



Dapoli Education Society's

DAPOLI URBAN BANK SENIOR SCIENCE COLLEGE DAPOLI.

Presenting

Eureka *E-info letter*

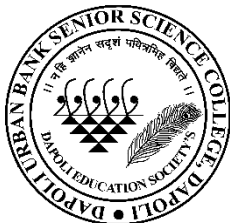
SCIENCE

COMMERCE

SOCIAL SCIENCE

**VOL.- I
ISSUE.- 3**





NAAC Accreditation B⁺⁺ Grade

www.dubsscdapoli.in

Principal & Chief Editor:

Dr. Sandesh Jagdale

Sub Editor:

Mr. Santosh Marathe

Miss. Deepali Nagvekar

Member of Editorial Board:

1. Dr. G.B. Sathe
2. Dr. R.S. More
3. Dr. R.L. Ghalme
4. Mr. D. D. Kulkarni
5. Mr. S.S. Dongare
6. Mrs. J.A. Chaugale
7. Mrs. A. A. Mohite
8. Miss. P.S. Salvi
9. Dr. B. A. Yamgar
10. Mr. V. R. Joshi
11. Mrs. R. A. Deorukhakar

Design & Page Setup:

Mr. S. S. Kadam

Front Page Concept & Design:

Mr. A.V. Mulukh

Eureka E-Info Letter

Form No. IV (Rule No. 8)

(Central Rule, 1956)

Index

Sr. No.	Name of Article	Page No.
1.	Discoveries of Molecular Mechanisms Controlling the Circadian Rhythm	3-4
2.	Plastic Waste Pollution	5
3.	Advertisement Unfolding Understanding Changing Pattern of Advertising Industry	6-7
4.	Processor and Brain	8-9
5.	Electronic Storage Devices	10-12
6.	What you need to know about the Delta variant	13-14
7.	Inside the Atom: Internal Structure of Atom	15-19
8.	The Nobel Prize in Physiology or Medicine Har Gobind Khorana	20-21

1. Place of Publication:

Dapoli Urban Bank Senior Science College, Dapoli
Dist. Ratnagiri

2. Publisher's & Editor's Name:

Dr. Sandesh Pandurang Jagdale

Nationality- Indian

Address:-

Principal,

Dapoli Urban Bank Senior Science College, Dapoli

Dist. Ratnagiri -415712

Phone- 02358 283256

3. Name & Address of Principal:

Principal Dr. S. P. Jagdale

Dapoli Urban Bank Senior Science College, Dapoli

Dist. Ratnagiri -415712

Phone- 02358 283256

I, Shri Dr. S. P. Jagdale hereby declared that the particulars given above are true to the best of my knowledge and belief.

Sign /-

(Dr. S.P. Jagdale, Principal)

(The editor and publisher may not agree with the views expressed in articles.)

“Discoveries of Molecular Mechanisms Controlling the Circadian Rhythm”

Living organisms, including humans, have an internal clock, called biological clock that helps them anticipate and adapt to the regular rhythm of the day. Three Nobel laureates - Jeffrey C. Hall, Michael Rosbash and Michael W. Young were successfully demonstrated the inner workings of biological clock that helps to adapt to the rotation of our planet. Their discoveries explain how plants, animals and humans adapt their biological rhythm so that it is synchronized with the Earth's revolutions.

They used the fruit flies as a model organism for their research. Nobel laureates isolated a gene that controls the normal daily biological rhythm. They showed that this gene encodes a protein that accumulates in the cell during the night, and is then degraded during the day. Subsequently, they identified additional protein components of this machinery, exposing the mechanism governing the self-sustaining clockwork inside the cell. Hence, it is now possible to recognize the function of biological clocks by the same principles in cells of other multicellular organisms, including humans.

Our inner clock precisely, adapts our physiology to the dramatically different phases of the day. The clock regulates critical functions such as behavior, hormone levels, sleep, body temperature and metabolism. Our wellbeing is affected when there is a temporary mismatch between our external environment and this internal biological clock. There are also indications that chronic misalignment between our lifestyle and the rhythm dictated by our inner timekeeper is associated with increased risk for various diseases.

The inspiration for their discovery was from the experiments done by the

astronomer Jean Jacques d' Ortois de Mairan by using the mimosa plants during the 18th century who reported that the plants seems to have their own biological clock. Other researchers also reported that not only plants, but animals and humans also have a biological clock that helps to prepare our physiology for the fluctuations of the day. This regular adaptation is referred to as the *circadian* rhythm. But, how our internal circadian biological clock worked remained a mystery.

