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Satellite image of Moon's shadow over Indonesia. Insets: Total solar eclipse in Indonesia; partial eclipse in Vietnam

## TOTAL SOLAR ECLIPSE

On March 8 and 9, several million people in Indonesia and some Pacific islands experienced a total solar eclipse. Daylight turned to darkness. Depending where people were, the darkness lasted from 90 seconds to four minutes.

Solar and lunar eclipses are different. A solar eclipse occurs when the Moon passes between the Earth and the Sun. For it to be a total solar eclipse these three bodies have to line up exactly. A lunar eclipse occurs when the Earth is between the Sun and the Moon. The darkness of a solar eclipse is caused by the shadow of the Moon passing across the Earth's surface. A lunar eclipse is when the Earth's shadow falls on the surface of the Moon.

During a total eclipse, the Moon appears to fit neatly over the face of the Sun. This only happens because of a strange [coincidence](#). The Earth's distance from

the Sun is about 400 times the distance from the Earth to the Moon. Amazingly, the diameter of the Sun is approximately 400 times the size of the Moon's diameter. Therefore, during a total eclipse the Sun and the Moon look as if they are exactly the same size in the sky. This has not always been true. The Moon is very slowly moving farther and farther away from the Earth. Each year this distance increases by about 1.6 inches (four centimeters). Therefore, long ago this exact fit did not happen. Nor will it do so far into the future.

On average there is a total solar eclipse somewhere on the Earth once every 18 months. Often they are in places where few people live. The last one was about 12 months ago. It could only be seen from Svalbard. This remote archipelago, or group of islands, is in the Arctic Ocean. These islands

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are part of Norway and few people live there. The light around the outer edge of the Sun can be seen behind the Moon during a total eclipse. This is called the corona. The corona is sometimes described as the Sun's "atmosphere".



Path of totality

The dark shadow of a total eclipse is not very wide. It traces a narrow band across the Earth's surface. This band is known as the "path of totality". During the recent total eclipse, the path of totality was about 93 miles (150 kilometers) across. The shadow first appeared in the Indian Ocean. It then traveled eastwards across Indonesia. Palembang was the biggest town or city on the path of totality. This Indonesian city is home to two million people. Unfortunately, the skies above the city on this day were cloudy. After leaving Indonesia, the Moon's shadow sped over the Pacific Ocean. It then crossed the International Date Line. The solar eclipse finally ended north of Hawaii about four hours after it had begun.

The International Date Line is an imaginary line that divides the Pacific Ocean in two. When you cross this line, the date changes. If you are on the west side and cross it going east, you go from today to yesterday. Yet if you cross the other way, you leap from today to tomorrow. The path of totality crossed the Date Line going west to the east. This explains why the eclipse was on the March 8 and 9. West of the

International Date Line was March 9, yet on the east side it was still March 8.

As the Moon moves between the Sun and the Earth, it creates two types of shadow: the umbra and the penumbra. The umbra, or dark shadow, creates the path of totality. The penumbra is lighter. It occurs on either side of the totality path. People in parts of the world on which the penumbra fell could see a partial eclipse. This is when the Moon blocks only a part of the Sun's surface. As people in certain parts of Indonesia experienced a total solar eclipse, those in the rest of the country saw a partial one. The partial eclipse could also be seen in southern China and Vietnam as well as other parts of South East Asia, northern Australia, Hawaii, and Alaska.

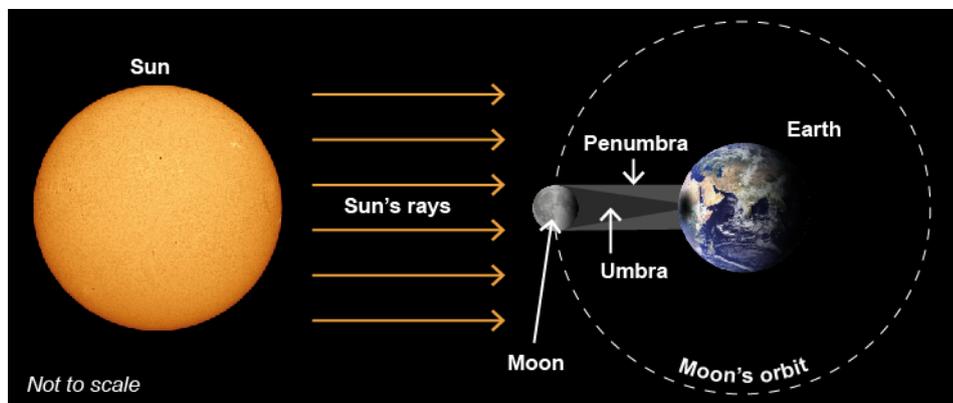
People traveled to Indonesia from many different countries to see the total eclipse. Hotels on the path of totality were fully booked months in advance. Some holiday companies chartered, or hired, ships. The ships sailed to places that were on the line of totality. Before an eclipse, people are warned not to look at the Sun. This is because it can damage the eyes. Usually, people use specially made shaded glasses, or dark filters, to protect their eyes.

NASA scientists in the U.S. used several satellites to film the eclipse.

These recordings clearly show the Moon's umbra and penumbra shadows moving across the Earth's surface. NASA also set up a live broadcast, so people in other parts of the world could watch the event in real time.

The Moon's orbit around the Earth is elliptical, or oval-shaped. So the distance between the Earth and the Moon is not always the same. When the Moon is farthest away, it's called the lunar apogee. At its closest it's the lunar perigee. The difference in distance to the Earth between apogee and perigee is roughly 35,000 miles (56,000 kilometers). When a solar eclipse happens at the time of its apogee, the Moon does not fully cover the Sun. It therefore looks as if one coin has been placed on top of a slightly larger one. This is known as an annular solar eclipse. During this type of eclipse, the outer edge of the Sun looks like a bright ring. (Annulus is the Latin word for "ring".)

The next solar eclipse is on September 1, 2016. It is an annular one. On this day, people in parts of Africa and the Middle East will be able to see the ring-like Sun. Another total solar eclipse follows on August 21, 2017. Visible right across the U.S., it is already being called the "Great American Eclipse". ■



## PET PENGUIN

Joao Pereira de Souza is a fisherman. He lives on a small island in Brazil. It is not far from Rio de Janeiro, one of the country's biggest cities. Mr. de Souza has become good friends with a small penguin. He calls it Dindim. Their unusual friendship began five years ago, after Mr. de Souza rescued the bird. Now, every year, the penguin spends eight months with Mr. de Souza. It then swims away to breed.

Penguins are flightless birds. They cannot fly, but are very good swimmers. Penguins spend about half of their lives in the sea. There, they feed on squid and other small sea creatures. There are many penguin species. Apart from those in zoos, all live in the southern hemisphere. Many people imagine Antarctica's ice and freezing temperatures when they think of penguins. However, only two types of penguin, Adélie and Emperor penguins, breed in Antarctica.

Some penguins live on islands around the Antarctic Peninsula. They are also found on islands in the Southern Ocean and on the coast of the southern part of South America. Others live farther north in places like New Zealand, Australia, South Africa, Brazil and even the Galapagos Islands, off the coast of Ecuador. Emperor penguins are the largest. Adults are 3.6 feet (1.1 meters) tall.

Dindim is a Magellanic penguin. With a height of 30 inches (75 centimeters), it is one of the smallest penguin species. Most Magellanic penguins breed around the most southerly coasts of Argentina and Chile. They are also found on the Falkland Islands, in the Southern Atlantic Ocean. Only a few travel as far north as Brazil.

Magellanic penguins have black backs and white fronts. They are named after Ferdinand Magellan (1480 – 1521). He was a famous ship's captain and explorer from Portugal. Magellan was the first European to sail around Cape Horn, or the southern tip of South America. He was also the first person to record the penguins that lived in this part of the world.



Joao Pereira de Souza with the penguin called Dindim (University of Rio de Janeiro)

When Mr. de Souza first found Dindim, the penguin was covered in thick black, sticky oil. It was lying on some rocks. The oil stuck to the penguin's feathers probably came from a ship or undersea oil-drilling platform. Floating oil is a danger for seabirds. This is because it sticks to their feathers and does not wash off. Mr. de Souza took the penguin back to his home. There, he cleaned the bird's feathers, fed it fish every day and slowly nursed it back to health. The penguin would have died, if Mr. de Souza had not rescued it. After 11 months, he went down to the sea and released the bird. It quickly swam away. Then, four months later, to Mr. de Souza's great surprise, Dindim returned.

Now, Dindim goes back to Mr. de Souza every year. The penguin leaves in February and returns the following June. Some people suspect that Dindim goes to the Magellanic penguins' breeding areas around Cape Horn. If so, it must

swim a distance of about 5000 miles (8000 kilometers). However, others think that this is unlikely. This is because the four months that Dindim is away is not long enough to travel this far.

