

Science News

CLASSROOM READY MONTHLY SCIENCE NEWS • JUNE 2008 • GRADES 8, 9 & 10



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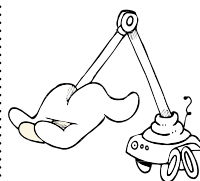
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Visionary Diagnosis



A SCIENTIST WORKING AT ETH ZURICH, A TECHNICAL INSTITUTE IN SWITZERLAND, HAS INVENTED AN INNOVATIVE NEW DEVICE THAT TRACKS EYE MOVEMENTS AS A WAY OF DIAGNOSING DISEASE.

Called the Wearable Eye Tracker, the device can be used to diagnose problems such as schizophrenia, **rotary vertigo** and reading and writing deficits. These illnesses have symptoms that can include unusual and distinctive eye movements.

Invented by doctoral student Andreas Bulling, the Wearable Eye Tracker identifies and records these eye movements. The device consists of a set of goggles with electrodes that detect eye movements through changes in electric potentials in the eyes—in a similar way to how electrocardiograms, or ECGs, detect heart beats. The use of electric potentials to track eye movements is based on the science of electro-oculography (EOG), a technique that has actually been around for 30 years. But what makes the Wearable

Eye Tracker innovative is that it is completely portable.

In the past, EOGs were recorded using large machines where a person would sit motionless in a doctor's office or clinic. Beyond being uncomfortable, this wasn't always effective

The Wearable Eye Tracker can be worn by a person who is moving around in normal life, while recording eye movements for up to eight hours.

because the eye movements the doctors were looking for might not manifest themselves right at that moment.

In contrast, the Wearable Eye Tracker can be worn by a person who is moving around in normal life, while recording eye movements for up to eight hours. In addition to the goggles,

the device includes a mini-computer about the size of a credit card. As the goggle electrodes record the eye movements, they transmit the data along cables to the computer, which records and analyzes the signals in real time.

To allow the device to work while a person is moving, Bulling had to deal with the fact that electrical potentials in the eye change not only as a result of eye movements, but also as a result of changes in light intensity (e.g., moving from a dim room into bright sunlight), as well as changes in movement speed (e.g., from walking to jogging). The Wearable Eye Tracker includes both light and acceleration sensors to compensate for these factors.

In addition to its use as a medical diagnosis device, the Wearable Eye Tracker could also be used for applications like interactive gaming. Bulling has filed a patent application and is looking to further develop its uses in both the medical and gaming industries. ★

Rotary Vertigo: A condition where a patient feels an illusory sensation of movement, such as the room spinning around her.

Facts & Ideas

FACTS

1. How does the Wearable Eye Tracker diagnose disease? Name some of the problems it can diagnose.

2. How does this new innovative device make recording EOG's easier?

3. Why does the Wearable Eye Tracker need to have light and acceleration sensors?

IDEAS

1. Explain how the Wearable Eye Tracker works.

2. Describe how the device could be used for applications like interactive gaming.

Scrambled Tracker

The scrambled words below can be found in their unscrambled form, in order, in the story "Visionary Diagnosis."

- vitennioav _____
- eadgniso _____
- arytro ergovti _____
- lgegogs _____
- dorteseelc _____
- cretole-golparhycou _____
- borpleat _____
- fanimets _____
- dircet drac _____
- aadt _____
- sentnitiy _____
- snossre _____
- sponcatmeen _____
- bawreela _____
- antept _____
- mingga _____

Make sentences with or draw a picture of any three of these words to show that you know what they mean.

A Really Big Squid



IN THE DAYS OF ANCIENT MARINERS, GIANT SQUID WERE CONSIDERED TRUE MONSTERS OF THE DEEP, WITH LEGENDS OF TALL SHIPS BEING DRAGGED DOWN INTO THE OCEAN DEPTHS BY THEIR MASSIVE TENTACLES.

Though no longer viewed as monsters, giant squid, and their even more massive cousins, colossal squid, are still a source of mystery and fascination—as evidenced by the worldwide attention paid to the landing of a 10-metre (34-foot) long, 495 kg (1091 lb) colossal squid by New Zealand fishermen in the Ross Sea, near the coast of Antarctica.

Residents of the deepest parts of the ocean, colossal squid are rarely seen. Only six specimens of colossal squid have ever been found and little is known about how and where they live. The specimen caught is the largest intact colossal squid body ever captured.

Since it was dragged up in a net by deep-sea fishermen in 2007, the squid has been kept frozen in a walk-in freezer. Recently, scientists at the Museum of New Zealand Te Papa Centre defrosted the creature over four days—doing it slowly in a bath of icy salt water to prevent the outside tissues from rotting before

Colossal Calamari

If the colossal squid were made into calamari, the rings would be the size of tractor tires.

the inside tissues had thawed. They then dissected it to learn more about this mystery of the deep, with the entire **autopsy** carried live to the world via webcast.

