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SCIENCE CENTRE

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WHAT'S NEW IN SCIENCE?

From the inside out: How the brain forms sensory memories

A new study identifies a region of the thalamus as a key source of signal encoding past experiences in the neocortex.

The brain encodes information collected by our senses. However, to perceive our environment and to constructively interact with it these sensory signals need to be interpreted in the context of our previous experience and current aims.

In the latest issue of Science web Journal "Science Daily", a team of scientists led by Dr. Johannes Letzkus, Research Group Leader at the Max Planck Institute for Brain Research, has identified a key source of this experience-dependent top-down information.

The neocortex is the largest area of the human brain. It has expanded and differentiated enormously during mammalian evolution, and is thought to mediate many of the capacities that distinguish humans from their closest relatives. Moreover, dysfunctions of this area also play a central role in many psychiatric disorders. All higher cognitive functions of the neocortex are enabled by bringing together two distinct streams of information: a 'bottom-up' stream carrying signals from the surrounding environment, and a 'top-down' stream that transmits internally-generated information encoding our previous experiences and current aims.

Previous work by us and many other scientists had suggested that the top-most layer of neocortex is likely a key site that receives inputs carrying top-down information. Taking this as a starting point allowed us to identify a region of the thalamus -- a brain area embedded deep within the forebrain -- as a key candidate source of such internal information.

Motivated by these observations Dr. M. Belén Pardi,



the first author of the study and postdoctoral researcher in the Letzkus lab, devised an innovative approach that enabled her to measure the responses of single thalamic synapses in mouse neocortex before and after a learning paradigm, whereas neutral stimuli without relevance were encoded by small and transient responses in this pathway, learning strongly boosted their activity and made the signals both faster and more sustained over time." This suggests that the thalamic synapses in neocortex encode the

previous experience of the animal. Letzkus also explained that they were really convinced that this is the case when they compared the strength of the acquired memory with the change in thalamic activity: This revealed a strong positive correlation, indicating that inputs from the thalamus prominently encode the learned behavioral relevance of stimuli.

The scientists speculated that the way these signals are received in the neocortex must be tightly regulated. Pardi and co-workers addressed this in further experiments, combined with computational modeling in collaboration with the laboratory of Dr. Henning Sprekeler and his team at Technische Universität Berlin. The results indeed identified a previously unknown mechanism that can finely tune the information along this pathway, identifying a specialized type of neuron in the top-most layer of neocortex as a dynamic gatekeeper of these top-down signals.

In conclusion Letzkus says that these results reveal the thalamic inputs to sensory neocortex as a key source of information about the past experiences that have been associated with sensory stimuli. Such top-down signals are perturbed in a number of brain disorders like autism and schizophrenia, and our hope is that the present findings will also enable a deeper understanding of the maladaptive changes that underlie these severe conditions.

SCIENTIST OF THE MONTH

Hermenegild Santapau

Hermenegild Santapau was born at La Galera, in the Catalan province of Tarragona, Spain, on 5 December 1903 at the age of 16 he became a member of the Society of Jesus based at Gandia City in Valencia., he got Doctor of Theology and Doctor of Philosophy from Pontifical Gregorian University, Rome in 1927. He did B.Sc. (Hons) in Botany and Ph.D from the University of London . He also got an associate ship diploma from the Royal College of Science and another diploma from the parent institute of Imperial College of London. He came to India in 1928.

Santapau worked for four years in Eastern Pyrenees and Italian Alps collecting Plant Specimens. From 1938 he did research at the herbarium of Royal Botanical Gardens, Kew, England for two years. After that he joined St. Xavier's College, Mumbai as member of the faculty of Botany in 1940. He also served as an accredited lecturer for post graduate studies in Botany at the Universities of Mumbai, Pune, Agra and Kolkata. When the Government of India decided to revive the Botanical Survey of India, Santapau was appointed as the Chief Botanist in 1954. He headed the Indian

delegation to the tenth edition of the International Botanical congress held at Edinburgh in 1954 and represented India at the International Standards Organization Conference of 1964 held at New Delhi.

Santapau returned to the St. Xavier's College, Bombay after his retirement from the Botanical Survey of India in 1967 and worked there as the rectro till his death, aged 66 on 13 January 1970.

During his career in India, he visited many parts of India and abroad, collecting plants Specimens. Baluchistan, Kathiawar, Dangs forest in Gujarat, the western and Eastern Ghats, Goa, Assam, Andhra Pradesh, Eastern Himalyas, Dehradun and Mussorie were some of the places he visited during the period from 1946 to 1967. He was selected for the Birbal sahani Medal in 1963 by the Indian Botanical Society. The Government of

India honored him with the civilian award of Padma Shri in 1967.