If another person tries to touch the penguin, it pecks them. However, Mr. de Souza can stroke and feed Dindim. Mr. de Souza says that the small penguin is now like his own child. Every time Dindim sees Mr. de Souza, it wags its tail and makes honking noises. It's like a pet dog that's pleased to see its owner. ■

## ROME STREET MAP PUZZLE

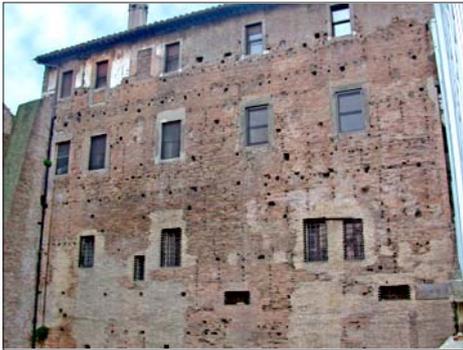
Scholars in Rome, Italy's capital city, have been trying to solve a puzzle for hundreds of years. It's an ancient street map of the city. The map was made 1,800 years ago. It used to cover a large wall in Ancient Rome. Only small pieces, or fragments, remain. However, archaeologists are now a bit closer to solving the puzzle. Another one of the missing pieces has recently been found.



Recently discovered triangular shaped fragment of the street plan, fitted next to other pieces

The city of Rome is over 2,500 years old. For hundreds of years it was the center of a huge empire. At its most powerful, the Roman Empire covered much of northern and southern Europe, and parts of North Africa and the Middle East. The empire lasted for 1,400 years. During this time, Rome was the largest city in the world.

The street map is known as *Forma Urbis Romae*. It was made between 203 and 211 CE. The map covered a wall that was 59 feet (18 meters) across and 43 feet (13 meters) high. It was made up of 150 pieces of flat marble, or marble slabs. Marble is a hard stone, which is often used for large buildings and statues. The map was carved on the marble slabs. It showed every street and building in the city as well as staircases and columns. Many streets and buildings were named. South was at the top of the map.



The wall of a former temple, in Rome, on which the *Forma Urbis Romae* street plan was attached

The huge street map was destroyed after the Roman Empire collapsed. Many of its marble slabs were broken up. They were used as material for other buildings or making lime. This was used to make cement. Even though the map was lost, the wall on which it was attached still exists. Originally, this wall was inside a Roman temple. Now, it is an outer wall of a church. The marble slabs were attached with clamps made from bronze. The places where the clamps fitted into the wall can still be seen.

The first parts of the map were found in 1562. Since then many more pieces have been discovered. In total there are nearly 1,200 fragments. All are a different size and shape. Yet archaeologists believe that this is only 10% of the original

map. It's known where about 200 pieces fit on the map. Drawings of some fragments exist, but the original pieces of marble are missing. All of the pieces are kept in one of Rome's many museums. This is not far from the wall on which the map used to hang.

The latest piece of the map was found last year. It is triangular shaped. The fragment was discovered within material that had been used to build a nearby palace. This building was probably constructed about 500 years ago. Workmen realized that it was a missing part of the ancient map. The recently discovered fragment meant that archaeologists could join three pieces together.

The city of Rome was divided into 14 regions, or areas. Parts of the words "Circus Flaminius" are carved on the new piece. The Circus Flaminius was one of Rome's 14 regions. It was a large circular area. As well as buildings and monuments, this part of Ancient Rome contained a racetrack.

In the past, trying to work out how different bits of the street map fitted together was difficult. The pieces of broken marble had to be picked up and moved around. Some are heavy and awkward to handle. Nowadays, it is much easier. Scans or photographs of all the fragments can be moved around on a computer screen. ■

## PLANET 50-50

International Women's Day (IWD) is on March 8. Each year people in many parts of the world organize special events on this day. They do this to remember what women have done in the past, and to celebrate their achievements

today. Another reason for IWD is to highlight inequalities that still exist in many countries between men and women.

The first IWD was held in 1911. Then, over one million men and women attended IWD events in Denmark, Germany, Austria, and Switzerland. They were campaigning for women to be allowed to vote in elections. The right for women to vote is known as women's suffrage. The people taking part in IWD events also wanted women to be able to stand, or be candidates, in elections. They insisted that there should be gender equality, or for men and women to be treated equally.

In 1893, New Zealand became the first country to give women the right to vote in nationwide elections. At that time, New Zealand was a self-governing British colony. By the 1950s, women could vote in nearly all the world's countries. However, this right has only recently been granted in Saudi Arabia. Now, 196 countries have some form of elected or appointed leader. Nineteen are women. Of the world's 500 richest people, only 55 are women. Many people argue that these numbers are far too low. The figures, they say, should be equal between men and women, or 50-50.



Today, there are still inequalities between men and women. Women are not allowed to do some jobs. In some countries unequal wages are not unusual. This is when a man is paid more than a woman is for doing the same job. Education in many developing, or less wealthy, countries is also unequal. Of all the children

in the world who do not get a primary school education, most are young girls. Therefore, in many places, it is much harder for girls to go on to study at college or university.

The United Nations (U.N.) has supported IWD since 1975. It has its own organization that works to stop inequalities between men and women in its member countries. Called U.N. Women, it was set up in 2010 by joining, or merging, several U.N. women's groups. Currently, Phumzile Mlambo-Ngcuka is in charge of U.N. Women. She is a former deputy president of South Africa.



International Women's Day march (U.N. Women)

In recent years, the U.N. has chosen a theme for IWD. This year it is "Planet 50-50 by 2030: Step It Up for Gender Equality". This fits with a U.N. project called the [Sustainable](#) Development Goals. The U.N. announced these goals at its annual meeting last year. This meeting is known as the General Assembly. It takes place at the U.N.'s headquarters, in New York City, in the U.S., at the end of September.

There are 17 Sustainable Development Goals. All U.N. member countries are supposed to achieve them within 15 years, or by 2030. One goal is gender equality. Others include: [eradicating](#) poverty and hunger; promoting peace; boosting prosperity; improving health and education; and fixing the causes of climate change.

On March 8, IWD events took place in countries all around the world. Examples were: concerts, conferences, exhibitions, sports competitions, marches, festivals, and theater and dance performances. In some countries, such as China, Vietnam and Russia, IWD is a national holiday. In these places, many people give gifts to their sisters, mothers and grandmothers. ■

## RUSSIA WITHDRAWS FROM SYRIA

Vladimir Putin, the president of Russia, made a televised announcement on March 14. What he said surprised many people in Russia and in other countries. Mr. Putin declared that he had ordered most of his country's forces in Syria to withdraw. Russian ships, planes and helicopters were sent to Syria five and a half months ago.

When Russian soldiers first arrived in Syria, they built an airbase close to Latakia. This city is in the country's northwest. After Mr. Putin's announcement, Russian military aircraft were filmed taking off from their airbase. Later, the same planes were shown landing in Russia. After they touched down, the planes were greeted by cheering crowds. Some Su-24 pilots were given flowers. Su-24s are a type of Russian attack aircraft.

The war in Syria began five years ago. The United Nations (U.N.) estimates that, so far, 250,000 people have died in the conflict. It began when some Syrians began to demonstrate. They said that the country's president, Bashar al-Assad, should stand down. His family have run Syria for over 45 years. Those demonstrating wanted to elect their own leaders. Soldiers from the

Syrian army were ordered to shoot at the protesters. Armed groups formed to fight against the army. At first, an organization called the Free Syrian Army (FSA) was the main opposition, or rebel, group.



Russian Su-24 warplanes

When the fighting first began, countries such as the U.S., Britain and France said that they supported the FSA. These countries also want Mr. al-Assad to leave Syria. Over time, many other rebel groups became involved in the conflict. They are either described as "moderate" or militant Islamic organizations. Moderate groups, such as the FSA, want Syrians to elect their own leaders. The militant Islamic groups plan to take over the country. Everyone in Syria would then have to obey strict religious laws.

Most of those supporting the Syrian government are Shia Muslims. Those fighting against it are mainly Sunni Muslims. Saudi Arabia, the largest Sunni country in the Middle East, has been helping the anti-government forces. Iran is the biggest Shia country. It supports Mr. al-Assad and his army.

Two years ago, a militant Islamic group known as ISIS (or ISIL) took over large areas of northeast Syria. This group now calls itself the Islamic State (IS). Its headquarters is in the city of Raqqa. The IS also controls parts of Iraq. This area includes Mosul, Iraq's second largest city. The IS has between 20,000 and

30,000 fighters. Most are willing to commit mass murder. They treat Shia Muslims, Christians and people of other religions very harshly.

Kurdish groups are also fighting in Syria. They oppose the Syrian government and the IS. The Kurds are a separate ethnic group. Kurdish people live in Syria, Turkey, Iraq, and Iran.

A few years ago the U.S. set up an anti-IS group, or coalition. Around 40 countries agreed to join. Military aircraft from a few of these countries, such as the U.S. and France, have been attacking the IS.

