. That is greater than the distance between Saturn and the Sun. At that distance, even this monster comet will only appear as a faint glow in the night sky.

5. When will BB return?

Astronomers better get a look while they can. When the comet completes its orbit and heads back to the outer reaches of the solar system, it will be gone for a while. Astronomers estimate BB takes three million years to complete a single orbit of the Sun.

Comets

1. P/2001 Q6
2. P/2004 C029
3. Väisälä

4. Four
5. P/2005 S2
6. Sheppard
7. Väisälä
8. Dubiago
9. Read
10. 21.89 years

Using Geothermal Energy to Make Wine

1. How do vineyards in Canada protect their grapevines during the winter?

During the winter, many vineyards in Canada cover their grapevines with an insulating material called geotextile. Combined with a blanket of snow, it creates a little cocoon to keep the grapevines from freezing in the winter.

2. How do vineyards in Canada protect their grapevines? Does this work?

During the winter, many vineyards in Canada cover their grapevines with an insulating material called geotextile. Combined with a blanket of snow, it creates a little cocoon to keep the grapevines from freezing in the winter. However, a period of especially cold weather can cause problems, damaging or killing these valuable plants.

3. What is geothermal energy?

Geothermal energy is energy from the Earth. There is actually a lot of energy within the Earth in the form of heat. The Earth has a hot, molten core. The deeper you go under the surface, the warmer it gets.

4. How does traditional geothermal energy work?

Traditional geothermal energy works by digging a hole deep into the crust of the Earth. Water is pumped down the hole to between 500 metres and several kilometres below the surface. There, the Earth is hot enough that it superheats the water. Hot water rises back to the surface where it can be used to heat a building or be converted into steam.

Science News Answer Key

that can power a generator.

5. How did the team at Vignoble du Ruisseau use geothermal energy?

Even two metres below the Earth, temperatures stay relatively warm—a constant 5 to 8 degrees Celsius throughout the year, including in winter. To tap into this source of heat, the owners at Vignoble du Ruisseau created a network of pipes that go underground, and then come up above ground and intertwine with the grape bushes. A material called glycol is pumped through the pipes. The glycol warms up underground and carries that heat to the surface.

Scientists Discover Important Facts about Epilepsy

1. Why is epilepsy a challenge for doctors and scientists?

They don't fully understand what causes epilepsy or how to cure it. There are treatments, including anti-seizure drugs and surgery. However, medicines only work in about two out of every three people who have epilepsy. Surgery has risks and is also not guaranteed to be successful.

2. How does the brain get energy?

To keep up with their high energy demand, brain cells are nourished by a large network of capillaries. These capillaries bring blood, packed with oxygen and nutrients, to brain cells.

3. What is the blood-brain barrier?

To protect the brain from unwanted chemicals, viruses, and bacteria, there is a thin membrane that separates the brain from the capillaries. This membrane is called the blood-brain barrier (BBB). Its job is to ensure that only oxygen and desired nutrients make it into the brain.

4. What theory did the team of scientists have?

Campbell's team theorized epilepsy occurs when the BBB gets damaged and starts to leak. This would allow unwanted chemicals to enter the brain from the blood. Enough of those chemicals could trigger a seizure.

5. What did the team discover?

Campbell and his team discovered that some people who have epilepsy are missing a protein called claudin-5. This protein is known to be important at helping the BBB work properly. To test this idea, the scientists removed the gene responsible for making claudin-5 in some lab mice. These mice soon developed seizures.

This Is Your Brain

1. Controls memory storage area and emotion

Temporal lobe

2. Receives and processes sensory information

Parietal lobe

3. Responsible for balance and muscle coordination

Cerebellum

4. Controls basic survival functions

Brainstem

5. Processes images from the eyes

Occipital lobe

6. Involved in motor skills and cognitive functions

Frontal lobe

Mushroom Leather

1. Why is leather a highly desirable material?

It is used to make everything from jackets and handbags to couches. It is tough, fashionable, and distinctive.

2. What do critics say about the use of leather?

Animal rights groups protest the killing of animals to make leather. Also, the cattle industry—one of the main sources of leather—has come under fire. Raising cows requires large amounts of water and land. Cows also produce a fair amount of methane—a greenhouse gas that contributes to climate change.

3. What has Mycoworks developed?

Mycoworks has developed a process that uses mushrooms to make a material that closely

Science News Answer Key

imitates the look and feel of leather.

4. How does Mycoworks make their mushroom leather?

To make their mushroom leather, Mycoworks grows mycelium cells. These are the thin thread-like cells that make up a mushroom. They are grown in a 3-D structure that is specially engineered to make the mycelium threads become densely intertwined. This causes them to form a tough material that has the strength and durability of traditional leather.

5. What are some of the benefits of Fine Mycelium?

Fine Mycelium can be grown in trays in a matter of weeks. It can be grown into different shapes and sizes as desired. Once the Fine Mycelium has finished growing, it is tanned to make it look and feel like animal leather. It has a flexible grainy surface like real leather. Mycoworks also points out their product is sustainable and won't contribute to climate change because it is carbon-neutral.

Measuring the Emotions of Animals

1. What have Western thinkers assumed about animals?

For much of human history, most Western thinkers have assumed animals don't have emotions. They have assumed emotions are a product of sentience, and therefore a distinctly human experience.

2. What is part of the reason that it is difficult to determine whether animals have emotions?

Part of the problem is that emotions are subjective and difficult to measure. Since most animals don't have the ability to speak—at least in any way humans can understand—they can't tell us what they are feeling.

3. How did Martine Hausberger and her team investigate the emotional states of horses?

They used electroencephalography (EEG), a method for measuring brain waves. They attached a simple EEG headset device onto horses' heads so their brain waves could be measured as they went about their day.

4. What did they discover?

They found that horses that roamed freely with their herd outdoors had more brain waves called

theta waves. In humans, theta waves are believed to reflect calm and well-being. Horses that lived in stalls and had little contact with other horses had more gamma brain waves. These waves are associated in people with anxiety and stress.

5. Why is the research important?

The research is important for people who support animal rights. Knowing that animals have emotions could drive changes in how we treat animals in our care. An example is a proposed law in the U.K. that would make it illegal to boil lobsters alive. The law would require swifter, less painful methods of killing lobsters to avoid their suffering.

Science News Quiz

A GIANT COMET IS HEADED OUR WAY

1. How big across is the comet?

C. 128 kilometres

2. As a comet approaches the Sun, the icy material on the outside of the comet warms and turns into gases that reflect light, producing a visible **TAIL.**

Using Geothermal Energy to Make Wine

1. Geothermal energy is energy from what?

D. The Earth

2. To tap into this source of energy, the vineyard created a network of **PIPES that go underground, and then come up above ground and intertwine with the grape bushes.**

SCIENTISTS DISCOVER IMPORTANT FACTS ABOUT EPILEPSY

1. Epilepsy is a brain illness that causes a person to have **SEIZURES.**

2. To protect the brain from unwanted chemicals, viruses, and bacteria, there is a thin membrane that separates the brain from the capillaries.

True

Science News Answer Key

MUSHROOM LEATHER

1. **Real leather is made from what?**
A. The skin of animals
2. Fine Mycelium can be grown in trays in a matter of **WEEKS**.

MEASURING THE EMOTIONS OF ANIMALS

1. **For much of human history, most Western thinkers have assumed that animals have emotions.**
False – That animals don't have emotions
2. Knowing that animals have emotions could drive changes in how we **TREAT** animals in our care.