Among their discoveries were the colossal squid's huge eyes—

measuring 27 centimetres (10.6 inches) in diameter—about the size of a soccer ball. “They are clearly the largest eyes ever recorded from any animal,” noted Dan-Eric Nilsson, a biologist at the University of Lund in Sweden. The massive eyes may be necessary for the squid to see in the extreme dark of the depths at which it hunts (believed to be 1,000 metres, or 3,300 feet below the surface of the ocean).

The Te Papa team has also discovered bioluminescent (light-emitting) organs called photophores just underneath the eyes. The squid might use these organs to confuse prey about its size, or as a “**cloaking** device” when near the surface.

The team has also determined that the squid was a female, and that it was probably not fully grown—suggesting that adult colossal squid are even bigger. ★

Autopsy: Examination of a body after death; often internal organs are examined.

Cloaking: Device used to cover up or hide something.

Facts & Ideas

FACTS

1. Describe the size and location of the recent colossal squid find.

2. Why is so little known about the colossal squid?

3. What has happened to the squid since it was netted?

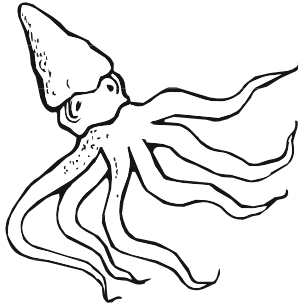
IDEAS

1. Describe some of the unusual features of the squid's eyes and offer a few additional speculations as to what the photophores might be for.

2. Would you watch an autopsy of a squid live on a webcast? Why or why not? What types of people do you imagine would be watching this webcast?

Colossal Squid Facts

Match up the numbers with the descriptions to get some facts about the colossal squid.



10 metres

2007

4

6

1,000 metres

495 kg

Number of colossal squid that have ever been found

Number of days it took to thaw the squid

Length of squid

Depth at which the squid hunts

Weight of the squid

Year the squid was found

Write the equivalents in Imperial measurements:

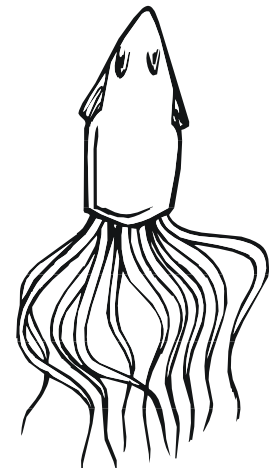
495 kg _____

10 metres _____

1,000 metres _____



What does a tractor have to do with a colossal squid?



The Face Never Lies



WOULDN'T IT BE GREAT TO KNOW WHEN SOMEONE WAS LYING? PERHAPS YOU COULD READ THEIR THOUGHTS, OR THEIR NOSES WOULD GROW LIKE PINOCCHIO.

Everyone lies. A recent study at Dalhousie University, Nova Scotia, discovered that most university students fibbed an average of two or three times during short everyday conversations. Generally, women lied to make the person they were talking to feel good, while men lied to make themselves look better. An unrelated experiment revealed that students lied more frequently on the telephone than they did in face-to-face conversations.

Dalhousie researchers, Stephen Porter and Leanne ten Brinke, showed images that ranged from happy (puppies playing) to fearful (a close-up of an angry, rabid dog) to disgusting (a severed hand) and instructed the volunteers to respond to the photographs with either real or fake emotional expressions. For example, some people were told to smile when looking at the photo of a severed hand. The reactions were watched and judged by other volunteers, who could not see the images. They were

also videotaped and analyzed frame by frame.

The secret to detecting falsehoods lies in the face. The face and its **musculature** are much more complex than any other external place on the body. According to Dalhousie professor, Dr. Stephen Porter, "there are some muscles in the face you can't control. You just can't do it."

The scientists concluded

According to Dalhousie professor, Dr. Stephen Porter, "there are some muscles in the face you can't control. You just can't do it."

that no one could hide their emotions perfectly and that some emotions were harder to fake. Happiness was easier to disguise than either disgust or fear. Video-tape analysis showed "microexpressions," flashes of true emotion that appeared from one-fifth to one-25th of a second on the faces of the participants who attempted to deceive the watchers. "The facial expression appears to crack and

another emotion leaks on the face, however briefly," noted Leanne ten Brinke.

Another study has shown that most people don't focus on the area of the face that displays true emotions. These researchers found that most people focus on the lower part of the face when talking with others. However, people's true emotions are "leaked" to the observer through the upper face around the eyes and are often missed. This is especially true for cultures which consider looking people directly in the eye to be an aggressive or threatening behavior.

One potential problem with the Dalhousie research is that culture has been shown to be an important factor for interpreting facial emotions. Cultures where emotions are strictly controlled, such as in Japan, focus on the eyes to interpret emotions. But in cultures where emotion is openly expressed, such as in Canada, people usually focus on the mouth. "These findings go against the popular theory that the facial expressions of basic emotions can be universally recognized," concluded University of Alberta researcher Dr. Takahiko Masuda. ★

Musculature: The system or arrangement of muscles in a body or a body part.

