SPECTRUM
HUES OF SCIENCE

ISSUE NO : 11

Insight

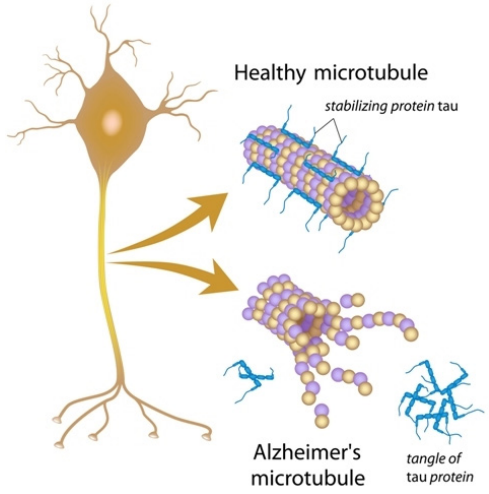
Tau Proteins and Alzheimer's Disease

Gayathri Chandran, SYBSc,

Sophia College - Autonomous, Mumbai.

Like all other eukaryotic cells, neurons have microtubules. In normally functioning brain cells, the tau protein (an important microtubule associated protein) is involved in the formation of axonal microtubules, their stabilization and their neutrite outgrowth (a process where new projections are produced by developing neurons in response to certain cues).

Why does the tau protein matter? Very simply put, severe human neurodegenerative diseases (like Alzheimer's) have been linked to improper interactions between the tau proteins and the microtubules. Dysregulation due to genetic mutations or dysregulation by hyperphosphorylation (hyperphosphorylation occurs when the numerous phosphorylation sites on a biochemical are fully saturated) cause tau dysfunction. These changes cause the tau proteins to move away from the microtubules and self-aggregate. Eventually, these proteins disrupt the neuron's ability to communicate efficiently with other cells as they form neurofibrillary tangles. This tau build-up to cause tangles is an important characteristic of the Alzheimer's disease.



Are environmental risk factors for Alzheimer's like traumatic brain injury associated with tau? The answer could be a yes. Researchers found a modified version of the tau protein in the brain of mice having Alzheimer's after a traumatic brain injury called 'cis P-tau'. Very interestingly, this same modified version of the tau protein was also found in the brains of humans having Alzheimer's indicating that possibly even cis P-tau causes disruptions in the nerve cells and interferes with their communication.

The abnormal tau proteins may also explain how Alzheimer's spreads in the brain. Researchers injected brain material from mice which make the abnormal form of the tau protein into the brain of healthy mice. They found that the protein tangles had spread from the injected site to distant parts of the brain. This makes it clear that the tau tangles spreads between cells. Researchers hope that with this knowledge they can identify drugs which can block the symptoms caused by the spread of the tau proteins.

Image-https://alzheimersnewstoday.com/2014/11/03/tau-protein-leads-to-neuronal-death-in-alzheimers/

In The News

Moonstruck – Chandrayaan 2

Ira Pillai, T.Y.B.Sc,

Sophia College - Autonomous, Mumbai.

On 22nd July, 2019 India witnessed the launch of the Chandrayaan 2 spacecraft, a mission to the moon. It was not only a euphoric moment for our country but also a proud one, as we entered into the pages of history. The whole world sat at the edge of their seats and witnessed the launch of the Chandrayaan-2 spacecraft as it was broadcast live. This was India's second mission to the moon, a decade after Chandrayaan - 1 was launched.

Nearly fifty years ago the space race between the United States and the then Soviet Union developed a keen interest in the moon and drove countries, including India, to reach further in the solar system. Many

countries tried and failed including India, but the launch of Chandrayaan-2 and its unique features have revived the world's interest in man's nearest stellar body.

Way back in 2008, the project was conceived as a collaboration between the Russian Federal Space Agency (Roscosmos) and ISRO. The deal fell through due to technical errors. Undeterred, ISRO decided to accomplish the project on their own. Thus, the Vikram Lander, the Pragyan Rover and the Orbiter were developed by ISRO and Chandrayaan 2 was made ready for launching with these three components.

The primary intent of the mission was to make an in-depth study of its topography, seismography, identification and distribution of minerals present, chemical composition of its surface, characteristics of its top soil and composition of its atmosphere and most importantly to detect the presence of water and demonstrate a soft landing of the lander. This would make India the fourth nation to do so. The information gathered from this expedition is expected to lead scientists to new revelations about the origin and evolution of the Moon.

Once thought impossible for a developing country to achieve such a feat, India broke barriers and proved everyone wrong by designing the impeccable spacecraft coupled with a rover and lander, which put scientists all over the world in awe. There were initial hiccups in the time leading to the launch but overcoming these technical snags, the spacecraft was finally launched on July 22, 2019, from the Satish Dhawan Space Centre in Sriharikota.