These three Nobel Laureates, were discovered the molecular mechanism of our internal circadian biological clock by using fruit flies as model organism. In 1984, Jeffrey Hall and Michael Rosbash and Michael Young successfully isolated the *period* gene. Jeffrey Hall and Michael Rosbash then went on to discover the PER, the protein encoded by *period*, accumulated during the night and was degraded during the day. Thus, PER protein levels oscillate over a 24-hour cycle, in synchrony with the circadian rhythm. Furthermore, they reported that how such circadian oscillations generated and sustained. There is a regulatory molecular feedback mechanism that set controls the frequency of the oscillations. This provided insight into how an oscillation is adjusted to more closely match a 24-hour cycle.

The laureates established key mechanistic principles for the biological clock. During the following years other molecular components of the clockwork mechanism were elucidated, explaining its stability and function. The biological clock is involved in many aspects of our complex physiology. All multicellular organisms, including humans, utilize a similar mechanism to control circadian rhythms. A large proportion of our genes are regulated

by the biological clock and, consequently, a carefully calibrated circadian rhythm adapts our physiology to the different phases of the day. Since, the seminal discoveries by the three laureates, circadian biology has developed into a vast and highly dynamic research field, with implications for our health and wellbeing.

E-article by-

Dr. R.S. More,
Head, Department of Zoology
DUBSSC, Dapoli

Story Source:

- Nobel Foundation. 2017, Nobel Prize in Physiology or Medicine: Molecular mechanisms controlling the circadian rhythm." ScienceDaily. ScienceDaily, 2 October 2017.

Plastic Waste Pollution



Plastic waste pollution is becoming the major issue in universe. It is threatening each and every aspect of human life and environment. Plastic pollution can afflict land, waterways and oceans. It is estimated that 1.1 to 8.8 million tonnes of plastic waste enters the ocean from coastal communities each year. It is estimated that there is a stock of 86 million tons of plastic marine debris in the worldwide ocean as of the end of 2013, with an assumption that 1.4% of global plastics produced from 1950 to 2013 has entered the ocean and has accumulated there. Some researchers suggest that by 2050 there could be more plastic than fish in the oceans by weight. It was estimated that global production of plastics is approximately 250 metric ton/yr. Their abundance has been found to transport persistent organic pollutants, also known as POPs. These pollutants have been linked to an increased distribution of algae associated with red tides.

Besides threatening marine life and possibly even human health, researchers consider plastic to be a novel entity that has the potential to alter the dynamics of Earth's life support systems. A new study has found that 26,000 metric tons of pandemic-related plastic waste has been released into the world's oceans since the start of the Covid-19 pandemic in January 2020.

Plastic is non-biodegradable. It is nearly impossible for it to break down. It sticks around for a long number of years longer (e.g up to 1,000 years longer) than other forms of trash. People are enjoined/advised to avoid bring plastic bags to their various homes and purchasing items with too much packaging. This way you can help in contributing towards the environment in the form of reducing plastic pollution whose ill effects are not reversible. Plastic bags can be replaced by reusable bags. So it's everyone prime responsibility to shift our moto avoids use of plastic and contributes to a fund to help clean up our world.

References:-

https://en.wikipedia.org/wiki/Plastic_pollution

<https://www.eco-business.com/news/hospital-waste-not-masks-are-plastic-threat-of-pandemic-study/>

Obebe S.B., Adamu A.A. Plastic Pollution: Causes, Effects And Preventions International Journal Of Engineering Applied Sciences And Technology, 2020

Article by-

Mr. Aniruddha V. Sutar

Department of Environmental science
Dubssc, Dapoli

Advertisement Unfolding

Understanding Changing Pattern of Advertising Industry

Advertising is a finest way for companies to get their message across and reach an audience. Audience or consumers gets familiar with products by advertisements. It plays vital role to boost the sale of product or services.

The history and evolution of advertising won't happen immediately. Over the years, the medium of advertising has substantially changed, and is still happening. From billboards, newspapers, radio, television, then computers to mobile phones, advertising has had assorted communication mediums. Concurrently the attitude and thinking towards advertising was also changing. It was evolving.

Today's advertising is proficient (i.e., apt), full of ingenuity, innovative and consumer driven rather than product driven

American Marketing Association recognizes the term advertising as – any paid form of non- personal presentation and promotion of ideas, goods and services by an identified sponsor. Advertising is not the same as publicity.

According to Kotler's definition, advertising is “any paid form of non- personal presentation and promotion of ideas, goods and services through mass media such as newspapers, magazines, television or radio by an identified sponsor”

Advertising consists- of all the activities involved in presenting to a group, a non- personal, oral or visual, openly sponsored message regarding a product, service or idea; this message called an advertisement, is disseminated through one or more media and is paid for by the identified sponsor.” —WILLIAM J. STANTON.

In a nutshell, advertising is paid form; it is not free, the advertising message

given to masses, it acts as a marketing vehicle and is useful for drawing the attention of people towards a particular product or service.