Facts & Ideas

FACTS

1. According to the study at Dalhousie, what were the general reasons women and men lied?

2. How was the Dalhousie study conducted?

3. What were the results of the study?

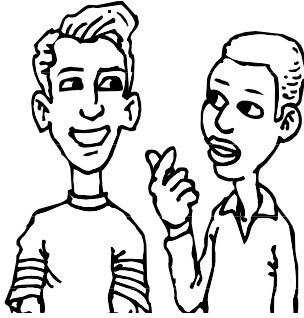
IDEAS

1. List reasons why students would lie more frequently on the telephone than in face-to-face conversations.

2. Other than cultural reasons, why do you think that most people don't focus on the area of the face that displays true emotions?

Science of Lying

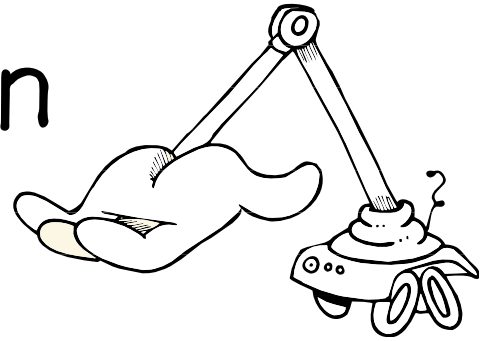
Below or beside each picture, tell what you know about the “science of lying” for each situation.







Getting A Grip On Things



WHAT CAN HOLD A CREDIT CARD, USE A KEYBOARD, AND LIFT A 20 KG BAG? THE ANSWER - THE WORLD'S FIRST COMMERCIALY AVAILABLE PROSTHETIC HAND.

Eighteen-year-old Sören Wolf was born with only one hand. His first **prosthetic** hands only allowed him to “pinch” an object using his thumb, index, and middle fingers. He recently tested the two most advanced prosthetic hands, the “i-LIMB” and the “Fluidhand,” and was enthusiastic about both models.

The i-LIMB has motors in each finger so every digit can work individually. Muscle signals located in the stump are picked up by **electrodes** on the skin and transferred to the controls in the prosthetic hand. Batteries provide the power.

The Fluidhand is based on a different principle. The drives located in the movable finger joints operate on the biological principle of the spider leg – to flex the joints, elastic chambers are pumped up by miniature **hydraulics**. The index finger, middle finger and thumb can be moved independently. The

prosthetic hand gives the stump feedback, enabling the **amputee** to sense the strength of the grip. It requires less gripping power and feels softer, more elastic, and more natural than conventional hard prosthetic

“A robotic hand which can perform tasks with the dexterity of a human hand is one of the holy grails of science,” said Dr. Honghai Liu, professor of artificial intelligence at the University of Portsmouth, “We are talking about having super high level control of a robotic device. Nothing which exists today even comes close.”

devices.

Hundreds of people lose their hands every year, most commonly from motorcycle accidents and industrial incidents. The human hand has 27 bones, is very flexible, and can make such a large number of complex move-

ments that it is very difficult to duplicate. Until recently, prosthetic hands looked like a hand but didn't move, or could only “pinch” with a simple single-motor grip, and were so heavy that they were uncomfortable and caused injury to the area where it joined with the arm.

According to Dr. Paul Chappell at the University of Southampton, the perfect prosthetic hand must have “the sort of functionality a human hand has but also a sense of touch. This will let the hand know how tightly to grip an object like a coffee cup without dropping it, but not so tightly that it's crushed. It will tell the hand if something is beginning to slip out of its grip so it can grip slightly harder. It'll be quite a clever system.”

Thus far, Sören has been the only patient in the Orthopedic University Hospital in Heidelberg who has tested both models. Only one patient in the world has received a Fluidhand for every-day use. A second patient will soon be fitted with this innovative prosthesis in Heidelberg. ★

Prosthetic: An artificial device used to replace a missing or defective body part, such as a limb or a heart valve.

Electrode: A conductor of an electric current.

Hydraulics: A mechanical device worked by the force of moving liquid.

Amputee: A person who has lost all or part of one or more limbs.