Then came the most dramatic moment of this mission. In the early hours of the 7th of September 2019, millions of people awaited the soft landing of the Vikram Lander on the lunar surface, when it tragically lost contact only 2.1 km from the surface. It started deviating from its intended trajectory at the Lunar South Pole. ISRO chairman Kailasavadivoo Sivan confirmed the rumours of a crash and described the final moments of the Lander as "fifteen minutes of terror". The team of scientists behind the launch were heartbroken. But ISRO has not lost hope. The other part of the Chandrayaan-2 mission – the Orbiter – is safe in its orbit around the Moon. It has begun carrying out its experiments, which it will continue to do over its extended mission life of seven years.

Let us remember that the courage shown by the ISRO team needs to be applauded. The set back did not discourage them and has compelled them to understand and rectify their mistakes. Success and failures are a part of life and as the saying goes " failures are only a steppingstone to success" The ability to learn from one's mistakes is the greatest lesson of any project. We, as Indians are proud of the Chandrayaan mission and we salute the people behind it.

Through The Lens

Yasmin Khan, Staff,
Sophia College - Autonomous, Mumbai.

A tiny flowering plant found abundantly on Kaas plateau in Satara. It is fondly called Mickey Mouse flower. Can you identify it?

Science In Daily Life

Robot Of The Match Goes To…

Avni Rao, MSc,
Sophia College - Autonomous, Mumbai.

Did you know that machines can play sports? As absurd as it may sound, this has been possible due to the extravagant field of artificial intelligence. Artificial intelligence (AI) is the ability of a machine to think and learn. It is basically a computer program designed to improve human activities by calculating, generating and sometimes performing complex functions to give an improved result.

Robots these days have been replaced to perform functions that humans would have initially had to tiringly perform, like stacking boxes on a shelf in a general store etc.

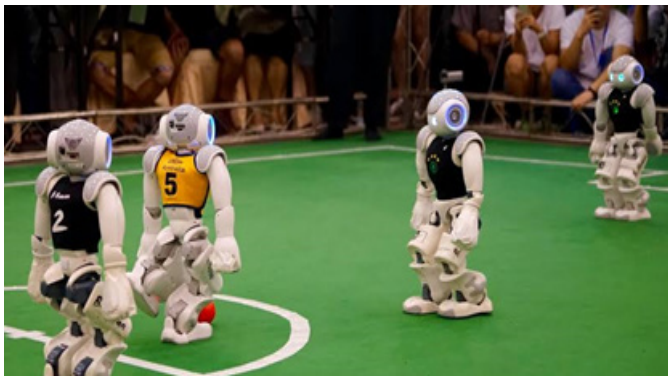
A robot stacking boxes

With the increase in number of robots replacing human activities, what do you think would happen first, an actual apocalypse or a robot uprising?

Imagine you are playing football with your friend. Your friend plays foul and you suddenly hear a whistle from your coach. When you turn to look towards your coach you are astonished because the whistle did not come from a human, instead it was a robot! The field of AI research has done so much progress that robots have now been upgraded from 'stack boys' to actual football coaches! Robot umpires are also now being developed for optimal decision making.

The use of AI in sports is not uncommon or unheard of these days. An example of this can be seen in the movie Moneyball, where the coach uses AI to strategically recruit his team members. Not only that, during the game, he uses the AI to get instant data on the heart rate, development and status of the player to replace the players if necessary. This led to the team winning the cup!

We've all heard of FIFA cup, World Cup, etc. But have you heard about 'RoboCup'? RoboCup is an annual international robotics competition proposed and founded in 1996 by a group of university professors. Their main intention is to promote robotics and AI research, by offering a challenge.



RoboCup 2019, Sydney, Australia

Although AI is developing at an unprecedented rate, we're still a long way from mechanised punch-ups like those seen in the 2011 film Real Steel. Unlike humans, robots cannot jump, run, bend, etc. Imagine robots trying to swim. The robot would crash and the water would catch fire! Robots can't perform gymnastics in terms of flexibility and grace. But they can definitely land on cue because the landing can be calculated and set; robots lack 'balance' which is a determining human essential in humans.

AI in sports aims on developing technology that would revolutionise, not only the field of sports, but also show advancements in various applications that would aid in helping and guiding humans. Since there is no scope for injuries in robots, having robot players would be the most efficient solution. But what future would that entail for professional sportspersons? Would the sports entertainment industry also be affected? Only the future knows, but the possibility of that future is not very far where every human has a pet robot!

Stimulate Your Grey

Cyrus Khan,

Freelance Science Communicator.