Before 15th century

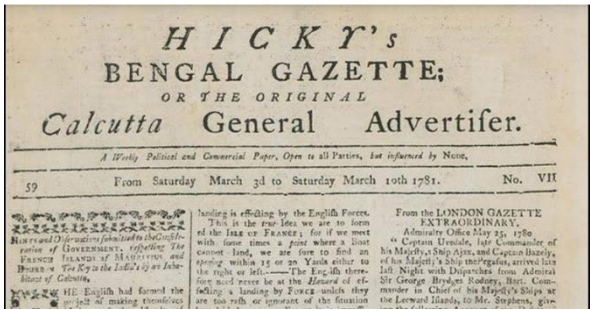
During this period, sign boards and bill board were used by traders outside their shops to indicate the type of product sold. Town criers were also popular. Back in the day, hawkers used clever messages and slogans to sell their wares, right from the



days when cities and markets began

15th – 18th century

Industrial revolution took place in Europe. Print technology was developed in early 15th century. Ads appeared for the first time in print in Hickey's Bengal Gazette, India's first weekly newspaper. To 'advertise' meant merely to 'inform' until the end of the eighteenth century, and the early newspapers and periodicals announced births, deaths, arrivals of ships from England, sale of household furniture, etc. some journals like the Bengal Journal (first published in 1785) even offered to print government advertisements free. The approach towards advertising changed. Manufacturer realized the importance of advertising in creating awareness about the product.



19th century and early 20th century

With the advent of radio and television in the early 1900's, a new era of advertising began. Radio gives audio impact, T.V. offers audio & visual impact both. Since it was speaking to audience or people directly through the medium of Radio & T.V., it felt more personalised. With growth of mass media (Radio, T.V.) the reach of advertising become far and wide.

Late 20th century and 21st century

In addition to traditional media like T.V. radio, press etc. media option are available to the advertisers like internet, SMS on mobile, satellite television channels, social media. This period was known for instigating new channels and mediums and a radical shift in motive. At this point advertising focuses on brand awareness, brand recognition, customer's preferences, requirements, satisfaction, feedback etc. Previously, goods were given importance, now consumers have gained more significance. The Internet has created tremendous diversity in the field of advertising. New methods are being explored. With the right balance between the old forms and the new method / practices, the advertising sector has gained a commercial status today.

References

<https://talentedge.com/blog/history-advertising-india/>

https://en.wikipedia.org/wiki/History_of_advertising

<https://www.saching.com/Articles/Changing-Scenario-of-Advertisements-943.html>

Article by-

Miss. Siddhi Salgaonkar

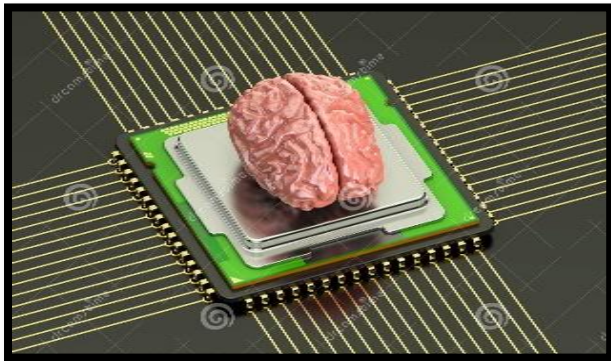
Department of Commerce

Dubssc, Dapoli

Processor and Brain

'Microprocessor', the brain of Computers. Throughout history, people have compared the brain to different inventions. These days, the favourite invention that the brain is compared to is a processor.

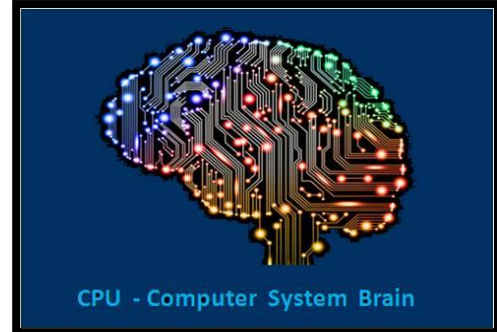
The brain uses chemicals to transmit information; the processor uses electricity. Even though electrical signals travel at high speeds in the nervous system, they travel even faster through the wires in a computer. A processor uses switches that are either on or off ("binary"). In a way, neurons in the brain are either on or off by either firing an action potential or not firing an action potential. Computer memory grows by adding computer chips whereas memories in the brain grow by stronger synaptic connections.



It is much easier and faster for the brain to learn new things. Yet, the Processor can do many complex tasks at the same time ("multitasking") that are difficult for the brain. For example, try counting backwards and multiplying 2 numbers at the same time. However, the brain also does some multitasking using the autonomic nervous system. For example, the brain controls breathing, heart rate and blood pressure at the same time it performs a mental task.