Facts & Ideas

FACTS

1. How does the i-LIMB work?

2. What is the principle on which the Fluidhand is based?

3. Why is the human hand so difficult to duplicate?

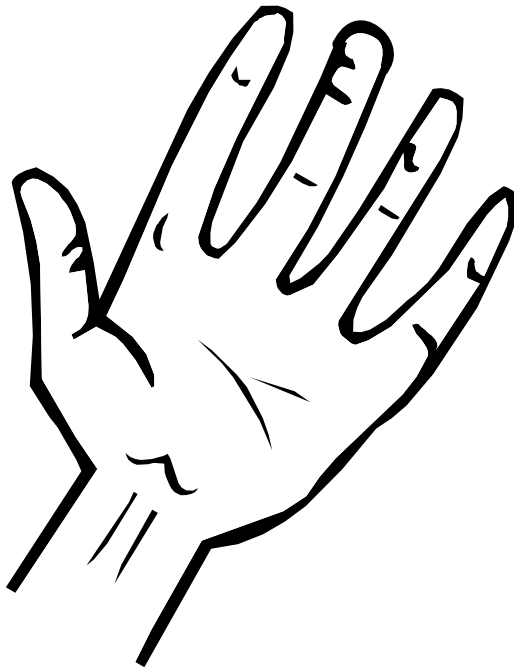
IDEAS

1. Until recently, what have been some of the limitations of prosthetic hands?

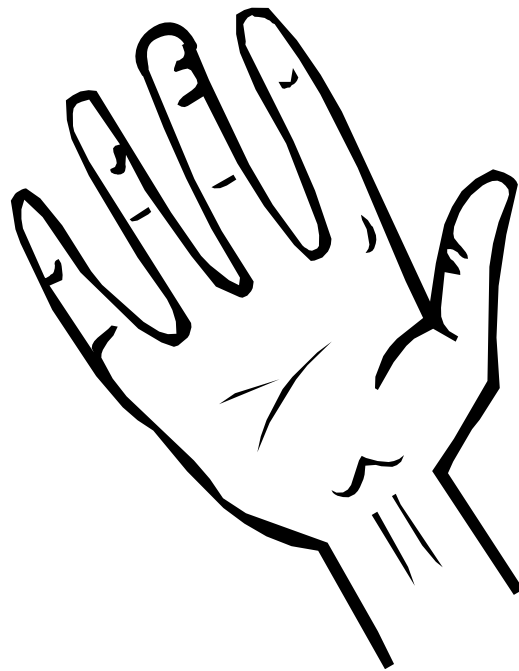
2. Explain why the perfect prosthetic hand must have “the sort of functionality a human hand has but also a sense of touch.”

The Amazing Hand

Make labels or write brief notes around each hand to show the difference between the i-LIMB and the Fluidhand. Below those, trace your own hand and make some notes and labels describing its capabilities.

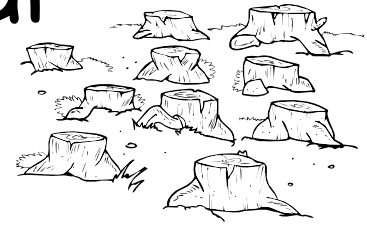


i-LIMB



Fluidhand

Bug Adds to Global Warming Woes



The villains in humanity's battle to stop global warming are well known—exhaust from cars and airplanes, emissions from coal, oil and gas-fired power plants, gas furnaces and factory smokestacks—all of which release carbon dioxide and other greenhouse gases into the atmosphere. Well, add to the list a **diminutive** yet deadly foe: the mountain pine beetle.

Canadian researchers have determined that the pine beetle outbreak which is currently ravaging the forests of western Canada is a serious contributor to the problem of global warming. Though smaller than a grain of rice, swarms of these beetles have been killing the mightiest of pine trees. An estimated 33 million acres of pine forest in B.C. and Alberta have already been affected by the outbreak.

The problem is double-edged because forests are normally a “carbon sink”—that is, they absorb carbon dioxide out of the atmosphere, in this case

through the process of photosynthesis. With the death of so many trees due to pine beetles, not only are these trees no longer alive to remove carbon from the

The Pine Beetle Attack

Mountain pine beetles bore through the bark of pine trees into their phloem layer—the living tissue that carries water and nutrients throughout the tree. There, the beetles feed and lay eggs, as well as releasing pheromones to attract more beetles, resulting in a mass attack that can kill a tree within two weeks.

atmosphere, their gradual decay is actually turning the forests into a new “carbon source”: as trees rot, their stored carbon is released back into the atmosphere.

Scientists from Natural Resources Canada (NRCan)

estimate that between 2000 and 2020, the **decimation** of western Canada's forests by pine beetles will cause the release of 990 megatonnes of greenhouse gases into the atmosphere. “That's equivalent to five times the annual emissions from the transportation sector in Canada,” said NRCan's senior research scientist Werner Kurz.

“The impact of the mountain pine beetle in B.C. is so large that the release of carbon dioxide in the affected areas is greater than the uptake of all the forests of B.C. together,” added Kurz, who suggests the problem can be alleviated by logging the dead trees and planting new ones as quickly as possible.

Ironically, one of the believed causes of the pine beetle outbreak is global warming itself. Extended cold periods of -30°C temperatures are needed to kill pine beetles. A succession of mild winters over the past decade have allowed the pine beetle population to grow out of control. ★

Diminutive: Extremely small in size; tiny.

Decimate: To destroy a great number or proportion of.

