

# SCIENCE CENTRE NEWS LETTER

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## SCIENCE CENTRE

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### WHAT'S NEW IN SCIENCE?

#### Scientists work out the effects of exercise at the cellular level.

The health benefits of exercise are well known but this new research on “effects of exercise at the cellular level” shows that the body's response to exercise is more complex and far-reaching. In a study on rats, Scientists from Broad Institute of MIT (Massachusetts Institute of Technology) and Harvard, Cambridge; Stanford University, The National Institutes of Health (NIH), Maryland and The University of Iowa (all located in United States) has found that physical activity causes many cellular and molecular changes.



as they were put through the paces of weeks of intense exercise. The findings appear in 'Nature' Journal.

Scientists studied a range of tissues, such as the heart, brain and lungs. They found that each of the organs changed with exercise, helping the body to regulate the immune system, respond to stress and control pathways connected to inflammatory liver disease, heart disease and tissue injury.

Scientist's hopes that their findings could one day be used to tailor exercise to an individual's health status or to develop treatments that mimic the effects of physical activity for people who are unable to exercise.

Exercises lowers the risk of many diseases, but Scientists still don't fully understand how exercise changes the body on a molecular level. To look at the Biology of exercise, Scientists with the Molecular Transducers of Physical Activity Consortium (MoTrPAC) used an array of technique in the laboratory to analyze molecular changes in rats

**Main Source:** Broad Institute of MIT (Massachusetts Institute of Technology) and Harvard in Cambridge, Stanford University, The National Institutes of Health (NIH) in Maryland and The University of Iowa in Sciencedaily.com

**Image:** Ricardo Job-Reese, Broad Communications

### SCIENTIST OF THE MONTH

#### Dr. Chintamani Nagesa Ramachandra Rao

Dr. Chintamani Nagesa Ramachandra Rao was born on June 30, 1934 at Bangalore, Karnataka. He obtained a Bachelor of Science degree from the University of Mysore, Karnataka in 1951 and Master of Science from Banaras Hindu University, Uttar Pradesh in 1953. In 1954, he worked under Professor R. L. Livingston and obtained Doctor of Philosophy at Purdue University, USA (United States of America). He joined the IISc (Indian Institute of Science), Bangalore, Karnataka in 1959 as a Lecturer and then moved to IIT (Indian Institute of Technology), Kanpur, Uttar Pradesh in 1963, where he served as Professor and Head of the Department of Chemistry. Later became the Director of IISc (Indian Institute of Science).



researched extensively in the application of spectroscopic methods for the study of molecular structure, UV (Ultra Violet) and IR (Infra Red) spectra being his main areas of specialization. He has published more than 900 original research papers and several books.

Dr. Rao received the Shanti Swarup Bhatnagar Prize in 1968, the Padma Shri Award in 1974, Sir C.V.Raman Award in 1975, Padma Vibhushan in 1985, Jawaharlal Nehru Award in 1988, Meghnad Saha Medal in 1990 and the Albert Einstein Gold Medal,

UNESCO (United Nations Educational Scientific and Cultural Organization) in 1996.

Dr. Rao contributed immensely to the Molecular Spectra Structure Correlation and Solid State Chemistry, Hydrogen bonding and charge transfer complexes. He