The brain is always changing and being modified. There is no "off" for the brain - even when an animal is sleeping, its brain is still active and working. The Processor only changes when new hardware

or software is added or something is saved in memory. There is an "off" for a Processor. When the power to a that is turned off, signals are not transmitted.



Scientists understand how Processor works. There are thousands of neuroscientists studying the brain. Nevertheless, there is still much more to learn about the brain. "There is more we do NOT know about the brain, than what we do know about the brain"

The calculation speed of the human brain can be compared with the processor speed of a computer, measured in bits per second.

10 bits per second means essentially that the computer or person can make 10 basic binary decisions every second, for example toggling every 0 and 1 in a 10-digit binary number like 0111010011 to the other number:

Unlike a computer, the processing power of the human brain is very difficult to calculate. However, psychologists have done some clever experiments to determine how fast humans can think.

Several decades ago, the Hick-Hyman Law was established:

The time taken to perform a single operation is proportional to the logarithm of the number of choices available.

Using this, Psychologists recently found an estimate of around 60 bits per second for the maximum processing speed of the human brain.

This article describes only some of the similarities and differences between the computer and the brain. Can you think of any more?



Article by-
Mr. Vishvesh Joshi
Department of Physics
Dubssc, Dapoli

Electronic Storage Devices

Computer data storage device is a tool used to store digital information. These serve to temporarily or permanently store any data as per the user's needs. There are types of Storage Devices that can hold the data more data than Primary memory.

It is transferable, but the speed of accessing data is slower than Primary Memory. Let's see what the computer storage devices or types of storage devices are.

The storage devices are useful technology, created to save or archive digital information according to the user's requirements. This data and files are stored in an organized way to access it more easily.

Without computer storage devices in the computer system, laptops and smartphones would not be very helpful. Well, every device needs a storage unit to work. The information or data can be text files, videos, programs, documents, images, and applications.

Characteristics of Secondary Storage Devices:

The secondary memory is also called external or permanent memory.

It is non-volatile memory but also a backup memory for the computer.

Secondary memory is made up of magnetic and optical devices.

Secondary memory stores the data permanently. Even if you have switched off the power, it doesn't lose the data.

The processing speed is slower than the primary memory.

A computer can work without a secondary memory but not without a primary one.

Storage Devices of Computer

1. USB Drive

A USB drive is a small, light, ultra-portable storage device compatible with Windows, Mac, and Linux.

The pen drive, also known as a USB memory device, memory stick, USB flash drive, memory unit, data stick, pen drive, kitchen drive, thumb drive, USB keychain, USB stick, or a portable data storage unit.

The pen drive replaced floppy drives and became one of the most popular portable data storage devices on the market. It is small, lightweight, practical, and can be easily carried anywhere instead of an optical drive or a traditional hard disk drive.

These types of computer storage devices are used to store documents, photos, music files, and videos. Its range is from 1 GB to 2 TB.

2. Hard Disk Drive

The short form of the hard disk drive is HDD. A hard drive is a computer-accessible storage device based on the made of magnetic recording technology. They are used in the vast majority to store all types of small or big files or data of computers, storing backup copies of data, like file storage, etc., on our digital computer or Laptop.

A round-shaped disk consists inside the hard disk; the disk rotates inside the hard disk. The faster the speed of turns, the faster it can store or read data.

The speed of the hard disk is measured in terms of RPM, i.e., Revolution Per Minute. Most hard disks are of 5400 RPM or 7200 RPM; obviously, the hard disk of 7200 RPM is much faster than the 5400 RPM.

An IBM company created the first hard disk in the 1st generation of computers (1953). Initially, storage capacity was just 5 MB and weighed around 250 KG. Later, many changes were made, which is today's modern Hard Disk with increased storage capacity.

There are four types of Hard Disk drives.

1. PATA (Parallel Advanced Technology Attachment)
2. SATA (Serial Advanced Technology Attachment)
3. SCSI (Small Computer System Interface)

3. Solid State Drive

SSD stands for “Solid State Drive,” which is a computer storage devices bit similar to a hard disk drive., but it has storage capacity more than a hard disk and a more sophisticated device.

It neither has a motor nor a spinning disk as a hard disk has. It uses the integrated circuit memory made of semiconductor technology like RAM, but it is used to store data permanently.

Hard Disk read/ write the data with the help of a mechanical arm. In contrast, an SSD does not have a mechanical arm, so an embedded processor, also known as a Controller, is used to read and write data. This difference makes SSD faster than HDD.

The better quality of the controller will be of a good SSD for the computers. Like flash and USB drives, and memory cards store the data, SSD stores the data in the same way.