Facts & Ideas

FACTS

1. Name some of the villains in humanity's battle to stop global warming.

2. How does the pine beetle contribute to the problem of global warming?

3. What is believed to be one of the causes of the pine beetle outbreak?

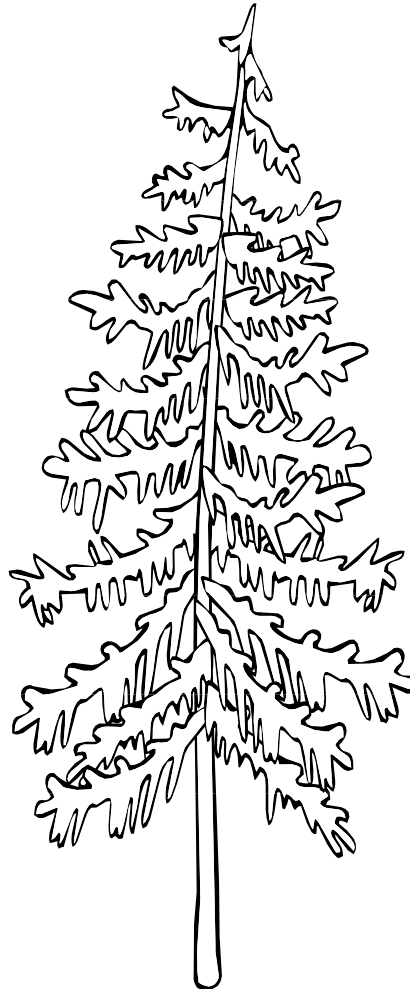
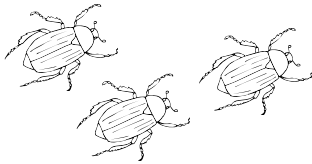
IDEAS

1. How does Werner Kurz suggest to alleviate the problem of the outbreak? What are some other possible solutions?

2. Explain how the pine beetle kills a pine tree.

The Powerful Pine Beetle

The tiny pine beetle is about half a centimetre long, compared to a Ponderosa Pine which can grow as tall as 50 metres. Write a ratio comparing these two sizes, or pace off a scale drawing outside.

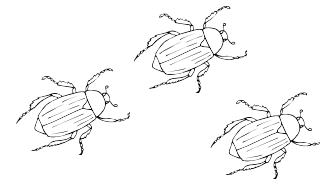


Acres of forest in BC: 149 million

Acres of forest in Alberta: 94 million

Acres affected by the pine beetle already:

Percentage of total forests so far affected by the pine beetle:



Between 2000 and 2020, the decimation of western Canada's forests by pine beetles will cause the release of 990 megatonnes of greenhouse gases into the atmosphere.

That's about equivalent to five times the annual emissions from the transportation sector in Canada.

How many megatonnes of greenhouse gases does the transportation sector in Canada emit each year?

How many megatonnes would the transportation sector in Canada emit in 20 years?

Which will create more greenhouse gases between 2000 and 2020, pine beetles or transportation? How much more?

Science Fun

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

SETIOTHRPC

CILRUHSYDA

POASYUT

ULSEMMAUO

SUUTURLEMCA

DECMEATI

1	2	3

4	5	6	7	8	9	10	11	12	13	

14	15	16	17

Use each of the above words in a sentence.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Quiz

Match the word on the left to the correct definition on the right. (6 marks)

- | | |
|--------------------|---|
| ___ Diminutive | A. Device used to cover up or hide something. |
| ___ Amputee | B. A conductor of an electric current. |
| ___ Cloaking | C. A person who has lost all or part of one or more limbs. |
| ___ Rotary Vertigo | D. The system or arrangement of muscles in a body or a body part. |
| ___ Musculature | E. A condition where a patient feels an illusory sensation of movement, such as the room spinning around her. |
| ___ Electrode | F. Extremely small in size; tiny. |

Answer the following questions in the space provided. (4 marks)

1. Which two provinces have been affected by the pine beetle outbreak?

2. Who invented the Wearable Eye Tracker?

3. How many bones are in the human hand?

4. How many colossal squid specimens have been found?

China's Terracotta Army



Marches to the Beat of an Egg

IT IS CONSIDERED TO BE ONE OF CHINA'S GREAT HISTORICAL AND CULTURAL TREASURES.

The **Terracotta** Army was created around 210 BC to accompany China's first Emperor, Shi Huang Di, into the afterlife. More than 7,000 ceramic warriors, chariots and horses were individually sculpted and then buried with the Emperor when he died.

The Terracotta Army was discovered in 1974, when local farmers drilling a water well near Xian, in the province of Shaanxi, stumbled across some of the **funerary** statues. The rest of the figures were soon excavated and the site has since become a popular tourist attraction and a UNESCO World Heritage Site.