Russia has been friends with the Syrian government for over 30 years. Syria allows Russian warships to dock at Tartus. This port city is on Syria's Mediterranean shore. The Syrian army uses many Russian-made weapons. Five and a half months ago, Mr. Putin suddenly announced that Russia would help Mr. al-Assad. Then, many people thought that Mr. al-Assad was losing the war. Russia sent military ships, planes and helicopters to Syria.



Russian planes then began attacking all opposition groups. Air strikes were launched on both moderate and militant Islamic organizations as well as the IS. The U.S., Britain and France were unhappy about attacks on moderate groups. Russian attack and bomber planes helped the Syrian army to recapture large areas of the country.

Senior politicians from the U.S. and Russia have been trying to arrange a ceasefire in Syria for many months. At the end of February, Mr. al-Assad and most opposition groups agreed to stop fighting. Peace talks have begun in Geneva, in Switzerland. The U.N. has arranged these. The talks are between representatives of several moderate rebel groups and the Syrian government.

Mr. Putin claims that the Russian **intervention** in Syria has been a success. Others argue that Russian air strikes caused the deaths of many civilians. Many people have tried to explain why Mr. Putin made his decision. Some say that it was because peace talks have started. Others suspect that it was becoming too expensive, or that Mr. Putin no longer wants to support Mr. al-Assad. Not all Russia's forces in Syria have left. A few planes and ships will stay in the country. ■

## SAVING OKAPIS

Several conservation groups working in Africa have announced a new ten-year plan. The groups hope that their plan will save an animal called the okapi. Okapis are found only in rainforests in parts of the Democratic Republic of Congo (DRC).

Okapis were one of the last large mammals to be discovered in Africa by Europeans. They were first recorded around 100 years ago. Okapis are the only living relatives of giraffes. They are about 6.5 feet (two meters) tall. Females are slightly bigger than males. The animals have an unusual coloring. The fur on their bodies is reddish brown. Yet their front and back legs have white horizontal stripes.

Even though they look a bit like zebras, okapis are far more giraffe-like. Males have short horns, which are covered in skin. Females have small “bumps” instead of horns. As they are short, the horns do not get caught in branches and bushes. The animals are herbivores, or plant-eaters. They eat leaves, fruits, buds, grasses, ferns, and small pieces of wood, or twigs. Like cows (and giraffes), okapis are ruminants. These animals rechew their food. Sometime after swallowing it, food is brought back up to the mouth, or regurgitated. Then, it is rechewed and swallowed again. This can happen several times. When cows do this it is called “chewing the cud”.



Okapi

The okapi also has a very long giraffe-like purplish tongue. This is 18 inches (46 centimeters) long. The animal uses its long tongue to strip leaves and buds from branches and plant stems. An okapi's tongue can even reach its own eyes and ears. The animals have large ears and excellent hearing. They also have a good sense of smell. These senses mean that okapis are alert to any nearby danger. Leopards are the only animals that prey on okapis. Okapis are mostly active during the afternoon and early evening. Each day they can walk up to 2.5 miles (four kilometers) in the rainforest looking for food.

Okapis are solitary, or normally live on their own. When males and

females mate, they may spend a few weeks together. Females are pregnant for between 12 and 14 months. They give birth to one calf. The calf will stay with its mother for about one year.

Okapis are **elusive**. No one is sure how many live in the wild. About 100 years ago, there were thought to be 45,000. Today, this figure is believed to be around 10,000. The animals are threatened in several ways. Deforestation, or cutting down the rainforest, is one. Poachers are another. These are people who unlawfully kill animals for their skins and meat. Other problems include illegal gold and diamond mining as well as armed rebel groups. These groups have been fighting against the DRC government.

The conservation groups' plan is to protect the parts of the forest where most okapis live. More rangers, or local people who can check these forest areas, are needed. Lowland gorillas and forest elephants used to live in the same areas as okapis. Both of these animals are no longer found there. The conservation groups warn that if nothing is done to protect them, okapis could disappear. ■

## ORANG-UTAN SURVEY

Wildlife researchers have done a survey of orang-utans on Sumatra. This is the largest of Indonesia's many islands. The researchers discovered that the Sumatran orang-utan population is far bigger than previously thought. However, they warn that these large animals are still endangered. A survey eight years ago showed that there were 6,600 orang-utans on Sumatra. The researchers' figure is 14,600.

The orang-utan is one of the world's largest hominids or "great apes". As well as orang-utans, hominids include: humans, gorillas, chimpanzees, and bonobos (a type of monkey). Orang-utans are intelligent. They can reason and think. Orang-utans share nearly 97% of the same DNA as humans. This means that they are one of mankind's closest relatives. Of all the great apes, orang-utans (and humans) are the only ones found in Asia. The others live in Africa. The name "orang-utan" comes from Malay and Indonesian words. "Orang" means "person" and "hutan" means "forest". Therefore an orang-utan is a "person of the forest".



*Female orang-utan on Sumatra (Greg Hume)*

Orang-utans' natural habitat is rainforest. They are the world's largest arboreal animals. Arboreal describes animals that spend nearly all their time in trees. There are two orang-utan species. One lives on Sumatra. The other is found on Borneo. Most of this large island is either a part of Malaysia or Indonesia. The small country of Brunei is also on Borneo. Fully-grown male orang-utans are 4.6 feet (1.4 meters) tall. They can

weigh 200 pounds (90 kilograms). Females are slightly smaller.

Both orang-utan species have reddish hair. This is **unique** in the ape world. The orang-utans on Sumatra have longer faces and longer hair. They also spend more time in groups. The orang-utans from Borneo are more likely to come down from the trees and walk around on the ground.

Orang-utans mainly feed on fruit. Yet they will also eat tree bark, flowers, leaves, and insects. The apes eat at least 300 kinds of fruit and leaves. They know when these fruits are in season. At different times of the year, orang-utans travel to certain parts of the forest. The animals seem to have a "forest map" in their heads. They remember the time of year when trees fruit and where in the forest these trees are. This means that they do not waste energy looking for food. Orang-utans drink rainwater that falls on leaves. They also scoop out water that collects in natural bowls in trees.

The apes are very good climbers. Orang-utans' feet are more like hands. (This is why they find it difficult to walk on the ground.) The animals have strong arms. With their gripping hands and feet, orang-utans can move effortlessly from branch to branch. They sleep in nests, which they make from branches and leaves.

Orang-utans are solitary animals. They spend most of their time on their own. When mating, males and females stay together for a few days. A female gives birth once in every eight years. So in a lifetime, a female may have only four or five babies. Unlike most other animals, young orang-utans stay with their mothers until they are in their teens.

There are believed to be around 54,000 orang-utans on Borneo. In Sumatra and Borneo the animals are threatened by loss of habitat. In Sumatra huge areas of forest have been felled, or cut down. Palm oil plantations now cover much of the cleared land. Palm oil is added to many foods. It is also used for cooking and to make soap and cleaning products.

The researchers who did the survey in Sumatra say that orang-utan numbers have not increased. They believe that the last population count was incorrect. Before it was thought that orang-utans did not live in areas over 2,950 feet (900 meters) above sea level. However, the researchers discovered that this is not true. They found many orang-utans living above this height. ■

## OCULUS STATION OPENS

A new train station has opened in New York City, in the U.S.. The station is a part of the World Trade Center site. The two skyscrapers that used to be in this area were destroyed during an attack on America 15 years ago.

The two skyscrapers were called the World Trade Center. They were also known as the “Twin Towers”. The towers have been replaced by an even taller building. Many people who live in the city call it Freedom Tower. The building’s official name is “1 World Trade Center”. This 104-floor skyscraper was completed in 2014. It is one of the world’s tallest buildings.

On September 11, 2001, 19 members of an Islamic militant group called al-Qaeda **hijacked** four passenger planes. Two were deliberately flown into the Twin Towers. A third hit the Pentagon, the U.S.’s

military headquarters near Washington DC, the U.S.’s capital city.

The fourth aircraft crashed in the state of Pennsylvania. The passengers on board had realized what was happening. Some tried to overpower the hijackers and the aircraft came down in a field. These hijackers are thought to have planned to fly the plane to Washington DC. There, it would be crashed into the Capitol building, or the White House, the home of the American president.

The planes had recently taken off, so all were fully loaded with fuel. Those that hit the Twin Towers created huge fires and thick black smoke. The impact, the flames and damage to the towers’ steel frames eventually caused both buildings to collapse. Almost 3,000 people were killed in the attacks.

The attacks took place on September 11, 2001. Nowadays, they are usually called “9/11”, after the date on which they took place. Some people describe 9/11 as “the day that changed the world”. This is because it led to the wars in Afghanistan and Iraq.



*The Oculus, in New York City*

The new 1 World Trade Center overlooks a memorial park. The places where the Twin Towers once stood are marked by large square holes lined with **granite**. Water flows down the sides. The holes are like two huge square waterfalls.

