

# SCIENCE CENTRE NEWS LETTER

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## SCIENCE CENTRE

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### WHAT'S NEW IN SCIENCE?

#### Mind-controlled arm prostheses that 'feel' are now a part of everyday life

For the first time, people with arm amputations can experience sensations of touch in a mind-controlled arm prosthesis that they use in everyday life. A study in the New England Journal of Medicine reports on three Swedish patients who have lived, for several years, with this new technology -- one of the world's most integrated interfaces between human and machine.

The advance is unique: the patients have used a mind-controlled prosthesis in their everyday life for up to seven years. For the last few years, they have also lived with a new function -- sensations of touch in the prosthetic hand. This is a new concept for artificial limbs, which are called neuromusculoskeletal prostheses -- as they are connected to the user's nerves, muscles, and skeleton.

The research was led by Max Ortiz Catalan, Associate Professor at Chalmers University of Technology, in collaboration with Sahlgrenska University Hospital, University of Gothenburg, and Integrum AB, all in Gothenburg, Sweden. Researchers at Medical University of Vienna in Austria and the Massachusetts Institute of Technology in the USA were also involved.

"The study shows that a prosthetic hand, attached to the bone and controlled by electrodes implanted in nerves and muscles, can operate much more precisely than conventional prosthetic hands. They further improved the use of the prosthesis by integrating tactile sensory feedback that the patients use to mediate how hard to grab or squeeze an object. Over time, the ability of the patients to discern smaller changes in the intensity of sensations has improved," says Max Ortiz Catalan.

"The most important contribution of this study was to demonstrate that this new type of prosthesis is a clinically viable replacement for a lost arm. No matter how sophisticated a neural interface becomes, it can only deliver real benefit to patients if the connection between the patient and the prosthesis is safe and reliable in the long term. Our results are the product of many years of work, and now we can finally present the first bionic arm prosthesis that can be reliably controlled using implanted electrodes, while also conveying sensations to the user in everyday life," continues Max Ortiz Catalan. Since receiving their prostheses, the patients have used them daily in all their professional and personal activities.

The new concept of a neuromusculoskeletal prosthesis is unique in that it delivers several different features which have not been presented together in any other prosthetic technology in the world:

- It has a direct connection to a person's nerves,

muscles, and skeleton.

- It is mind-controlled and delivers sensations that are perceived by the user as arising from the missing hand.

- It is self-contained; all electronics needed are contained within the prosthesis, so patients do not need to carry additional equipment or batteries.

- It is safe and stable in the long term; the technology has been used without interruption by patients during their everyday activities, without supervision from the researchers, and it is not restricted to confined or controlled environments.

The newest part of the technology, the sensation of touch, is possible through stimulation of the nerves that used to be connected to the biological hand before the amputation. Force sensors located in the thumb of the prosthesis measure contact and pressure applied to an object while grasping. This information is transmitted to the patients' nerves leading to their brains. Patients can thus feel when they are touching an object, its characteristics, and how hard they are pressing it, which is crucial for imitating a biological hand.

"Currently, the sensors are not the obstacle for restoring sensation," says Max Ortiz Catalan. "The challenge is creating neural interfaces that can seamlessly transmit large amounts of artificially collected information to the nervous system, in a way that the user can experience sensations naturally and effortlessly."

The implantation of this new technology took place at Sahlgrenska University Hospital, led by Professor Rickard Brånemark and Doctor Paolo Sassu. Over a million people worldwide suffer from limb loss, and the end goal for the research team, in collaboration with Integrum AB, is to develop a widely available product suitable for as many of these people as possible.



Integrum AB, is to develop a widely available product suitable for as many of these people as possible.

"Right now, patients in Sweden are participating in the clinical validation of this new prosthetic technology for arm amputation," says Max Ortiz Catalan. "We expect this system to become available outside Sweden within a couple of years, and we are also making considerable progress with a similar technology for leg prostheses, which we plan to implant in a first patient later this year."