**Main Source/ Author:** 101 Great Indian Scientists Book, Shyam Dua /www.iiap.res.in  
**Image:** www.iiap.res.in



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## SCIENCE FACTS JUNE 2024

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|--|--|
| 1 June 1833  | James Clark Ross discovers the position of the North Magnetic Pole on the Boothia Peninsula.   |
| 1 June 1917  | American Chemist William S. Knowles (Co- winner of the 2001 Nobel Prize in chemistry for his work in asymmetric synthesis, specially in hydrogenation reactions) was born.           |
| 4 June 1877  | German Biochemist Heinrich Wieland ( made research into the bile acids) was born.  |
| 5 June   | World Environment Day  |
| 5 June 1900  | Hungarian Physicist Dennis Gabor (inventor of holography) was born.  |
| 6 June 2012  | The astronomical event "Transit of Venus" happened on this day   |
| 7 June 1862  | Austrian Physicist Philipp Lenard (worked on cathode rays and the discoveries of many of their properties ) was born.  |
| 7 June 1896  | American Physical Chemist Robert S. Mulliken (responsible for the early development of molecular orbital theory ) was born.  |
| 8 June 1916  | English Molecular Biologist Francis Crick ( played crucial roles in deciphering the helical structure of the DNA molecule) was born.   |
| 11 June 1963   | First Lady Astronomer "Valentina " came back from journey to Space.  |
| 12 June  | World Day against child labour.  |
| 12 June 1899   | American Biochemist Fritz Albert Lipmann (co- discoverer of coenzyme A) was born.  |
| 13 June 1831   | Scottish Physicist James Clerk Maxwell was born.   |
| 13 June 1911   | American Physicist Luis Alvarez ( Awarded the Nobel Prize in Physics in 1968 for his discovery of resonance states in particle physics using the hydrogen bubble chamber ) was born. |
| 13 June 1983   | Pioneer 10 becomes the first manmade object to leave the Solar System.   |
| 14 June  | World Blood Donor Day (WHO)  |
| 15 June 743 BC   | Longest total Solar Eclipse of millennium  |
| 15 June 1917   | American Chemist John Fenn ( worked in mass spectrometry ) was born.   |
| 16 June 1897   | German Chemist Georg Witting ( reported the method of synthesis of alkenes from aldehydes and ketones using compounds called phosphonium ylides) was born.                           |
| 18 June 1918   | American Chemist Jerome Karle ( Awarded the Nobel Prize in Chemistry in 1985 for the direct analysis of crystal structures using X-ray scattering techniques)                        |
| 19 June  | World Sickle cell Anaemia Awareness Day  |
| 19 June 1623   | French mathematician Blaise Pascal was born.   |
| 19 June 1897   | English Chemist Cyril Norman Hinshelwood (Expert in chemical kinetics) was born.   |
| 20 June 1877   | Alexander Graham Bell installs world's first commercial telephone service in Hamilton, Ontario, Canada.  |
| 22 June 1973   | Successful landing of the astronomer of Skylab in Pacific Ocean after revolving around the earth for 28 days.  |
| 22 June 2006   | The newly discovered moons of Pluto are officially named Hydra and Nix by the international Astronomical Union.  |
| 28 June 1943   | German Physicist Klaus von Klitzing (Winner of the 1985 Nobel Prize in Physics for discovery of the integer quantum Hall effect) was born.   |
| U. N. : United Nations<br>WHO -World Health Organization<br>UNESCO - United Nations Educational Scientific & Cultural Organization |  |

Answers : 1. c 2. c 3. c 4. b 5. b

## SCIENTIFIC QUESTION

### What is Superconductivity?

Superconductivity is the property of certain materials to conduct direct current (DC) electricity without energy loss below a critical temperature ( $T_c$ ), critical field ( $B_c$ ) and critical current density ( $J_c$ ). These materials also expel magnetic fields as they transition to the superconducting state.

When the electrical conductivity reaches to its maximum, the material acquires almost completely zero resistance and all the magnetic fields expelled from the material. The zero resistance is achieved by lowering the temperature of the material which leads to a decrease in the resistance of the material and an increase in the conductivity.

In 1911, Heike Kamerlingh Onnes, a Dutch physicist, discovered the superconductivity phenomenon. Currently, the research for the explanation of the phenomenon is done using Quantum Mechanics as it cannot be completely explained by the concept of perfect conductivity in Classical Physics.

#### Properties of Superconductors:

##### 1) Critical temperature/Transition temperature:

The temperature below which the material changes from conductors to superconductors is called critical temperature or transition temperature. The transition from conductors to superconductors is sudden and complete.

**2) Zero Electric Resistance/Infinite Conductivity:** In the superconducting state, the material has zero resistance. When the temperature of the material is reduced below the critical temperature, its resistance suddenly reduces to zero. Mercury shows zero resistance below 4 Kelvin.

**3) Expulsion of Magnetic Field:** Below the critical temperature, superconductors do not allow the magnetic field to penetrate inside it. This phenomenon is called Meissner Effect.

**4) Critical Magnetic Field:** The certain value of the magnetic field beyond which the superconductors return to conducting state is called the critical magnetic field. The value of the critical magnetic field is inversely proportional to the temperature. As the temperature increases, the value of the critical magnetic field decreases.

**Meissner effect:** The Meissner effect is the expulsion of a magnetic field from a superconductor during its transition to the superconducting state when it is cooled below the critical temperature. This expulsion will repel a nearby magnet.

One of the important physical properties exhibited by a conducting material exhibiting superconductivity is that there is no magnetic field present in the material as the presence of magnetic flux leads to a loss in energy and an indication of the presence of resistance in the material.

The use of superconductors in magnetic field is limited to the fact that when magnetic fields are super strong and above a

certain critical value, it causes the superconductor to revert to its normal non-superconducting state, even when the material is kept well below the transition temperature. The critical value varies for material used in superconductors.

Superconductor is a material that incorporates the physical property of superconductivity. Normally when the temperature of a conductor is decreased there is an increase in conductivity as one move to absolute zero temperature ( $0^\circ\text{K}$  or  $-273^\circ\text{C}$ ). But superconductors are those special materials in which after a certain critical temperature the resistance drops to zero value and the conductivity thus reaches the maximum and there will be complete ejection of any magnetic field from the material. If an electric current is passed through a loop of such a superconductor, the electric current will keep flowing through it indefinitely without any need of a power supply.

This property can lead to the creation of self-sustaining energy sources solving innumerable problems such as power surges and costly electricity and because there is no loss of energy due to zero resistance of the material the electricity available will be much cheaper when such superconducting material sources are used as power sources.