The train station has replaced the old World Trade Center station. Its official name is the World Trade Center Transportation Hub. The platforms and trains are underground. The part of the station above ground is called the Oculus. (An oculus is an opening at the apex, or top, of a dome.) It is close to the 9/11 memorial park. Two other tall towers are being built on either side. When complete, they will become “2 World Trade Center” and “3 World Trade Center”.



*Inside the Oculus, in New York City*

Santiago Calatrava designed the train station. He is a Spanish architect and engineer. The Oculus is a giant white oval-shaped structure. It is made of steel shafts, or ribs, and glass. It is meant to look like the wings of a dove. This bird is a symbol of peace. Later in the year, shops will open on either side of the large open area inside the Oculus. Most floors and walls are marble. This is a type of hard, white colored stone.

Many people have praised the new building. Yet others are critical. It was supposed to be finished seven years ago. Building work cost \$3.85 billion. This is almost twice as much as originally planned. It is probably the world’s most expensive railway station. Some people complain that it does not resemble a bird. They say that it looks more like a stegosaurus (a type of dinosaur) or whale **carcass**. ■

## DISASTER REMEMBERED

Japan's Emperor Akihito, his wife Empress Michiko and the country's prime minister, Shinzō Abe, attended a memorial service on March 11. It was held in a large hall in Tokyo, Japan's capital city. The ceremony marked the fifth anniversary of what's now known as the Tohoku, or Great East Japan, earthquake.



Japan's Emperor Akihito and his wife Empress Michiko at the memorial service in Tokyo

The earthquake's epicenter was under the sea off Japan's northeast coast. Records of the world's earthquakes have been kept for over 100 years. The Tohoku earthquake had a magnitude of 9.0. It was the fourth most powerful ever recorded. It was also the strongest to have hit Japan. The earthquake created a tsunami, or giant wave. It struck many towns and villages along Japan's northeast coast. More than 18,000 people died.

The disaster also caused serious problems at one of Japan's many nuclear power stations. The Fukushima nuclear power plant was built on the coast. It was hit by the tsunami. Soon afterwards some of the power station's radioactive fuel rods overheated. Several explosions followed. Dangerous radioactivity was released into the surrounding area. People living within 12 miles (20

kilometers) of the power plant were ordered to leave their homes. Fukushima was one of the world's worst nuclear accidents.

Japan is made up of four main islands: Kyushu, Shikoku, Honshu, and Hokkaido. The epicenter of the earthquake was about 81 miles (130 kilometers) off the northeast coast of Honshu, or largest island. Yet the earth tremors were so strong that they were felt in most parts of the country. Tall buildings in Japan are designed to withstand strong earthquakes. In Tokyo, tall skyscrapers moved from side to side, but none collapsed.

Sendai was the nearest city to the epicenter. In the area around the city many buildings, roads, bridges and a large dam were badly damaged or destroyed. Yet, it was the giant tsunami that followed the earthquake that caused far more destruction. The earthquake forced a large part of the seabed to suddenly move upwards. This movement pushed up the sea in the ocean above. This **displaced** an enormous volume of seawater. It is this displaced water that creates tsunamis.



Picture taken in April 2011. Memorials set up among the ruins of a coastal town destroyed by the tsunami

A tsunami is not like a large wave you might see at a beach. It can be many miles long. The wave is more like a huge surge, or series of surges, of water. As it gets closer to the coast, the front of the surge increases in height. Ships far out to

sea may not even notice a tsunami. Damage is caused when the tsunami rushes inland and when the water suddenly starts flowing back to the sea again. Some tsunami waves created by the Tohoku earthquake were 130 feet (40 meters) high.

Many towns and villages by the sea in Japan have seawalls built for protection against tsunamis. They also have loudspeakers to broadcast tsunami warnings. Soon after the undersea earthquake was recorded, tsunami alerts were broadcast all along the northeast coast of Honshu. Many people living by the sea rushed to leave their houses to move to higher ground. Yet the huge tsunami arrived very quickly. It destroyed the seawalls and almost everything in its path. In some areas the seawater reached places six miles (ten kilometers) from the coast. Large ships were carried far inland.

On March 11, people attended memorial services in many parts of Japan. At 2:46 pm they observed a one-minute silence. Those in the streets and in cars stopped. This was the exact time at which the undersea earthquake began five years ago. Some people who live along the northeast coast, walked down to the sea. There, they threw flowers into the waves to remember those who died. ■

## "SEA LIZARD" EXTINCTION

An international team of researchers have completed a study of ichthyosaurs (pronounced ick-thee-oh-sores). These large marine reptiles lived in the oceans millions of years ago. Some people describe them as dolphin-like. In Ancient Greek, ichthyosaur means "fish lizard".

During the Earth's long history there have been at least five mass extinctions. These are often called extinction events. Perhaps the best known is the extinction of the dinosaurs. This happened about 66 million years ago. This event may have been caused by a large asteroid or comet hitting the Earth. Another possibility is an enormous volcanic eruption in what we now call India. This eruption lasted for over 500,000 years.

The biggest extinction event happened before the dinosaurs. Known as the Permian-Triassic mass extinction, it was 252 million years ago. This event marked the end of the Permian and the beginning of the Triassic period. The Triassic was the start of the Mesozoic Era, which is also known as the "age of dinosaurs". The Mesozoic is divided into three separate periods. These are: the Triassic (252 to 204 million years ago), the Jurassic (204 to 140 million years ago), and the Cretaceous (140 to 66 million years ago).



*A painting of what ichthyosaur may have looked like by Heinrich Harder (1858-1935)*

Scientists can work out when ancient creatures first appeared and then disappeared, or became extinct. They do this by recording fossils in different layers of rock. Uppermost layers of rock are younger than those deeper under the ground. From fossils, it is also possible to study how these creatures changed, or evolved.

Ichthyosaurs lived in the oceans at the same time that dinosaurs walked on the land. However, the sea creatures died out about 30 million years before the dinosaurs disappeared. Why they vanished is a mystery. There was no mass extinction event at that time. Having completed their study, the researchers now think that they know what happened to them.



*Ichthyosaur fossils in a London museum*

There were many types of ichthyosaur. They ranged in length from one to 69 feet (0.3 to 21 meters). The creatures had rows of sharp teeth and long thin snouts, or noses. Ichthyosaurs fed on fish and squid. Most marine predators have poor eyesight. They use other ways to hunt, such as smell, a sense of movement and echolocation. Echolocation is the use of sound waves. Scientists believe that ichthyosaurs were different. For their size, these sea creatures had very big eyes. Scientists therefore think that they hunted by sight.

Ichthyosaurs spent all the time in the sea. They breathed air. So the creatures must have frequently come to the surface. Some ichthyosaur fossils have been found with babies, or offspring, within them. This means that they gave birth to live young.

The researchers studied ichthyosaur fossils from the last 120 million years of their existence. They

compared them with how the world changed during the same period. For example, at that time there was no ice at the North and South Poles. This made sea levels far higher than today.

The researchers now believe that there were several reasons why ichthyosaurs died out. The temperature of the upper oceans changed. This probably affected the ichthyosaurs' prey. "Moving" continents blocked migration routes and places where they gave birth. The researchers discovered that, during the last 50 million years of their lifetime, ichthyosaurs evolved very slowly. They therefore think that the creatures were unable to evolve, or adapt, to the changing seas quickly enough. Yet other sea creatures managed to do this. This would explain why these sea creatures survived and ichthyosaurs died out.

The first complete fossil of an ichthyosaur was dug up in Britain in 1811. A famous fossil hunter called Mary Anning found it. At that time, her discovery led to new ideas about the Earth. These included how old it is and that strange creatures had lived many millions of years ago. ■

## LINES OF THOUGHT

A new exhibition opened at the Cambridge University Library on March 11. It celebrates the library's 600th anniversary. An ancient document held by the library is dated March 10, 1416. It mentions "the common library of all [scholars](#)". At that time, the library was probably no more than a wooden chest full of books.

Cambridge University is in Britain. Founded in 1209, it is one of the world's oldest universities. The scholars who started the university came from the University of

Oxford. This university, which is also in Britain, is even older. It dates back to 1096. Nowadays, both Oxford and Cambridge are world-famous universities.

People connected with the university are able to use the Cambridge University Library. It is also what's known as a copyright library. Copyright libraries keep a copy of every book published in the country in which they're located. Cambridge University Library has over eight million items. Most are books, but others are maps, sheet music, [periodicals](#), and manuscripts. The library receives hundreds of new books and publications every week. Six years ago, the university began a project to make digital copies of many of its ancient books and documents. This means that they can now be accessed via the internet.



Cambridge University Library

Work on the library's current building was completed in 1934. It has been enlarged several times. The library's buildings contain more than 125 miles (200 kilometers) of bookshelves. Some people who work in the library are known as "book fetchers". If a scholar requests any book, a book fetcher can usually find it within 17 minutes. The library is running out of space. A new storage center is being built at a nearby site.