### SCIENTIST OF THE MONTH

#### Chittar Mal Gupta

Chittar Mal Gupta was born on September 1, 1944 at Bharatpur in Rajasthan. He did his B.Sc from M.S.J. College, Bharatpur in 1964, M.Sc from Rajasthan University in 1966, Ph.D from Central Drug Research Institute, Lucknow in 1969. Later, he did his postdoctoral research from Lucknow.

He has promoted the understanding of the structure of membranes. He has also forwarded the cause of using liposome's as drug delivery system. An organochemical approach for studying lipid-



protein and lipid-lipid interactions in biological membranes has been developed by him. He discovered strong antidiabetic activity in 2-substituted pyrimidines and their derivatives. This gave rise to a lead to the design of new antidiabetic agents.

He received the Rajasthan University Gold Medal in 1966, Shanti Swarup Bhatnagar Prize in 1985, Ranbaxy Research Foundation Award in 1985 and Dr. Nitya Anand Endowment lecture Award in 1989.

## SCIENCE FACTS SEPTEMBER 2020



### Timings

Tuesday to Friday  
9.30 am to 4.30 pm

Saturday - Sunday  
& Public Holidays  
11.00 am to 6.30 pm

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2 August 1861	Indian Scientist Sir Prafullchandra Ray was born.
4 August 1956	India's first Nuclear Reactor "Apsara" was established at ' Trombay' (BARC-Bhabha Atomic Research Centre)
5 August 1930	Neil Alden Armstrong (First person to set foot upon the moon) was born.
6 August 1881	Prof. Alexander Fleming (discoverer of Penicillin) was born.
7 August 1976	"Viking 2" Spacecraft of America entered into the Orbit of Mars.
8 August 1901	Ernest Lawrence (inventor of Cyclotron) was born.
12 August	International Youth Day. (by U.N.)
12 August 1919	Well known Indian Scientist Dr.Vikaram Ambalal Sarabhai was born.
14 August 1888	Johan Logie Baird (inventor of colour Television) was born.
17 August 1870	Frederick Russell (inventor of first successful typhoid fever vaccine) was born
21 August 1754	William Murdoch (inventor of Gas lighting) was born
22 August 1920	Denten Cooley (who conducted the first artificial heart transplant) was born.
25 August 1989	Space Craft 'Voyager 2's closest approach to Planet Neptune was noted.
26 August 1906	Albert Sabin (inventor of oral polio vaccine) was born
29th August	International Day against Nuclear Tests. (by U.N.)
	U. N. : United Nations
<p>Answers: 1) A 2) A 3) C 4) D 5) D</p>	

## SCIENTIFIC QUESTION

### What is Voltmeter ?

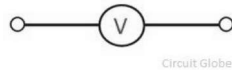
#### What is Voltmeter ?

**Definition:** The instrument which measures the voltage or potential difference in volts is known as the voltmeter. It works on the principle that the torque is generated by the current which induces because of measured voltage and this torque deflects the pointer of the instrument. The deflection of the pointer is directly proportional to the potential difference between the points. The voltmeter is always connected in parallel with the circuit.

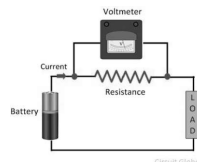
**Symbolic Representation of voltmeter :** The voltmeter is represented by the alphabet V inside the circle along with the two terminals.

#### Why is Voltmeter connected in Parallel?

The voltmeter constructs in such a manner that their internal resistance always remains high. If it connects in series with the circuit, it minimises the current which flows because of the measurand voltage. Thus, disturb the reading of the voltmeter. The voltmeter always connects in parallel with the circuit so that the same voltage drop occurs across it. The high resistance of the voltmeter combines with the impedance of the element across which it is connected. And the overall impedance of the system is equal to the impedance that the element had. Thus, no obstruction occurs in the circuit because of the voltmeter, and the meter gives the correct reading.



Circuit Globe

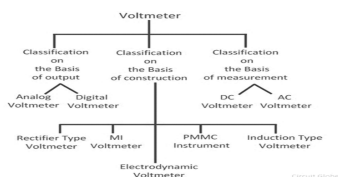


#### Why Voltmeter has High Resistance?

The voltmeter is constructed with very high internal resistance because it measures the potential difference between the two points of the circuit. The voltmeter does not change the current of the measuring device. If the voltmeter has low resistance, the current passes through it, and the voltmeter gives the incorrect result. The high resistance of the voltmeter does not allow the current to pass through it and thus the correct reading is obtained.