Timings

Tuesday to Friday
9.30 am to 4.30 pm

Saturday - Sunday
& Public Holidays

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SCIENCE FACTS DECEMBER 2020

AIDS Awareness Month

1st Dec	World AIDS Day. (by U. N.)
2nd Dec 1984	Bhopal Gas Tragedy.
3rd Dec	International Day of Persons with disabilities. (by U. N.)
3 rd Dec 1886	Swedish Physicist Karl M.G. Siegbahn (Inventor of Rontgen Spectroscope) was born.
7 th Dec	International Civil Aviation Day. (by U. N.)
7 th Dec 1972	American Space Craft "APOLLO 17" launched towards moon with Scientist.
9 th Dec 1868	German Physicist and Chemist Fritz Haber (Who discovered Haber Process) was born.
14 th Dec	National Energy Conservation Day.
15 th Dec 1852	Antoine Henri Becquerel (Who discovered Radioactivity) was born.
15 th Dec 1863	Arthur D. Little (Inventor of Rayon) was born.
17 th Dec 1797	American Scientist Joseph Henry (Inventor and Pioneer of Electromagnetism) was born.
17 th Dec 1903	Wright Brothers were the world's first successful persons who flew in an aeroplane.
17 th Dec 1908	Willard Frank Libby (Inventor of The Carbon 14) was born.
18 th Dec 1856	English Physicist Joseph John Thomson (Discoverer of electron) was born.
23 rd Dec	Farmer's Day. (Chaudhary Charansingh's Birth Anniversary)
24 th Dec 1818	Physicist James Prescott Joule (Who discovered the Principle of Conservation on energy) was born.
27 th Dec 1571	German Astronomer Johann Kepler (Who discovered elliptical orbits) was born.
	U.N. (United Nation)

Answers: 1. B 2.D 3.A 4.D 5.C 6.A 7. B 8.B

SCIENTIFIC QUESTION

What is Homeopathy?

Homeopathy or homoeopathy is a pseudoscientific system of alternative medicine. It was conceived in 1796 by the German physician Samuel Hahnemann. Its practitioners, called homeopaths believe that a substance that causes symptoms of a disease in healthy people would cure similar symptoms in sick people; this doctrine is called *similia similibus curentur*, or "like cure like". Homeopathic preparations are termed remedies and are made using homeopathic dilution. In this process, the selected substance is repeatedly diluted until the final product is chemically indistinguishable from the diluents. Often not even a single molecule of the original substance can be expected to remain in the product. Between each dilution homeopaths may hit and/or shake the product, claiming this makes the diluents remember the original substance after its removal. Practitioners



claim that such preparations, upon oral intake, can treat or cure disease.

Hahnemann's theory of disease, centered around principles he termed miasms, is inconsistent with subsequent identification of viruses and bacteria as causes of disease.

Preparations:

Homeopathic preparations are referred to as "homeopathic remedies" practitioners rely on two types of reference when prescribing: *Materia medica* and repertories.

A homeopathic *materia medica* is a collection of "drug pictures" organized alphabetically.

A homeopathic repertory is a quick reference version of the *materia medica* that indexes the symptoms and then the associated remedies for each.

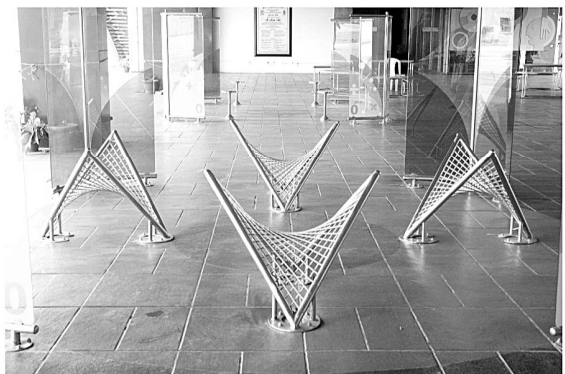
In both cases different compilers may dispute particular inclusions in the references.

KNOW THE EXHIBIT

Penrose Tiles

This exhibit is situated between Ticket Window and Souvenir Shop at Science Centre.

The classic Penrose tiles consist of two rhombi with angles 72 and 36 degrees. The edges of the rhombi are all of equal length. If we follow a few strict rules about how to place them together, we will wind up with an aperiodic pattern. This means that no section of the pattern will be repeated as a unit. The shape of a pair of Penrose tiles can vary but the most common are that kite (in red) and the dart (in blue). They are named after sir Roger Penrose an English Mathematical Physicist.



SCIENCE QUIZ

- Decibel is the unit of
(a) Speed of Light (b) Radio Wave Frequency
(c) Intensity of sound (d) Intensity of heat
- What is laughing gas ?
(a) Nitrous Oxide (b) Carbon Monoxide
(c) Sulphur Dioxide (d) Hydrogen Peroxide
- Air is a / an _____
(a) Compound (b) Element (c) Electrolyte (d) Mixture
- Which of the following is the lightest metal?
(a) Mercury (b) Lithium (c) Lead (d) Silver
- Bell metal is an alloy of _____
(a) Nickel and Copper (b) Zinc and Copper
(c) Brass and Nickel (d) Tin and Copper
- Which of the following is not an isotope of hydrogen?
(a) Tritium (b) Deuterium (c) Protium (d) Yttrium
- "Bar" is the unit of
(a) Temperature (b) Heat (c) Atmospheric Pressure (d) Current
- What Chronometer measures?
(a) Colour Contrast (b) Sound Wave (c) Time (d) Water waves

SCIENCE PROJECT

Surat Municipal Corporation had organized Science Fair at Art Gallery, Science Centre Surat on 30 & 31st August, 2019. Shardayatan School (English Medium) had presented their Science Project on "Bioremediation"

Aim of the project was to reduce the use of pesticides with the help of Bioremediation.

In this project they have explained the pesticide cycle i.e. how pesticides enter into our body and encourages biomagnifications.

To reduce Biomagnifications, Bioremediation is the method can be used in which organic farming plays a vital role because in this method bio-fertilizers and organic matters are being used for plant's growth.

There are majorly two types of Bioremediation.

(i) In Situ and (ii) Ex situ

- Under In situ method there are various methods such as Biosparging, Bioventing and Bioaugmentation.

- In Ex situ method there are Biofarming, Biopilling and Compositing

This project explains the need of organic farming. If the use of pesticides will be more, it will eventually results into deforestation which will lead us to increase of many diseases.