4. Memory Card

A memory card is also known as a flash memory card or SD Card (Secure Digital Card), is an external storage medium that allows us to save and delete information. We use memory cards as secondary storage for our devices to store data such as photos, videos, files, etc.

A memory card is considered a small storage medium that is commonly used for temporary storage. A memory card is a type of storage media often used to store photos, videos, or other data in electronic devices.

Devices that typically use memory cards include DSLR cameras, digital Camco orders, smartphones, MP3 players, PDFs, and printers. It is also used for small,

portable, and remote computer storage devices.

The amount of storage capacity can vary depending on the type of memory card. However, in general, most memory cards today range in size from 4 GB (gigabytes) to 256 GB. These numbers will increase in the future.

5. Optical Devices

Optical devices are nothing but CD and DVD we were used to watching videos and many more. Both are storage devices of computer are still used to store data.

A. CD

A ‘Compact Disc’ is an abbreviated form of a CD. It is a flat, round, optical storage medium used to store data like audio.

They are made to replace the floppy disks used to store files and programs from the computer. CDs eventually made floppy disks obsolete.

There are two sides of Compact Disc; one side contains the data, while on the other side, there is a label made for reading data is in the disc. It is an optical medium that saves our digital data.

Discs can store up to 700 MB of data, which equates to approximately 80 minutes of audio.

Mini-discs have also been recorded that can keep about 24 minutes of audio or software drivers. Initially, CDs offered more data than a computer’s hard drive, although, in modern technology, hard drives outperform CDs by a mile.

B. DVD

A complete form of DVD is “Digital Video Disc” or can “Digital Versatile Disc.”

DVDs are similar to CDs and are also optical storage devices. Before this, videos and films were recorded on a Video CD (VCD), while some DVDs are used to store software and computer files.

Also, DVDs can be double-layer and double-sided, which significantly increases the size of the drive. This allowed users to

store data up to 17.08 GB on a dual-layer, double-sided disc. A single-layer, the single-sided disc contains approximately 4.7 GB of data.

DVDs are in greater demand than CDs; they are used to record and store all data formats (audio, video, images, and photos), images (img, iso). However, after the DVD's arrival, the market saw a massive reduction in CDs' demand.

6. Floppy Disk

Floppy Disk is another storage device of a computer. The first floppy was first created in 1969, this the same year that the Internet was launched. That's pretty good, isn't it?

These magnetic disks are fragile and flexible enclosed in a square or rectangular plastic casing. That's why they are called floppy disks as well as diskettes.

The floppy disk stores a small amount of data. Earlier it used to be more on the computer due to its low storage capacity they have been replaced by CDs and flash memories that are small, portable.

In the 70-90s, floppy disks played a much more critical role in computers, but they lost the competition to CDs because the information capacity and lifespan of optical discs were higher.

The floppy disk was the primary portable storage medium for data and programs before the CDs' rise in popularity.

7. Magnetic Tape

Magnetic tape is also a storage device similar to audio cassettes. It is like the old-time audio case Magnetic Tape was primarily used to store a large amount of audio data. They were cheap. Even today, it is used to create a data backup.

Magnetic tape has been an effective medium to store audio and binary data storage for many years and is still part of some systems' storage devices.

Magnetic tape is made of a thin and long plastic strip. A magnetic layer is applied to it, and the data is saved to the

layer which is needed to send the tape to a coil to read, which by a process decodes the data present on that tape.

This tape was also used to store computer data. But these devices decline in popularity after the arrival of hard disk drives in the market.

References:

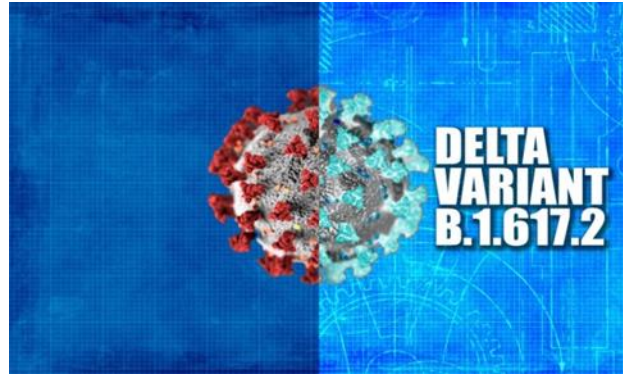
Digitalworld839.com

Article By-

Mrs. Pawar Shravya S.

Department of Computer Science,
DUBSS College Dapoli.

What you need to know about the Delta variant



What is the Delta variant?

The Delta variant of COVID-19 has been called a variant of concern by WHO because of its increased transmissibility and increased ability to cause a severe form of the disease. Where the Delta variant is identified, it quickly and efficiently spreads between people.