The 600th anniversary exhibition is called *Lines of Thought: Discoveries that Changed the*

*World*. Items displayed represent thousands of years of recorded thoughts. Around 70% of them have not been displayed in public before. The oldest is a 4,000-year-old clay tablet. It has cuneiform script written on it. This script was used in the Middle East. It is made up of different wedge-like shapes and lines. Cuneiform was written on soft, wet clay tablets. These were then left to dry and harden. The tablet in the exhibition is a [receipt](#) for some wool.



Sir Isaac Newton's own copy of his book, *Principia Mathematica* (Cambridge University Library)

The exhibition includes several Chinese oracle bones. These are 3,000-years-old. The bones have Chinese characters written on them. They were used for fortune telling. This is predicting what will happen to a person in the future. There is a manuscript written by a monk from Tibet 1,000 years ago. It is made from palm leaves. Some of the exhibition's more famous items include: a Gutenberg Bible, Sir Isaac Newton's own copy of his book, *Principia Mathematica* (Mathematical Principles), a Shakespeare First Folio, and papers written by Charles Darwin.

The Gutenberg Bible was the first book to be printed on a modern-style printing press in 1455. Newton (1642 – 1726) was a British scientist and mathematician. He was the first person to work out that the force that makes things fall to the ground

(gravity) is the same force that holds all the planets and stars in orbit. The First Folio is the earliest printed text of 20 plays written by William Shakespeare (1564 – 1616).

Charles Darwin (1809 – 1882) was a British naturalist. Naturalists are people who study plants and animals. They mainly do this by observation. Darwin became famous for his book about evolution. Called *On the Origin of Species*, it was published in 1859.

One of the more recent items on display is a book manuscript. It was hand written by Margaret Drabble. She is a well-known living novelist.

The exhibition ends on 30th September. ■

## WORLD'S LARGEST CRUISE SHIP

Thousands of people gathered near the port city of Saint-Nazaire, on France's western coast, on March 10. They watched as a huge new ship was pulled out to sea by six tugboats.

A French company is building the vessel. Called *Harmony of the Seas*, it is owned by Royal Caribbean International. This cruise line is based in the city of Miami, in Florida, in the U.S.. A cruise line is a company that operates large passenger ships used for holidays, or pleasure voyages. When completed, *Harmony of the Seas* will be the largest cruise ship in the world.

Royal Caribbean operates over 20 cruise ships. All have names ending in "of the Seas". Most of the company's holiday cruises are around the Caribbean. *Harmony of the Seas* is taller than a 20-story building. It is 1,190 feet (362 meters) long. The vessel has 18 decks. Sixteen are for passengers. The ship

will have a crew of 2,300 and cabins for 6,400 paying guests.

Building work began two years ago. The ship has several swimming pools and a giant multi-deck water slide. It also has a 3D cinema, theaters, an adventure playground, parks, a nursery, and many restaurants and bars. One is called the Bionic Bar. There, robots will serve the drinks. The stage of one theater has a large water tank. It will be used for diving displays. At the back of the ship is a large semi-circular area. For outdoor shows and entertainment, it looks like an Ancient Greek amphitheater.

The ship's designers have included seven different "neighborhoods". Each has parks and squares and a different theme. For example, one is Central Park. Others are for younger people and sport and fitness. All passengers will have access to a free high speed internet service. Many people describe Royal Caribbean's larger cruise ships, like *Harmony of the Seas*, as "floating theme parks".

Not all cabins have outside windows. Typically, passengers prefer cabins with windows. Yet cruise lines charge more for these. To solve the window-less cabin problem, *Harmony of the Seas* has "[virtual balconies](#)". These display a real-time view from the side of the ship.

Royal Caribbean claims that the ship has been designed to be "environmentally friendly". It reuses wastewater and does not dump any [sewage](#) into the sea. The company also claims that it uses far less oil than older, smaller cruise ships.

Environmentalists have criticized the building of these huge passenger ships. They say that the large amount of fuel they burn creates extra air pollution. Others think that it is a bad idea for giant ships to dock at smaller Caribbean

islands. They argue that thousands of tourists getting off a ship at the same time can damage these islands' local environments.



*Harmony of the Seas (Royal Caribbean)*

After being towed out to sea, *Harmony of the Seas* completed four days of sea trials. These were to check that the engines and navigation equipment work correctly. The ship is expected to be finished within the next two months. Its first cruise with paying passengers begins at the end of May. These seven-night cruises will be in the Mediterranean Sea. After the summer, the ship sails across the Atlantic Ocean to Miami. Then, it will be used for Caribbean cruises. ▣

## CANADA AND THE U.S.

On March 9, Justin Trudeau, the prime minister of Canada, traveled to Washington DC, America's capital city. This was the first official visit to the U.S. by a Canadian leader for 19 years.

Mr. Trudeau became the prime minister of Canada five months ago. He is the leader of the country's Liberal Party. Mr. Trudeau took over as prime minister after his party won a general election. At 44 years of age, Mr. Trudeau is Canada's second youngest ever prime minister. His father, Pierre Trudeau (1919 – 2000), was a former Cana-

dian leader. He was the country's prime minister from 1968 to 1979 and then again between 1980 and 1984. Pierre Trudeau also led the Liberal Party.

Canada's border with the U.S. is nearly 5,600 miles (9,000 kilometers) long. This is the longest land border between two countries in the world. Canada is much bigger than the U.S.. Yet few people live in its northern regions. Canada is home to 36 million people. The U.S.'s population is 322 million.

Canada is a bilingual country. Its two official languages are English and French. This is because people from both Britain and France left Europe to go to live in Canada in the 1600s and 1700s. The people who lived there before Europeans arrived are known as First Nations. The name Canada is believed to come from a First Nations word that means "village".



*Justin Trudeau, Canada's prime minister, and Barack Obama, the president of the U.S., at the White House*

In the early 1600s, Britain set up settlements and colonies on the eastern coast of what is now the U.S.. By the 1770s there were 13 separate colonies. All were controlled by Britain. Yet, at that time, many people in the 13 colonies were unhappy about being governed by Britain and its king. They wanted to elect their own leaders. The rulers of Britain disagreed.

In 1775 a war broke out. It ended in 1783. This war is known as the American War of Independence, or

the American Revolutionary War. During the conflict people living in Canada stayed loyal to Britain. George Washington (1732 – 1799) commanded the American army that fought against the British. He eventually defeated the British forces. One year after the war began, the leaders of the 13 colonies made an announcement. Each colony, they declared, was an independent state. Together, these states were part of a new country called the United States of America.

For many years Canada was a part of the British Empire. It became a fully self-governing country in 1867. Today, it is what's known as a Commonwealth realm. The Canadian people elect their own leaders, but their country's head of state is the king or queen of Britain. However, he or she has few powers in Canada. Currently, Queen Eliza-

both the Second is Canada's head of state. Australia, New Zealand, Jamaica, and Papua New Guinea (PNG) are examples of other Commonwealth realms.

