**Science News**

**Headlines**

. New maps of the brain

. Which asteroid caused the dinosaurs to go extinct?

. Adhesives inspired by spider hair?

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**New maps of the brain**

At Harvard University, a tiny piece of a woman's brain, the size of a mustard seed, was used to learn more about how connections are wired in the brain. The 45 year old woman was undergoing surgery for epilepsy. This already small piece of brain from the *cortex* region of the brain, was sliced into 5,000 pieces, so small, that they could not be seen by the naked eye.

It needed powerful electron microscopes to visualise them. Even so, it is difficult to get a complete understanding from so many tiny pieces. So computer programs were used along with artificial intelligence (AI) techniques to analyse the results.

The results were stunning. You may know that neurons transmit signals between the brain and different organs, and also within the brain itself. For instance, if you touch something hot, a sensory neuron passes on that information to the control centre in the brain or spinal cord, and the motor nerve carries back the information to take your hand away.

**BOX on Neuron Structure**

Neurons have a cell body containing the nucleus, filaments called *dendrites* that receive the signal, and a single long *axon* which sends out the signal. The signal is passed as an electrical impulse from neuron to neuron, but the neurons are not in contact with each other. There is a small gap or *synapse* between them. The axon connects to another neuron through the synapse via chemicals called neuro-transmitters.

**END OF BOX**

Usually, one axon connects to only one dendron to form a chain of connections that transmit the signal. But 10% of the time, the researchers from this study found cells that connected to another cell via multiple synapses, the maximum being a pair of neurons that were connected by 19 synapses!

Why do such strong connections exist? The answer is not yet known. After all, looking at a structure doesn't always tell you its function. It is possible that when you learn something intensely, spending hours reinforcing the learning everyday, then these multiple connections are formed to ensure that the target neuron responds powerfully to a stimulus.

The scientists also found curious pairs of neurons that were mirroring each other. That is, one neuron looked like the mirror image of another one. They also found axons that were coiled to form complicated bundles. Clearly, a lot of work is needed before scientists unwrap all the mysteries of how the brain functions.

**Did an asteroid cause the dinosaurs to go extinct?**

There is a small patch of forest in the small village of **Bukvarka** near Kiev, Ukraine. While the forest gently blends with the farmland, it hides the fact that 65 million years ago, an asteroid struck this place, leaving a 22 km wide crater. The remnants of this impact can be seen if you dig deep, about 500 m or so.

The impact of the asteroid generated so much heat that the rock itself melted and formed the **Boltysh** **crater**. You can see the quartz formation in the photo. Later on this was filled with water and became a lake, and even later, became a forest. For many years it was thought that this Boltysh impact was the reason for the dinosaurs to go extinct.

But another crater was found under the Yucatan Peninsula in Mexico. Called the **Chicxulub** **crater**, it was formed when a large asteroid struck the Earth slightly more than 66 million years ago. This date matches very well with what is called the *Cretaceous-Paleogene boundary*. This is a thin layer of rock that separates the **Cretaceous** period from the **Paleogene** period.

The Cretaceous period is characterised by warm climate, with an ice-free Earth, and of course, large dinosaurs roaming on it. It ended with the decline and sudden mass extinction of many groups of dinaosaurs, pterosaurs. In the new Paleogenic period, mammals diversified while India just began to collide with Asia to form the Himalayas.

It is now believed that the Mexican impact was what caused the decline of the dinosaurs. Earlier, it was difficult to date such an old event exactly. But now a precise study indicated that the Boltysh impact occurred 6,50,000 years after the Chicxulub one. This is a long gap, but short by geological standards! How did they find this out?

The scientists from UK looked at the age of the *sediments* that had settled on top of the Boltysh crater. These sediments came from rocks that had melted when the asteroid hit them. The sediments contained *Argon*, and by measuring the presence of an isotope of argon (like radiocarbon dating, except they used Argon instead), they found its age to be 65.39 million years. The second decimal place indicates that they have an accuracy of less than 1 lakh years, and so they can separate this from the Chicxulub event.

So the theory that the two asteoid impacts, so close together, was finally ruled out. Now we know that the Boltysh impact had nothing to do with the dinosaur extinction.

However, this study is useful in many ways. Just before the Blotysh event, the Deccan trap was formed with a lot of volcanic activity and emission of greenhouse gases. It is possible that the Boltysh asteroid impact triggered off a period of extreme global warming when temperatures rose more than 2 degreees. Normally, an asteroid impact damages the local environment. But because the Earth was already in fragile state after the Chicxulub event, it is possible that it had a bigger impact.

**Adhesives inspired by spider hair?**

You must have seen spiders walking on walls, even on the ceiling, upside down, and apparently not worried about falling! It was known that there are tufts of hair on spider's feet. Each hair contains thousands of smaller hairs called *setules* which are very very fine, with special triangular shaped tips. The spider uses these setules to stick to surfaces. Scientists have estimated that due to these setules, spiders can grip surfaces with a force nearly 200 times their own weight.

In an recent study of the wandering spider, *Cupiennius salei*, scientists found that these hair-like structures are even more variable than expected. They wanted to find the specific angle where the spider would *adhere* (stick) best to the surface. They then wanted to use this to make good quality adhesives! But the reality was more complicated. While one hair adhered well at small angles to the surface, another worked best when it was nearly perpendicular to it.

That is, the adhesion forces were different for the different hairs. This was because each hair was structurally different from the others. Since there are thousands of hairs on the feet, the scientists could study only a few, each about 1/100 of a mm thick. But they now believe that there could be clusters or repeating patterns which made the adhesion efficient.

Such different shapes and angles of adhesion can improve the overall ability of the hair to stick firmly on the wall. It will be interesting to manufacture materials inspired by these properties to make not only better and stronger adhesives but also reversible ones.

**Pine Island Glacier is ripping apart**

Pine Island glacier has an ice shelf that has helped to hold back one of the fastest moving glaciers in the Antarctic. Over the last decades, due to global warming, the ice shelf has become thin. Now large icebergs at its edge have broken off and the glacier is moving faster than ever. The Pine Island glacier is now collapsing into the sea faster and faster. This could contribute to 1/2 m of global sea level rise.

The mechanism of the melting is different. Warm ocean currents flow beneath the glacier and melt is from below. But recently, this is no longer the main melting mechanism. The melting caused the glacier to accelerate from 2.5 km/year to 4 km/year. Since it is a huge glacier containing 180 trillion tons of ice, this has caused internal stresses to arise inside the glacier. This can cause the entire outer part of the ice shelf to be lost. This will cause the glacier to accelerate further. It is possible that the entire ice shelf may be lost in the next decade or two rather than over 100 years, as thought before. So scientists are predicting that there will be rapid changes in the near future.

***Sources: phys.org, Science News, Smithsonian Magazine, and ANI***