**Types of Superconductors:** There are two types of superconductors. They are called Type I and Type II superconductors. Type I superconductors transform abruptly from

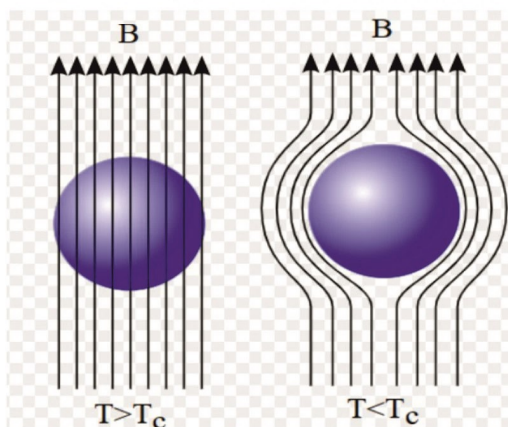
their normal state to superconducting state and vice versa at the transition temperature. These superconductors show complete Meissner's effect below their transition temperatures.

However, type II does not show any abrupt change. Instead, they first show partial Meissner's effect in between two critical values of applied magnetic field and later on show complete Meissner's effect.

#### Applications of Superconductors:

1. Superconductors are used in particle accelerators, generators, transportation, computing, electric motors, medical, power transmission, etc.
2. Superconductors are primarily employed for creating powerful electromagnets in MRI scanners.
3. These conductors are used to transmit power for long distances.
4. They are used in memory or storage Devices.

**Limitations of Superconductors:** Although useful in a diverse range of applications, Superconducting Materials are active only when they are kept at low temperatures. Every superconducting material has a critical temperature below which it becomes active. Keeping Superconducting Materials below the transition temperature involves a lot of expensive Cryogenic Technology. Hence, superconductors are still not being used in most everyday electronics. Scientists are researching ways that can make such superconductors operate at room temperatures.



## KNOW THE EXHIBIT

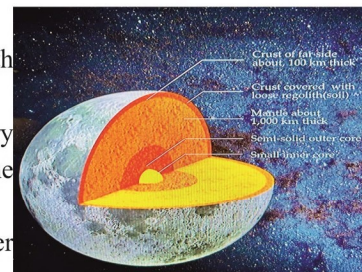
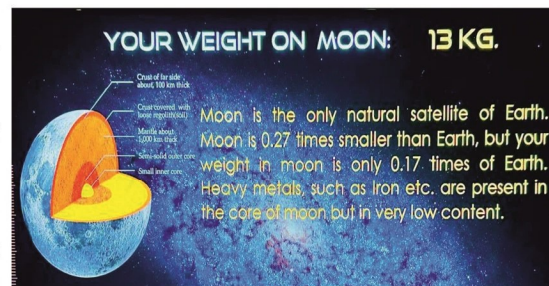
### Your Weight Varies

Moon is the only natural Satellite of the Earth. Moon is 0.27 times smaller than the Earth, but person's weight on the Moon is only 0.17 times less of the Earth. Heavy materials such as Iron, Nickel, Titanium and Uranium is present in the core of Moon but in very low content.

The Earth rotation has slowed down due to the Moon's gravity. Long ago, when Moon was not there, days were much shorter and rotation was faster. The dark side of the Moon is myth. Only one face of the Moon is seen from the Earth. This is because the Moon rotates around on its own axis is exactly the same time it takes to orbit the Earth, meaning the same side is always facing the Earth. The side facing away from the Earth has only been seen by the human eye from spacecraft.

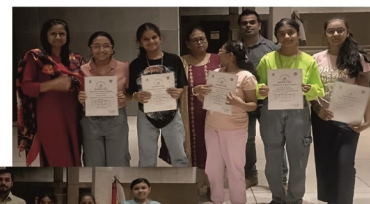
The Moon is moving approximately 3.8cm (centimeter) away from our planet (Earth) every year. It is estimated that it will continue to do so far around 50 billion years. By the time that happens, the Moon will be taking around 47 days to orbit the Earth instead of the current 27.3 days.

This exhibit is situated at "Entering Space Gallery" between Fun Science Gallery and Power of Play Gallery at the first floor of Science Centre.



## SUMMER CAMP-2024

Surat Municipal Corporation has organized Summer camp at Science Centre, Surat from 10<sup>th</sup> May 2024 to 20<sup>th</sup> May 2024. Total 75 students participated in the Summer camp in which Paper Art, Basic Science, Basic Astronomy, Basic Physics, Art (Lipan, Warli, Mandala, Madhubani, Handmade Jewellery), Robotics and Drone activities were done.



## QUIZ

- Which of the following is not a unit of Energy?  
a) Joule                      b) Newton meter                      c) Kilowatt                      d) Kilowatt hour
- Which Planet has a situation like Pressure Cooker?  
a) Jupiter                      b) Mars                      c) Venus                      d) Mercury
- Which nutrient does a plant get from Urea fertilizer?  
a) Phosphorus                      b) Calcium                      c) Nitrogen                      d) Potassium
- Which animal has a primary nervous system?  
a) Earthworm                      b) Liver worm                      c) Crabs                      d) Toad
- In which layer of the Earth is the geomagnetic field generated?  
a) Crust                      b) Outer core                      c) Mantle                      d) Inner core