Though more than 2,000 years old, the figures are in remarkably good condition and scientists may have figured out at least one reason why. German and Italian chemists have analyzed

paint fragments from the surface of several of the figures and have concluded that all of the figures were covered by beaten egg to help preserve them.

"Egg paint is normally very stable and not soluble in water...This

In addition to the sheer number of sculptures, the Terracotta Army is notable because each figure is life-size and life-like in appearance.

makes it less sensitive to humidity and moisture," noted Catharina Blaensdorf, a researcher at the Technical University of Munich. The proteins in the egg were also used to help bind colourful paints to a lacquer finish. Though many of the bright colours have now

faded, the scientists have found a range of pigments, from bone white to malachite, Chinese purple and azurite.

The discovery is intriguing because at the same time in history, artists in ancient Greece and the Roman Empire were also using egg as a binder in the creation of murals and stone paintings.

In addition to the sheer number of sculptures, the Terracotta Army is notable because each figure is life-size and life-like in appearance. In fact, the figures were individually sculpted with different heights, uniforms, hair styles and facial features. After they were created, the figures were arranged in precise military formation according to rank and duty. Ancient Chinese historian Sima Qian (145 BC – 90 BC) says that 700,000 workers were involved in the construction of the First Emperor's **Mausoleum**, and that it included great palaces, towers, and rivers fashioned in mercury. ★

Terra Cotta: A clay-based orangey-red hue ceramic, used in sculpture and pottery. **Mausoleum:** A large building that houses a tomb or tombs.

Funerary: Pertaining to a funeral or burial.

China's Terracotta Army Marches to the Beat of an Egg

Questions

1. What is the Terracotta Army?

2. When and where was it discovered?

3. Why were the figures covered in egg?

4. Explain why in ancient Greece and Rome egg was also used as a binder in the creation of murals and stone paintings.

5. Why is the Terracotta Army so notable?

Answer Key

Visionary Diagnosis (Page 1)

FACTS

1. How does the Wearable Eye Tracker diagnose disease? Name some of the problems it can diagnose.

The Wearable Eye Tracker tracks eye movements as a way of diagnosing disease. The device can be used to diagnose problems such as schizophrenia, rotary vertigo and reading and writing deficits. These illnesses have symptoms that can include unusual and distinctive eye movements.

2. How does this new innovative device make recording EOG's easier?

The Wearable Eye Tracker is completely portable. It can be worn by a person who is moving around in normal life, while recording eye movements for up to eight hours. In the past, EOGs were recorded using large machines where a person would sit motionless in a doctor's office or clinic. Beyond being uncomfortable, this wasn't always effective because the eye movements the doctors were looking for might not manifest themselves right at that moment.

3. Why does the Wearable Eye Tracker need to have light and acceleration sensors?

To allow the device to work while a person is moving, Bulling had to deal with the fact that electrical potentials in the eye change not only as a result of eye movements, but also as a result of changes in light intensity (e.g., moving from a dim room into bright sunlight), as well as changes in movement speed (e.g., from walking to jogging). The Wearable Eye Tracker includes both light and acceleration sensors to compensate for these factors.

IDEAS

1. Explain how the Wearable Eye Tracker works.

The device consists of a set of goggles with electrodes that detect eye movements through changes in electric potentials in the eyes—in a similar way to how electrocardiograms, or ECGs, detect heart beats. In addition to the goggles, the device includes a mini-computer about the size of a credit card. As the goggle electrodes record the eye movements, they transmit the data along cables to the computer, which records and analyzes the signals in real time.

2. Describe how the device could be used for applications like interactive gaming.

Answers will vary. It would allow games to be experienced in real time. Games would be more realistic because your reaction time would be very quick. It would work well for virtual reality and simulator type games.

SCRAMBLED TRACKER

- | | |
|------------------------|----------------|
| 1. innovative | 9. credit card |
| 2. diagnose | 10. data |
| 3. rotary vertigo | 11. intensity |
| 4. goggles | 12. sensors |
| 5. electrodes | 13. compensate |
| 6. electro-oculography | 14. wearable |
| 7. portable | 15. patent |
| 8. manifest | 16. gaming |

A Really Big Squid (Page 4)

FACTS

1. Describe the size and location of the recent colossal squid find.

The squid was 10 metres (34 feet) long, 495 kg (1091 lb) and it was found in the Ross Sea, near the coast of Antarctica.

2. Why is so little known about the colossal squid?

Colossal squid are rarely seen. They live in the deepest parts of the ocean and only six specimens of colossal squid have ever been found.

3. What has happened to the squid since it was netted?

It has been kept frozen in a walk-in freezer. Recently, scientists at the Museum of New Zealand Te Papa Centre defrosted the creature over four days—doing it slowly in a bath of icy salt water to prevent the outside tissues from rotting before the inside tissues had thawed. They then dissected it to learn more about this mystery of the deep, with the entire autopsy carried live to the world via webcast.