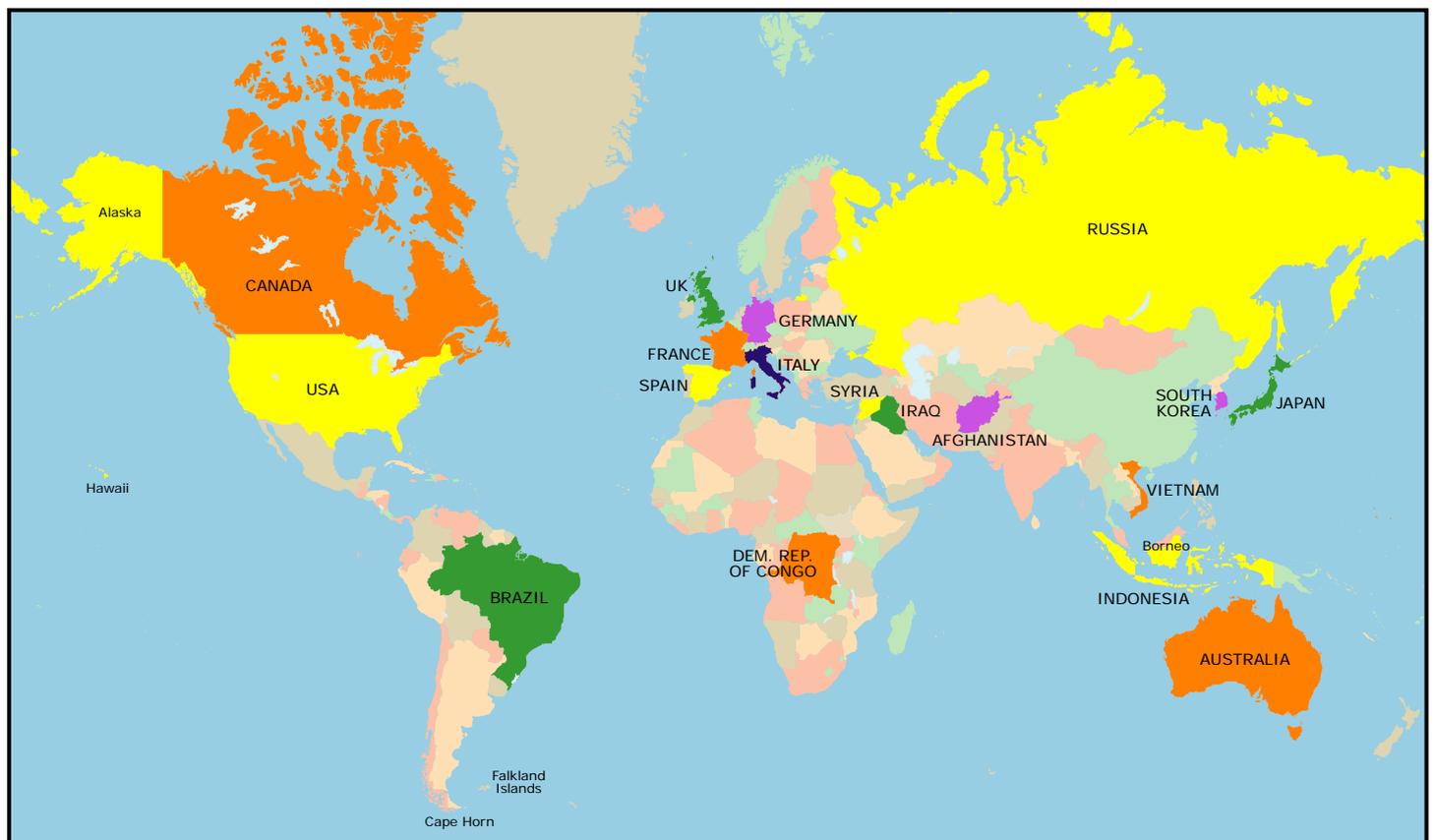
Presidents and prime ministers frequently travel to other countries. However, a state or official visit is different. These are formal events. For instance, a special welcoming ceremony is organized. During this there is a military parade and the two countries' national anthems are played. Mr. Trudeau's visit was an official visit. If Queen Elizabeth the Second were to be invited to Washington DC, it would be a state visit.

His wife and three young children accompanied Mr. Trudeau. The day after they arrived in Washington DC, the Trudeaus went to the White House. This is the home of the American president. There, Ba-

rack Obama and his wife, Michelle, greeted them. After the welcoming ceremony, Mr. Obama and Mr. Trudeau held several hours of talks. In the evening, there was a formal dinner. Both leaders made speeches. Mr. Obama declared that the U.S. and Canada were "blessed to be neighbors". ■

### GERMAN STATE ELECTIONS

Germany's parliament is called the Bundestag. Elections for this parliament take place every four years. The next election for the Bundestag will be held next year. Germany is divided into 16 regions, or states. Each state has its own local government. Regional elections for these state governments are not all held at the same time.



This map shows countries to which news stories refer in this issue. Visit [www.newsademic.com](http://www.newsademic.com) for more detailed world maps.

Elections for three German states were held on March 13. These were: Baden-Württemberg, Rhineland-Palatinate and Saxony-Anhalt. Many people were interested in the results. This is because they probably show what is likely to happen in next year's Bundestag election. The regional votes were the first elections to be held since the "European migrant crisis" began last year.



Angela Merkel has been Germany's elected leader, or chancellor, for over ten years. She is a member of a political party called the Christian Democratic Union (CDU). At the beginning of last year, tens of thousands of migrants began moving from Turkey to Greece. Most come from Syria, Iraq, Afghanistan, Pakistan, Bangladesh, and several North African countries. Some, such as those from Syria and Afghanistan, want to get away from fighting in their countries. Others are hoping to find a job and improve their lives. Nearly all the migrants are Muslims.

The European Union (EU) has 28 member countries. Germany is the wealthiest one. Greece is also a member of the EU. Last summer

Mrs. Merkel declared that Germany would welcome 800,000 migrants. Her announcement surprised many people in Germany and other parts of Europe. Mrs. Merkel did not consult the German parliament or other EU members before she made this announcement.

At first, many people in Germany and Austria welcomed the migrants. Last year about 1.1 million migrants arrived in Germany. Some people say that Germany is right to try to help these people. Others argue that Mrs. Merkel made the problem worse. They believe her offer encouraged many more to make the journey. In recent months, Mrs. Merkel has said that all EU countries must accept large numbers of migrants. Most are refusing to do so.

Officials in Germany have had to find places where all the migrants can live. In some towns and cities large camps have been set up. Many people in Germany are angry about what has happened. They say that most migrants have different beliefs and traditions. They think that it will be difficult for these people to become a part of German society.



Frauke Petry, leader of the AfD

A few years ago a new German political party was set up. It is called the Alternative for Germany (AfD). At first, it was an anti-euro party. Its followers wanted Germany to stop using the euro as its currency. More recently, the AfD has become an anti-immigration party. Its leader is

Frauke Petry. Many people thought that the AfD would do well in the three state elections. They predicted that fewer people would now vote for the CDU (Mrs. Merkel's party).

The AfD got 15% of the votes in Baden-Württemberg, 12.6% in Rhineland-Palatinate and 24% in Saxony-Anhalt. The CDU lost votes in all three regions. Yet it did not lose as many as some people expected. The results suggest that, for the first time, AfD candidates will be elected to the Bundestag next year. ■

## BULLFIGHTING SUPPORTERS

Valencia is one of the largest cities in Spain. On March 13, around 10,000 people walked through the city streets. All wanted to demonstrate their support for bullfighting. They believe that the government would like to stop, or ban, this ancient Spanish tradition.

No one really knows why bullfighting became so popular in Spain. Fighting against, or leaping over, bulls is many thousands of years old. A bullfight is described in a long poem called the *Epic of Gilgamesh*. It is at least 4,000 years old. A Sumerian wrote the poem. It is believed to be one of the world's oldest written stories. Sumer was an ancient civilization in Mesopotamia, or modern-day Iraq. The city of Sumer was founded about 4,000 BCE, or 6,000 years ago.

The Minoans were Europe's first advanced civilization. They lived on the Mediterranean island of Crete. Today, this island is part of Greece. The Minoan civilization began around 4,700 years ago. It lasted for 1,200 years. It's not known why this civilization declined or disappeared. One Minoan ruined city is called

Knossos. A wall painting found amongst its ruins shows a contest with a bull. Male and female acrobats **confront** the large animal. They can be seen taking hold of the bull's horns and leaping over its back.

Bullfights were popular in Ancient Rome. What's now Spain and Portugal was part of the Roman Empire. The Romans called this area of Europe Hispania. The Romans probably introduced bullfighting to Hispania. The Moors from North Africa took over much of southern Spain about 1,300 years ago. It's known that they turned bullfighting into a type of **ritual**. Bullfights were held on festival days.

Bullfighting is still popular in Spain, Portugal and parts of the south of France. Around 500 years ago, Spain took control of most of Central and South America. This explains why bullfights are also held in countries such as Mexico, Colombia, Ecuador, Venezuela, and Peru.

In Spain bullfights are thought of as a form of art or culture. They usually include traditional Spanish music. The most successful bullfighters are famous. During a bullfight, they wear **elaborately** decorated costumes.



*Bullfight in Spain*

Bullfights take place in large circular arenas. A bullfighter is known as a torero or matador. He performs a series of movements. These anger the bull. The bullfighter does this surrounded by spectators. They carefully watch his every move-

ment. Bullfighting is dangerous. It is not unusual for bullfighters to be badly injured. In some bullfights, the animals are stabbed so they lose blood and become weak. These bulls are normally killed. There are other types of bullfight where the bulls are not hurt.

Nowadays, bullfighting in Spain is **controversial**. Many people believe that it is cruel. They argue that killing or hurting animals for entertainment is wrong. Yet those who support bullfighting disagree. They insist that the tradition of bullfights is hundreds of years old.

Four years ago, Catalonia, one of Spain's most wealthy regions, banned bullfighting. Some believed that the Catalonia ban would encourage politicians to vote to stop bullfighting in the rest of Spain. Those who took part in the Valencia street protest want to make sure that this does not happen. ■

## BRAZIL'S CORRUPTION SCANDAL

Huge street protests took place in Brazil on March 13. The largest demonstration was in São Paulo, the country's biggest city. There, around 1.5 million people walked through the streets. Other smaller protests were held in over 100 other Brazilian cities. Many people wore yellow and green. These are the colors of the country's flag and its popular soccer team. All the demonstrations were peaceful.