In the cryptogram, the six letters are different digits and neither A nor D is zero.

$$\begin{array}{cccc} & A & B & C \\ - & & D & E \\ \hline & & & F \end{array}$$

Which of the following can be a value of F?

a. 1

b. 2

c. 3

d. 4

Long, Long Ago

The Green Revolution in Tea!

Fatema Brindanwala, Adjunct Faculty,

Sophia College - Autonomous, Mumbai.

Most of us Indians are Tea-drinkers today. India is one of the largest tea producers globally, with over 70% of the tea being consumed within the country itself. Though there are many reports mentioning of the origin of tea in China, there is there is some evidence to suggest that the tea plant was introduced to China from India. In an interesting story documented as late as the early 20th century, it was found that seven sacred and very ancient tea plants "from the land of the Buddha" which we know as Varanasi, were discovered still flourishing in the mountains of Hengduan, between Sichuan and Tibet,. These leaves were dispatched regularly to the Forbidden City, Peking, where they were mixed with vermilion ink and used by the Qing emperors to sign death warrants, thus mitigating any bad Karmic consequences of such actions.

Though we know a lot about our regular chai – the black tea, another tea that has gained maximum popularity is the green tea. According to a legend, green tea was first discovered by the legendary Chinese

emperor and herbalist, Shennong, in 2737 BC. The emperor was once accidently given water with a dead tea-leaf fallen in it while boiling. The emperor drank it and found it very refreshing, and cha (the chinese word for tea) came into being. Perhaps that's where we got our word for the present day 'chai'. When tea started to become a popular drink, Chinese Buddhist monks discovered that drinking tea helped with their daily meditation. In around 800 AD, a Chinese man Lu Yu in his book 'Cha Jing' or 'The Classic of Tea' mentioned for the first time the wonders and art of making and drinking green tea. By the end of the 19 century green tea became highly popular in European countries making it Great Britain's national beverage, along with black tea. Soon it was introduced to the American countries as well and it became so popular that Parliament imposed a Tea Tax in 1767. This made the colonists quite upset, and the Boston Tea Party took place. As a result of which, 45 tons of precious green tea was dumped into the harbor.

Known to be loaded with a number of health benefits – from reducing risks to different types of cancers, maintaining a healthy heart, improved brain function, for healthy hair and skin and many other incredible benefits, green tea is the new revolution in tea. It has gained maximum popularity all over the globe as a weight loss product, making it the second most popular beverage, after water and without doubt the healthiest drink option too.

So what exactly is the green tea? It may surprise some of you to know that that green tea and black tea originate from the same exact plant species—Camellia sinensis. It's ultimately the variety of tea plant and how the tea leaves are processed that defines how green tea becomes "green" and black tea becomes "black". Black tea is processed in a way wherein the leaves undergo vigorous oxidation and withering that allow fermentation whereas green tea's processing is much less and avoids the fermentation process. As a result, green tea retains maximum amount of antioxidants and poly-phenols the substances that give green tea its many benefits. Green tea is loaded with antioxidants such as catechins. There are four types of catechins namely, Epicatechin, Epicatechin-3-gallate, Epigallocatechin, and Epigallocatechin-3-gallate (EGCG). Of these four, EGCG is the most effective compund studied to treat various diseases and may be one of the main reasons as to why green tea has such powerful medicinal properties. Green tea also contains a small amount of caffeine and an amino acid L-theanine, which can work synergistically with caffeine to improve brain function.

While most people take a cup of boiling water and dip their green-tea bag in it, the best way to have green tea is quite different. Apparently one bag of commercially available green tea is enough for a litre of water! And green tea has its best benefits when had a luke warm temperature. So one can make a litre of green tea each morning and have it after meals all day long for most health benefits. Well guess its time to go green in tea as well!

Thought Byte

"The preservation of freedom is not the task of soldiers alone. The whole nation has to be strong. We all have to work in our respective spheres with the same dedication, the same zeal and the same determination which inspired and motivated the warrior on the battle front. And this has to be shown not by mere words but by actual deeds."

- Shree Lal Bahadur Shastri (Born on 2nd October 1904)

Answer: Through the Lens - The scientific name of this flower is *Smithia hirsuta* or Hairy Smithia.

Answer: Stimulate Your Grey- 4.

This is a collaborative endeavour of the Department of Life Sciences, Sophia College - Autonomous, Mumbai and the Department of Life Science and Biochemistry, St. Xavier's College - Autonomous, Mumbai; under the DBT STAR college scheme

Layout and design by **Kennith Castelino** TYBSc
St. Xavier's College - Autonomous, Mumbai

Write to us at spectrumsciencemagazine@gmail.com. Spectrum archives available at spectrumsciencemagazine.blogspot.in