How did the Delta variant come about?

When a virus is circulating widely and causing numerous infections, the likelihood of the virus mutating increases. The more opportunities a virus has to spread, the more opportunities it has to undergo changes.

Experts are constantly monitoring new variants of the coronavirus that causes COVID-19 to see if they spread more easily, cause more severe disease, or could have an impact on the effectiveness of public health measures or vaccines.

The best way we can limit the transmission of COVID-19 is for people to get the vaccine when available to them and continue to follow existing advice on preventing the spread of the virus, including physical distancing, wearing masks, regular handwashing and keeping indoor areas well ventilated.

Is the Delta variant more contagious?

Yes. The Delta variant is highly contagious, about twice as contagious as previous variants. However, the same precautions, such as avoiding crowded spaces, keeping your distance from others and mask wearing, still work against the Delta variant.

Are the COVID-19 vaccines effective against the Delta variant?

Yes. The WHO-approved COVID-19 vaccines continue to be highly effective at preventing severe illness and death, including against the Delta variant. When it's available to you, make sure to get vaccinated. If your vaccination involves two doses, it's important to receive both to have the maximum protection.

The vaccines protect most people from getting sick, but no vaccine is 100 per cent effective. A small number of vaccinated people may get infected with COVID-19; this is called breakthrough infection; however, the small number of vaccinated people who get infected with COVID-19, are likely to have milder symptoms. Therefore, if you live in an area with high-levels of COVID-19 transmission it's recommended to take additional precautions even if you are vaccinated. If you have been fully vaccinated but are showing symptoms of COVID-19, you

should contact your doctor about whether you should get tested.

Are children more likely to contract the Delta variant?

The Delta variant does not specifically target children. However, the Delta variant is more contagious than other strains and people who are mixing socially and those who are unvaccinated are more susceptible to contracting the Delta variant.

How can I protect myself and my family against the Delta variant?

Keep yourself updated on the level of COVID-19 transmission in your community and follow local guidance. In general, the higher the rate of transmission, the higher the risk of potential exposure in public settings. Here are some key ways to protect yourself and your loved ones:

Avoid crowded spaces and keep your distance from others.

- Keep all indoor spaces well ventilated (this can be as simple as opening a window).
- Wear a mask when in public places where there is community transmission and where physical distancing is not possible.
- Wash your hands regularly with soap and water or an alcohol-based hand rub.
- When it's your turn, get vaccinated. WHO-approved COVID-19 vaccines are safe and effective.

By UNICEF

Article By:

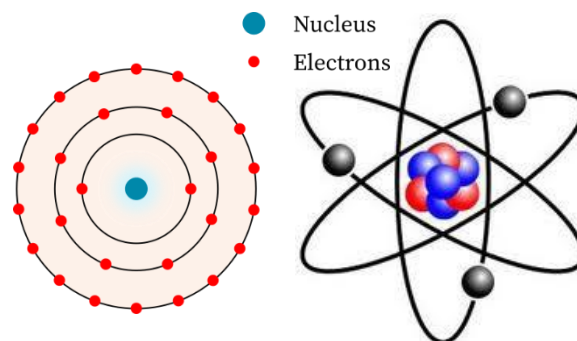
Miss. Priyanka Salvi

Head, Department of Microbiology
DUBSSC, Dapoli

Inside the Atom: Internal Structure of Atom

Inside the Atom: Internal Structure of Atom

- Major space inside the atom is hallow
- Nucleus is at the center of atom
- Subatomic particles present inside the atom namely proton neutron and electron
- Negatively charged electrons found in extra nuclear part
- Chargeless neutrons and positively charged protons reside in nucleus



- Originated the idea of Paramanu.
- It is a smallest indestructible particle of matter.

❖ 400BC

Democritus (Greek Philosopher)

Democritus was a Greek philosopher proposed the theory of the universe. He was the first philosopher to use the term atom. (Greek word atomos: meaning indivisible). He thought that if you take a piece of matter and divide it and continue to divide it, you will eventually come to a point where you could not divide it any more. This is the fundamental or basic unit was called an atom.

- All matter consists of atoms, which are bits of matter too small to be seen.
- There is an empty space between atoms.
- Atoms are completely solid.
- Atoms have no internal structure.
- Each atom of a different substance is different in size, weight and shape.

❖ 1803 John Dalton

John Dalton an English school teacher who was the first to adapt Democritus' theory into the first modern atomic model. He proposed his own theory about atom

John Dalton's Atomic Theory:

- All matter consists of tiny particles called as atoms, which are indestructible and unchangeable
- All atoms of a one element are exactly alike and atoms of different elements are different.