#### Types of Voltmeter

The voltmeter is classified into three ways. The classification of the voltmeter is shown in the figure.



On the basis of the construction, the voltmeter is of the following types.

#### PMMC Voltmeter

It works on the principle that the current carrying conductor placed in the magnetic field and because of the current the force acting on the conductor. The current induces in the PMMC instrument because of the measurand voltage, and this current deflects the pointer of the meter.

**The PMMC voltmeter uses for DC measurement.** The accuracy of the instrument is very high and having low power consumption. The only disadvantage of the instrument is that it is very costly. The range of the PMMC voltmeter increases by connecting the resistance in series with it.

#### MI Voltmeter



COMET

The MI instrument means moving iron instrument. This instrument uses for the measurement of both the AC and DC voltage. In this type of instrument, the deflection is directly proportional to the voltage of the coil. The moving iron instrument is classified into two types.

- Attraction Type Moving Iron Instrument
- Repulsion Type Moving Iron Instrument

#### Electro-dynamometer Voltmeter

The electro-dynamometer voltmeter is used for measuring the voltage of both AC and DC circuit. In this type of instruments, the calibration is same both for the AC and DC measurement.

#### Rectifier voltmeter

Such type of instrument is used in AC circuits for voltage measurement. The rectifier instrument converts the AC quantity into the DC quantity by the help of the rectifier. And then the DC signal is measured by the PMMC instrument. The following are the classification of instruments regarding the displays of output reading.

#### Analogue Voltmeter

The analogue voltmeter uses for measuring the AC voltage. It displays the reading through the pointer which is fixed on the calibrated scale. The deflection of the pointer depends on the torque acting on it. The magnitude of the develops torque is directly proportional to the measuring voltage.

#### Digital Voltmeter

The voltmeter which displays the reading in the numeric form is known as the digital voltmeter. The digital voltmeter gives the accurate result.

The instrument which measures the direct current is known as the DC voltmeter, and the AC voltmeter is used in the AC circuit for alternating voltage measurement.

## KNOW THE EXHIBIT

### Geodesics

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

A geodesic is the shortest are between two points on a convex surface, the rubber band will take the path of the geodesic. They generalize to curved surfaces the notion of "Shortest path" between two points in the plane. Geodesics play a very important role in surface theory and in dynamics. The geodesics on a sphere are the great circles. For example, the meridians are geodesics.



## SCIENCE QUIZ

- \_\_\_\_\_ is the longest cell.  
(A) Nerve Cell (B) Skin  
(C) Spleen (D) None of the above
- What is the name of the cells in the body that engulf foreign particles like bacteria?  
(A) Phagocytes (B) Globulin  
(C) Fibrinogen (D) Albumin
- Who had performed the world's first heart transplant?  
(A) Dr. Venugopal (B) William Harvey  
(C) Christian Bernard (D) None of the above
- Sodium metal is kept under  
(A) petrol (B) alcohol  
(C) water (D) kerosene
- From which mineral is radium obtained?  
(A) Rutile (B) Haematite  
(C) Limestone (D) Pitchblende

## SCIENCE PROJECT

Surat Municipal Corporation had organized 'Science Fair' at Art gallery, Science Centre, Surat on 30st and 31st August 2019. M.T. Jariwala Madhyamik Sala had presented their project on 'Magnetic Hover Car'.

Aim:- To make magnetic levitating car to reduce pollution and minimize the use of petroleum.

Magnetic levitation is highly advanced but with basic technology, it has various uses in transportation such as high speed trains and cars.

It increases efficiency, reduce maintenance cost and increase the useful life of the system. This technology can be used as an efficient and easy way in Mechanical and Automobile engineering .

This model does not uses fuel or petroleum, hence it does not create any type of pollution. Using magnets instead of tires it prevents accident this leads to a safe travelling. Since this project is still under study many more features can be built up in this hover car and this can be a good transportation way in future.