IDEAS

1. Describe some of the unusual features of the squid's eyes and offer a few additional speculations as to what the photophores might be for.

The eyes are huge, measuring 27 centimetres (10.6 inches) in diameter—about the size of a soccer ball. The squid also has (light-emitting) organs called photophores just underneath the eyes, which may be to confuse prey or may be used as a cloaking device. These could even be used to add additional light in the squid's dark environment.

2. Would you watch an autopsy of a squid live on a webcast? Why or why not? What types of people do you imagine would be watching this webcast?

Answers will vary. The webcast would presumably be of interest to marine biologists or anyone who is interested in amazing creatures.

LESSON

10 metres - Length of squid

2007 - Year the squid was found

4 - Number of days it took to thaw the squid

6 - Number of colossal squid that have ever been found

1,000 metres - Depth at which the squid hunts

495 kg - Weight of the squid

Metric Equivalents:

495 kg - 1,091 pounds

10 metres - 34 feet

1,000 metres - 3,300 feet

The Face Never Lies (Page 7)

FACTS

1. According to the study at Dalhousie, what were the general reasons women and men lied?

Generally, women lied to make the person they were talking

Answer Key

to feel good, while men lied to make themselves look better.

2. How was the Dalhousie study conducted?

Researchers showed images that ranged from happy (puppies playing) to fearful (a close-up of an angry, rabid dog) to disgusting (a severed hand) and instructed the volunteers to respond to the photographs with either real or fake emotional expressions. For example, some people were told to smile when looking at the photo of a severed hand.

3. What were the results of the study?

The scientists concluded that no one could hide their emotions perfectly and that some emotions were harder to fake. Happiness was easier to disguise than either disgust or fear.

IDEAS

1. List reasons why students would lie more frequently on the telephone than in face-to-face conversations.

Answers will vary. On the telephone, you don't have to worry about your face or body giving away the fact you are lying. You don't have to look at the person to whom you are lying. It is easier to not think about the consequences of the lie when the person is not there.

2. Other than cultural reasons, why do you think that most people don't focus on the area of the face that displays true emotions (around the eyes)?

Answers will vary. They could not be paying attention or thinking of other things. They could be focusing on the words and the mouth. It could be a confidence issue that makes them feel uncomfortable.

LESSON

Top left: Girls often lie to make the other person feel better.

Top middle: Guys often lie to make themselves look better.

Top right: Students lie more frequently on the phone than face to face.

Middle left: Most people focus on the lower part of the face when talking with others, but this isn't where the best lie detection happens. The upper part is more revealing. In Canada, people usually focus on the mouth; in Japan, on the eyes.

Middle right: Happiness is easier to disguise than either disgust or fear.

Bottom left: The face and its musculature are much more complex than any other external place on the body. There are some muscles in the face you can't control.

Bottom right: People's true emotions are "leaked" to the observer through the upper face around the eyes and are often missed.

Getting A Grip On Things (Page 10)

FACTS

1. How does the i-LIMB work?

The i-LIMB has motors in each finger so every digit can work individually. Muscle signals located in the stump are picked up by electrodes on the skin and transferred to the controls in the prosthetic hand.

2. What is the principle on which the Fluidhand is based?

The drives located in the movable finger joints of the Fluidhand operate on the biological principle of the spider leg – to flex the joints, elastic chambers are pumped up by miniature hydraulics.

3. Why is the human hand so difficult to duplicate?

The human hand has 27 bones, is very flexible, and can make such a large number of complex movements that it is very difficult to duplicate.

IDEAS

1. Until recently, what have been some of the limitations of prosthetic hands?

Until recently, prosthetic hands looked like a hand but didn't move, or could only "pinch" with a simple single-motor grip, and were so heavy that they were uncomfortable and caused injury to the area where it joined with the arm.

2. Explain why the perfect prosthetic hand must have "the sort of functionality a human hand has but also a sense of touch."

In addition to allowing the user to move like a human hand, the perfect prosthetic will also have a sense of touch that will let the hand know how tightly to grip an object like a coffee cup without dropping it, but not so tightly that it's crushed. It will tell the hand if something is beginning to slip out of its grip so it can grip slightly harder.

Bug Adds to Global Warming Woes (Page 13)

FACTS

1. Name some of the villains in humanity's battle to stop global warming.

The villains in humanity's battle to stop global warming are well known—exhaust from cars and airplanes, emissions from coal, oil and gas-fired power plants, gas furnaces and factory smokestacks—all of which release carbon dioxide and other greenhouse gases into the atmosphere.

2. How does the pine beetle contribute to the problem of global warming?

Swarms of these beetles have been killing the mightiest of pine trees. The problem is double-edged because forests are normally a "carbon sink"—that is, they absorb carbon dioxide out of the atmosphere, in this case through the process of photosynthesis. With the death of so many trees due to pine beetles, not only are these trees no longer alive to remove carbon from the atmosphere, their gradual decay is actually turning the forests into a new "carbon source": as trees rot, their stored carbon is released back into the atmosphere. Scientists from Natural Resources Canada (NRCAN) estimate that between 2000 and 2020, the decimation of western Canada's forests by pine beetles will cause the release of 990 megatonnes of greenhouse gases into the atmosphere.