Human curiosity has given birth to many studies, theories, discoveries, inventions and technologies. Development of science and studies of nature and its laws are the fruiting of curious behavior as well as rational & experiential nature of mankind. Human being had a wonder about the matter, its different states and composition of matter.

This curiosity about the matter has trigger the thought process within the human being. Since ancient times, we can find the evidence of this thought process. Outcomes of this is in the form of different concepts about the atom at different times and at various places of the globe.

Today we all are knowing that matter is composed of tiny particles called atom. The complete atomic structure is known to us. But this journey of atomic structure has started before century almost 600 years. As time progresses, evidence-based observations flash the light on the exact atomic structure. Each stage of atomic structure development was finally leads into todays accepted atomic model. Journey of atomic structure development is really remarkable and very interesting. Study of this journey is the wonderful experience like watching the movie on investigation of invisible things.

Timeline of Atomic Structure:

❖ 600 B.C. Maharshi Kanad:

- He is ancient Indian Philosopher.

- Elements are characterized by the mass of their atoms. Each atom has its own constant mass.
- When elements react, it is their atoms that have combined to form new compounds
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Dalton's atomic theory successfully explained Law of conservation of mass, Law of constant properties, Law of multiple proportions and Law of reciprocal proportions.

Demerits of Dalton's Atomic Theory

- The theory failed to explain the existence of isotopes.
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom, that proved the atoms are divisible.

❖ 1896 Sir J. J. Thomson

Discovery of Electron and Plum Pudding Model of Atom

In 1896, the British physicist J. J. Thomson proved that atoms were not the fundamental form of matter. He had given the first hint that an atom is made of even smaller particles. He carried out experiment with cathode ray tube and demonstrated that cathode rays could be deflected, or bent, by magnetic or electric fields, which indicated that cathode rays consist of charged particles. More important, by measuring the extent of the deflection of the cathode rays in magnetic or electric fields of various strengths, He had calculated the mass-to-charge ratio of the particles. These particles were emitted by the negatively charged cathode and repelled by the negative terminal of an electric field. As repulsion is observed in like charges while opposite charges attract, Thomson concluded that there is presence of negatively charged particles inside the atom. He called these particles as corpuscles and are now called electrons.

Video Link of To Thomson's Experiment:

<https://www.youtube.com/watch?v=XU8nMKkzbT8>

Thomson had proposed a model of the atom namely "Plum Pudding" model.

Thomson's Atomic Model:

- Each atom is a sphere filled with positively charged 'fluid'.
- This resembles the sticky jam part of a pudding.
- Corpuscles (later called electrons), are the negatively charged particles suspended in this 'fluid'.
- This resembles the plums in the pudding.

Limitations Thomson's Atomic Model:

Thomson's atomic model does not clearly explain the stability of an atom. Also, further discoveries of other subatomic particles, couldn't be placed inside his atomic model.

Plum Pudding Atomic Model by J. J. Thomson



Plums in a pudding is analogous with electrons in an atom

(Above Image is used from website <https://chemistrygod.com>)

❖ 1908 Ernest Rutherford

Ernest Rutherford was a student of Sir J. J. Thomson; he modified the atomic structure with the discovery of positively charged nucleus at the center of an atom. His atomic model is based on the Alpha particle scattering experiment.

Alpha particle scattering experiment

A very thin foil of gold containing approximate thousand atoms is bombarded by an alpha particle (He^{2+}). ZnS screen is placed around the gold foil to observe the scintillation marks due to striking of alpha particles on it.

Video Link of To Watch Rutherford's Experiment:

<https://www.youtube.com/watch?v=kHaR2rsFNhg>

Observations Recorded by Rutherford:

- Most of the alpha particles are passed through the gold foil making scintillations on the ZnS screen placed behind the gold foil.
- A few particles are reflected after hitting the gold foil.
- One out of 1000 particles are reflected by an angle of 180° (retraced path) after hitting the gold foil.

Conclusions:

- Since Most of the particles are passed through, from which Ernest Rutherford concluded that most of the space inside the atom is hollow.
- Few particles are reflected because of the repulsion from positively charged center present inside the atom.
- 1 out of 1000 alpha particles are bounced back through an angle 180° suggest that very strong positive charge is present in the center of the atom. He called this strong positive charge as "nucleus".
- Almost all the mass of an atom is supposed to concentrated at the center of the atom i.e. at the nucleus

Rutherford's Atomic Model

Based on the above observations and conclusions, Rutherford had proposed the atomic model as.

- Atom is spherical in shape.
- The nucleus is situated at the center of an atom, where most of the charge and mass are concentrated.
- Electrons revolve around the nucleus in a circular orbit, similar to the way planets orbit the sun.
- This model is called as Rutherford's Planetary model of an atom

Limitations of Rutherford Atomic Model

- As lots of energy is required to electrons to revolve around the nucleus, hence all the electrons will lose all their energy and

will fall into the nucleus so the stability of atom is not explained.