The protesters were complaining about a government corruption **scandal**. Many were demanding the impeachment of the country's president, Dilma Rousseff. Impeachment is when a senior official is accused of a crime. If guilty, they have to resign. They may also be given a

prison sentence or other punishment. Ms. Rousseff is a member of the Workers' Party. This is one of Brazil's largest political parties. Ms. Rousseff was first elected as the country's president in 2010. In Brazil presidential elections are held every four years. Just over 12 months ago, Ms. Rousseff was re-elected for another four-year term. However, the number of people who voted for her this time was much less than in 2010.



*Dilma Rousseff, Brazil's president, with Lula*

The Workers' Party has led the country for 14 years. As president, Ms. Rousseff took over from Luiz Inácio Lula da Silva (better known as Lula). He was Brazil's president for eight years. When he came to the end of his allowed term, Lula selected Ms. Rousseff to succeed him. When he was president, Lula was often described as the "most popular politician in the world". Then, Brazil had one of the world's most successful economies. This has now changed. Recently, Lula has also been accused of corruption. Those who protested on March 13, say that he should be sent to prison.

The corruption scandal began over 12 months ago. It is centered on a large Brazilian oil company called Petrobras. This is a state-run company, so the government controls it. For many years the government has given some of its supporters senior well-paid jobs at Petrobras.

One of Petrobras' bosses was arrested. He told the police that government-appointed people at Petrobras were receiving unlawful payments. These came from building and engineering firms that work for the oil company. Petrobras frequently asks these firms to work on large projects. Before work begins, the firms have to tell Petrobras the price. The firms' bosses would deliberately increase, or inflate, this price. The government supporters at Petrobras then chose the firms to do the work. In return, the firms gave these people the money that they had increased their price by.



*Corruption scandal protest in Brazil*

Lawyers and the police have been investigating the scandal. They believe that construction and engineering firms paid government supporters working at Petrobras large sums of money. The total amount is thought to be \$2 billion over the last ten to 15 years. The lawyers say that these people kept some of the money. Yet most of it was given to the Workers' Party. This type of corruption, or dishonesty, is known as bribery. Many people from Petrobras and the Workers' Party have been arrested. Politicians from several other parties have also been accused of accepting some of the money.

Ms. Rousseff worked closely with President Lula. For five years she was his energy minister. Between 2003 and 2010 Ms. Rousseff was in charge of the meetings that senior

Petrobras bosses attended. However, she insists that she did not know about the bribery. Many Brazilians do not believe her. Ms. Rousseff is also accused of altering some of the country's economic figures. She is supposed to have done this before the last election. By making the figures look better, Ms. Rousseff increased her chances of being reelected. She insists that this is untrue.

For many years a junta, or military dictatorship, governed Brazil. It ended in 1985. Some people think that the army may need to take over again. They say this may be necessary, as so many politicians are involved in the corruption scandal. ■

## BLACKER THAN BLACK

Surrey NanoSystems is a company based in Britain. Two years ago it created an unusual material, or coating. Company workers described it as the "blackest black". Now, the company has made the material "even blacker". When a person looks at the material the blackness is hard to "understand". The eyes cannot tell the brain what they are seeing.

The black color that we see is not really black. If we look at a black piece of screwed up paper some light is reflected from it. We still know that it is a piece of crumpled black paper. This is because the paper is not a real black color. The only place in the Universe where there is real black (where no light is reflected) is a black hole. Therefore looking at the black material is similar to what your brain might record if you looked at a black hole.

Black holes are space objects that have very strong gravitational fields. Nothing can escape from them. All material is sucked in and trapped.

Even light and other types of radiation cannot escape. Black holes cannot be seen. As no light is reflected from them, they look like "nothing". The only way to work out where black holes are is to observe what circles them. This could be stars or clouds of cosmic dust and gas.



*Vantablack grown on tinfoil*

The company uses nanotechnology to make its black material. This is the science of working with things at the level of their atoms and molecules. These are the tiny "building blocks" from which everything is made. The company calls the material Vantablack. Vanta stands for: Vertically Aligned NanoTube [Arrays](#).

Vantablack is grown from tiny carbon tubes, or nanotubes. These are like very thin drinking straws. Each tube is 3,500 times thinner than the diameter of a human hair. As the tubes are so small, light particles cannot enter them. Yet the particles do get into the gaps between them. There, the light keeps bouncing between the carbon tubes until almost all is absorbed. One way of imagining this is to think of a forest. If you walked in a forest where the trees were all 1.9 miles (three kilometers) tall, very little light would reach the ground. Even during the day, the forest would be very dark.

As Vantablack absorbs nearly all light there is nothing to see. You can only see the things that surround the material. The brain works out that

something must be there. Or it understands that something must be in the middle of what can be seen.

As a demonstration the company grew the carbon nanotubes on a sheet of tinfoil. It was crumpled, or crinkled, to create shapes like hills and valleys. Where Vantablack covers the foil, it looks like a “completely flat black space”. If a narrow laser light is shone on the tinfoil, you can see a circle, or spot, of light. When the laser moves, the spot moves. Yet, if the laser is shone on tinfoil covered in Vantablack, the spot disappears.

The company believes that in the future there will be many uses for its new material. For example, it could be used to cover military ships, planes and other equipment. They would then appear as black 2D (two-dimensional) spaces, or voids. Another possible use is in telescopes and cameras. Vantablack would absorb any extra light inside them and therefore improve the images that they record.

Sir Anish Kapoor is an Indian-born British sculptor. Recently, he spoke with Surrey NanoSystems. In return for a payment, the well-known sculptor now has [exclusive](#) rights to use Vantablack in or on his artworks. ■

## ALPHAGO WINS

AlphaGo is a computer program. A company based in Britain called DeepMind developed it. This company was bought, or acquired, by Google two years ago. DeepMind tries to create programs that work in the same way as a human brain. This is often called artificial intelligence (AI).

DeepMind developed the AlphaGo program to play an ancient Chinese board game known as “Go”.

The game is believed to be more than 2,500 years old. It is for two players. The square board has a grid of black lines. The grid has 19 squares along each side. Each player has a supply of black or white flat round stones.



*Go board with black and white stones*

At the start of the game the board is empty. The players take turns. They put their stones on the places where the lines [intersect](#). The idea is to surround, or encircle, the opponent's pieces. Stones can be placed next to a free space or next to a similarly colored stone. Stones that get surrounded are removed from the board.

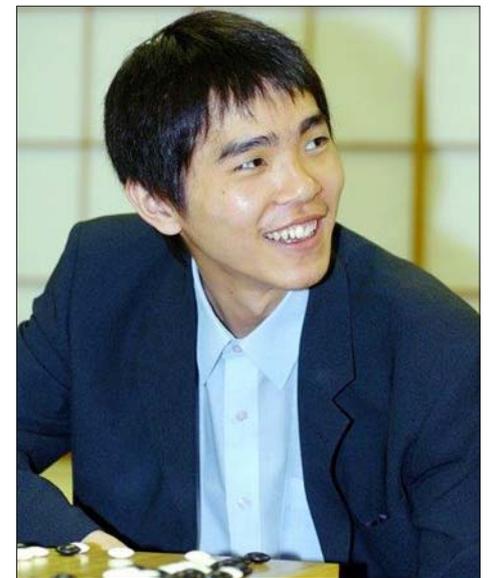
Go is a game of taking and holding territory, or areas of the board. It is popular in South Korea. There, the game is called “baduk”. This means “encircling game”. The game ends when both players pass. This means that they can no longer place any stones. The player that has managed to surround the most of his opponent's stones wins.

Twenty years ago a famous chess match took place. It was between Garry Kasparov, from Russia, and a computer called Deep Blue. Then, Kasparov was the world's best chess player. An American company called IBM developed Deep Blue. All possible chess moves were entered into the computer. News updates of the Kasparov - Deep Blue

chess competition were broadcast around the world.

Deep Blue won the first game. This was the first time that a computer had defeated a chess champion. However, Kasparov beat Deep Blue in most of the remaining games. So he won the match. Another contest was arranged the following year. This time Deep Blue won.

Nowadays, expert chess-playing computers are not unusual. This is because a computer can store all chess moves for all possible games. Go is different. Even though it looks simple, Go is very complex. Chess players have about 20 possible moves each turn. In Go this figure is 200. It's said that Go has more possible moves, or combinations, than there are atoms in the Universe. For this reason, few people believed that a computer program could master it.



*Lee Sedol*

AlphaGo is not like Deep Blue. It has taught itself how to play Go. First AlphaGo memorized about 30 million possible moves, or positions. These came from matches played between humans. It then used this information to play against itself. AlphaGo did this hundreds of

thousands of times. This is called “machine learning”. From this learning, AlphaGo can now work out the best moves. Computers are programmed to do things. AlphaGo is different. It can think.

Five months ago, AlphaGo played against the European Go champion. To many people’s surprise, the computer program won all five matches. Soon afterwards it was announced that AlphaGo would play Lee Sedol. Mr. Lee is from South Korea. He is believed to be the world’s best Go player.