3. What is believed to be one of the causes of the pine beetle outbreak?

Ironically, one of the believed causes of the pine beetle outbreak is global warming itself. Extended cold periods of 30°C temperatures are needed to kill pine beetles. A succession of mild winters over the past decade have allowed the pine beetle population to grow out of control.

IDEAS

1. How does Werner Kurz suggest to alleviate the problem of the outbreak? What are some other possible solutions?

Kurz suggests the problem can be alleviated by logging the dead trees and planting new ones as quickly as possible. Other possible solutions would be debarking of trees, herbicide with insecticide properties and controlled burning.

2. Explain how the pine beetle kills a pine tree.

Mountain pine beetles bore through the bark of pine trees into their phloem layer—the living tissue that carries water and nutrients throughout the tree. There, the beetles feed and lay eggs, as well as releasing pheromones to attract more beetles, resulting in a mass attack that can kill a tree within two weeks.

THE POWERFUL PINE BEETLE

Ratio: 50 metres = 5000 cm compared to .5 cm, so the ratio is 10,000 : 1

Area: Total forested area in the two provinces = 243 million acres

**Area affected by pine beetle so far: 33 million acres
So $33/243 =$ about 13.6% of the forested land has been affected by the beetle so far.**

Megatonnes of greenhouse gases emitted by transportation sector in Canada each year: $990/5 = 198$ megatonnes

In 20 years that would be $198 \times 20 = 3960$

The transportation sector will create 4 times as many megatonnes of greenhouse gases in 20 years as the pine beetle (3960/990). (Bottom line: the beetles will have an astounding affect, but transportation is still a bigger contributing factor.)

SCIENCE FUN

1. PROSTHETIC
 2. HYDRAULICS
 3. AUTOPSY
 4. MAUSOLEUM
 5. MUSCULATURE
 6. DECIMATE
- THE TERRACOTTA ARMY**

Science Quiz (Page 17)

MATCH THE WORD ON THE LEFT TO THE CORRECT DEFINITION ON THE RIGHT. (6 MARKS)

- | | |
|-----------------------|--|
| DIMINUTIVE | F. Extremely small in size; tiny. |
| AMPUTE | C. A person who has lost all or part of one or more limbs. |
| CLOAKING | A. Device used to cover up or hide something. |
| ROTARY VERTIGO | E. A condition where a patient feels an illusory sensation of movement, such as the room spinning around her. |
| MUSCULATURE | D. The system or arrangement of muscles in a body or a body part. |

ELECTRODE

B. A conductor of an electric current.

ANSWER THE FOLLOWING QUESTIONS IN THE SPACE PROVIDED. (4 MARKS)

- 1. Which two provinces have been affected by the pine beetle outbreak?**
B.C. and Alberta
- 2. Who invented the Wearable Eye Tracker?**
Doctoral student Andreas Bulling.
- 3. How many bones are in the human hand?**
27
- 4. How many colossal squid specimens have been found?**
Six

China's Terracotta Army Marches to the Beat of an Egg (Page 18)

QUESTIONS

- 1. What is the Terracotta Army?**
The Terracotta Army was created around 210 BC to accompany China's first Emperor, Shi Huang Di, into the afterlife. More than 7,000 ceramic warriors, chariots and horses were individually sculpted and then buried with the Emperor when he died.
- 2. When and where was it discovered?**
The Terracotta Army was discovered in 1974, when local farmers drilling a water well near Xian, in the province of Shaanxi, stumbled across some of the funerary statues. The rest of the figures were soon excavated and the site has since become a popular tourist attraction and a UNESCO World Heritage Site.
- 3. Why were the figures covered in egg?**
German and Italian chemists have analyzed paint fragments from the surface of several of the figures and have concluded that all of the figures were covered by beaten egg to help preserve them. "Egg paint is normally very stable and not soluble in water...This makes it less sensitive to humidity and moisture," noted Catharina Blaensdorf, a researcher at the Technical University of Munich. The proteins in the egg were also used to help bind colourful paints to a lacquer finish.
- 4. Explain why in ancient Greece and Rome egg was also used as a binder in the creation of murals and stone paintings.**

Answers will vary. Egg paint is not water soluble which would make paintings less sensitive to humidity and moisture. Egg would help preserve the artwork and keep the colours vibrant.

- 5. Why is the Terracotta Army so notable?**
In addition to the sheer number of sculptures, the Terracotta Army is notable because each figure is life-size and life-like in appearance. In fact, the figures were individually sculpted with different heights, uniforms, hair styles and facial features. After they were created, the figures were arranged in precise military formation according to rank and duty.