The five matches between AlphaGo and Mr. Lee took place between March 9 and 15. They were played in Seoul, South Korea’s capital city. The computer program won the first three. Mr. Lee managed to win the fourth, but lost the fifth. Mr. Lee admitted that he did not expect to lose so many matches. ■

## BRIAN THE SPIDER

A new and unusual spider has been discovered in Australia. It is semi-aquatic. The spider lives close to freshwater pools and ponds. So far, it has only been found in an area around the city of Brisbane.

There are over 43,000 types of spider. They can be found everywhere in the world except for Antarctica. All spiders have eight legs, but they vary in size. The smallest have a body length of only 0.015 inches (0.37 millimeters). The largest, called the Goliath birdeater, can have a leg span of 9.8 inches (25 centimeters).

Many people think that spiders are insects. This is incorrect. Insects’ bodies have three main segments. They have six legs and most insects have wings. Spiders are a type of animal called arachnids. This name

comes from the Ancient Greek word for “spider”. (People who are very scared of spiders have arachnophobia.) Spiders have no wings, eight legs and two main body parts. Unlike insects, spiders do not have antennas.



*Dolomedes briangreenei* (Queensland Museum)

Other arachnids include scorpions, mites and ticks. Arachnids are not able to chew. Spiders have no teeth. They cover their food with enzymes. These turn the food into a liquid, which the spiders then suck up. Many living things have enzymes that help to digest, or break down, food. Normally, they work inside the body.

When fully grown, the new Australian spider is about the size of the palm of an open hand. When hunting, the spider stays at the edge of the pond. Its two back legs are attached to the shore. The spider spreads its other four legs across the surface of the water. By doing this, it can sense any ripples, or movement, on the water’s surface. This is similar to spiders that build webs. They detect an insect’s movements after it becomes trapped in their web.

If an insect lands on the water, the ripples alert the spider. From these, it knows how far away the insect is and its size. The spiders can tell if other things, such as falling leaves, cause the ripples. When an insect lands, the spider quickly “skates” across the surface of the water. Like insects sitting or walking on water,

the spiders are held up by surface tension. This is like a thin “skin” on the water’s surface.

The spider will bite the insect and then drag it under water. Later, it will take the insect onto the land. There, it can be eaten. These spiders will also attack tadpoles (baby frogs or toads), small frogs and toads, and smaller fish. The spiders can stay under water for up to an hour. As they dive under water, hairs on the spiders’ bodies trap bubbles of air. While under water, the spiders can take in, or absorb, this air through tiny openings along their sides.

The new spider has been given the name *Dolomedes briangreenei*. *Dolomedes* is the scientific name given to all spiders that are semi-aquatic. They spend some of the time either on or under water. The second part of the new spider’s name comes from Brian Greene. He is an American physicist.

Mr. Greene has recently visited Australia. He was there to take part in a science festival. Mr. Greene is an expert on gravitational waves. These are like ripples in space. When told that a spider had been named after him, Mr. Greene was delighted. He declared that he was pleased to be associated with the spider that uses waves and ripples to find its prey. Many Australians now call the spider “Brian”. ■

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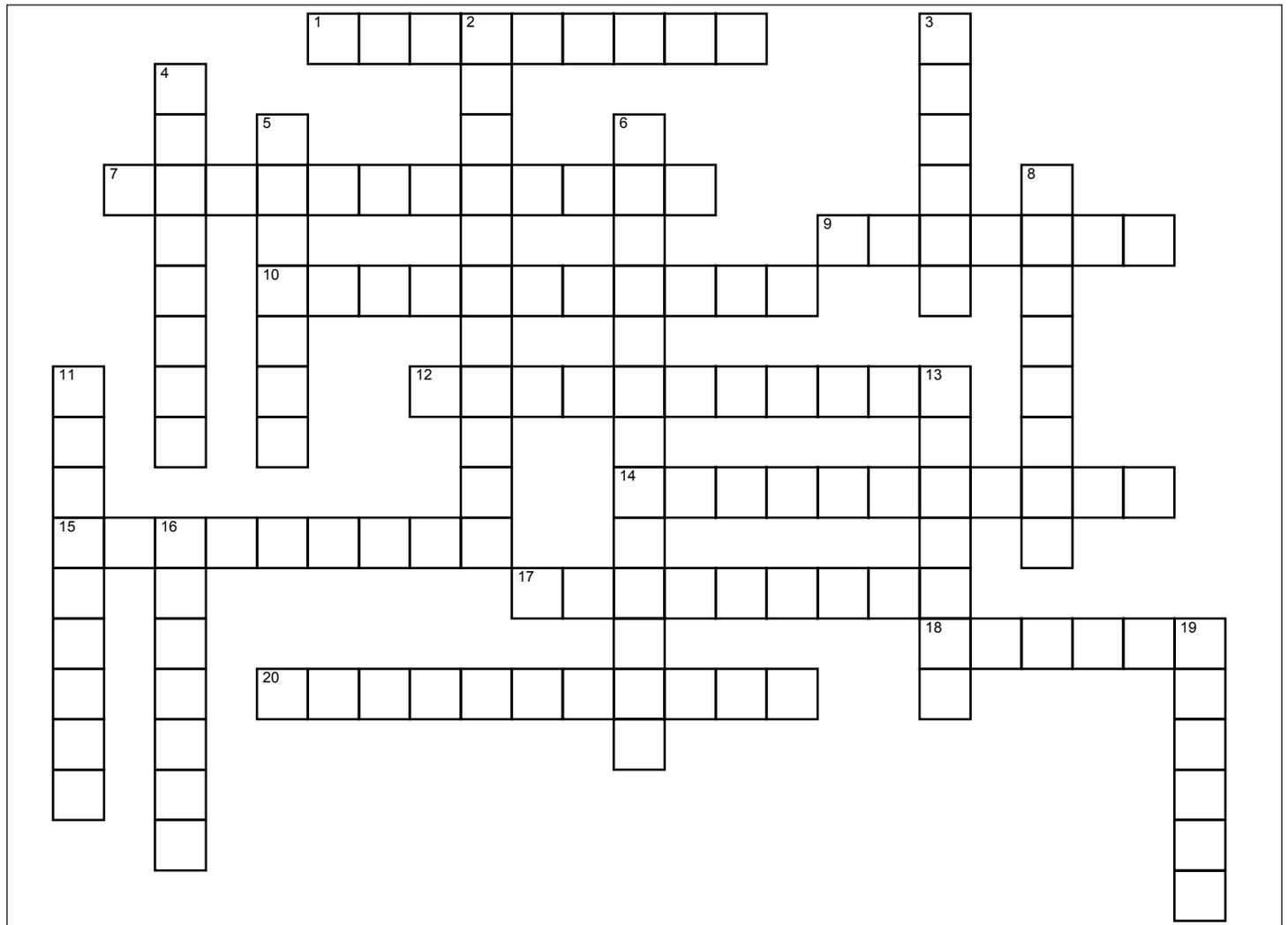
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# ISSUE 271

## GLOSSARY PUZZLE

**INSTRUCTIONS:** ① Complete the crossword. The answers are highlighted in orange in the news stories. There are 25 words highlighted and you need 20 of them to complete the crossword. ② Once you have solved the crossword go to the word search on the next page ➡



### Across

- 1 *Noun Plural* Platforms sticking out from the walls of buildings with access from a door or window, usually with a railing or low wall around it
- 7 *Noun* The act of preventing or changing a result or a course of events
- 9 *Adjective:* Describes something that is difficult to find or catch
- 10 *Verb* Getting rid of completely
- 12 *Noun Plural* Magazines or newspapers that are published one a week or once a month or other regular intervals
- 14 *Adverb* In a complex or fancy way
- 15 *Adjective* Limited to only a group of people or one person or an area
- 17 *Verb* Caused to move or take the place of
- 18 *Noun Plural* Pieces of equipment of the same type, connected together to do a particular job, especially telescopes or solar panels
- 20 *Adjective* Able to continue successfully over a long period of time

### Down

- 2 *Noun* When two or more similar things happen at the same time or place, for unconnected reasons
- 3 *Adjective* Being the only one of its kind
- 4 *Verb* To come together in a hostile or violent way
- 5 *Noun* A written or printed piece of paper that says something has been paid for or that an item has been received
- 6 *Adjective* Likely to cause arguments
- 8 *Verb* Violently took control of an aircraft, ship or other vehicle while it was travelling
- 11 *Verb* To cross, to meet at a point or to lie across one another
- 13 *Noun* A disgraceful event
- 16 *Verb* To ask someone for information or advice
- 19 *Noun* Human waste carried away in sewers or drains

# ISSUE 271

## GLOSSARY PUZZLE *CONTINUED*

**INSTRUCTIONS:** ③ Find 19 of the 20 crossword answers in the word search. Words can go vertically, horizontally, diagonally and back to front. ④ After finding the 19 words write down the 20th (or missing) word under the puzzle.

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

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**MISSING WORD ANSWER =**

**ISSUE 270 ANSWERS**

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

**R E S E R V O I R**