- If electrons continuously revolve around the 'nucleus, the type of spectrum expected is a continuous spectrum. But in reality, what we see is a line spectrum.

Presence of Proton in Nucleus:

In the year 1920 Rutherford had proved that the nucleus of the hydrogen atom contains positively charged particle, he had given the names to this particle 'proton'. He also suggested that the nuclei of elements other than hydrogen must contain electrically neutral particles with approximately the same mass as the proton.

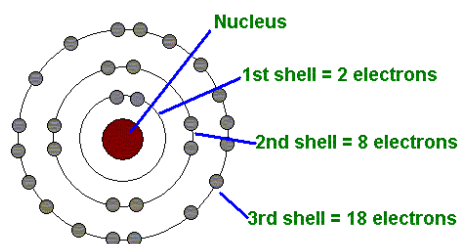
❖ 1910 – 1913 Niels Bohr:

Niels Bohr agreed with the planetary model of the atom, but he is expecting few corrections in the Rutherford model. Applying laws and knowledge of energy and quantum physics, he had modified the Rutherford's model. His model is able to answer why the electrons did not collapse into the nucleus.

Bohr's Atomic Model

- Electrons revolves around the nucleus in orbits of definite size and energy.
- Lower the energy of the electron, placed in an orbit closer to the nucleus.
- Placing the electrons in the orbits, starts from the lower energy level first.
- If energy level is filled with its capacity, electron starts to fill in next orbit.
- An electron moves from one level to another, then radiation is taken place.

Bohr's Atomic Model Diagrammatically



(Above Image is used from comer's chemistry classroom)

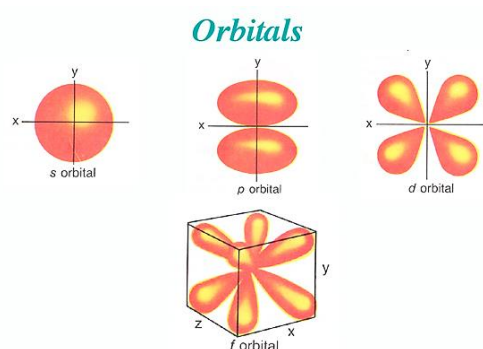
❖ 1920 Erwin Schrödinger

Erwin Schrödinger has used Heisenberg's uncertainty principle and proposed atomic model which we are using till today.

Schrödinger's Atomic Model

- Erwin Schrodinger developed the atomic model using the ideas of Louis de Broglie
- An electron does not travel in an exact orbit
- He said that all matter acts as waves, and electrons are wavelike.
- He defined the new concept of an orbital "The region of space that surrounds a nucleus in which two electrons may randomly move."
- This is the Quantum Model of Electrons
- Electrons are in constant motion and do not have definite or fixed position in the atom.
- But there is probable region to find the electrons called as "Atomic Orbitals"
- Atomic Orbitals are sorted with energy levels and distributed between electron clouds.
- The probability of orbital is dependent on the energy level described by Bohr

Schrödinger's Concept of Orbitals



(Above Image is used from site <https://sites.google.com/a/provo.edu/atomic-models/atomic-models/2-what-dalton-discovered>)

❖ 1932 Prof. James Chadwick

Rutherford had discovered the atomic nucleus and had observed the proton. However, it seemed there must be something in the nucleus in addition to protons. For instance, helium was known to have an atomic number of 2 but a mass number of 4. Some scientists thought there

were additional protons in the nucleus, along with an equal number of electrons to cancel out the additional charge. In 1920, Rutherford proposed that an electron and a proton could actually combine to form a new, neutral particle, but there was no real evidence for this, and the proposed neutral particle would be difficult to detect

In 1932, the physicist James Chadwick carried out an experiment in which Beryllium is bombarded with alpha particles from the natural radioactive decay of Polonium. The resulting radiation showed high penetration through a lead shield, which could not be explained via the particles known at that time.

He observed that radiation ejected by the beryllium was in fact a neutral particle about the mass of a proton. He postulated the presence of an uncharged (neutral) particle in the nucleus of an atom, of about the same weight as a proton. He also noted that because the neutrons had no charge, they penetrated much further into a target than protons would.

❖ Today's Accepted Atomic Model

- An atom is the smallest particle of an element.
- Atom of different element has different structure
- An atom contains subatomic particles namely Protons, Electrons and Neutrons.
- The nucleus is situated at the center of an atom and contains positive protons and neutral neutrons.
- Electrons are negatively charged and has negligible mass.
- Electrons occupy a certain energy level of a certain size.
- One energy level is full, a new level begins.
- Within each of energy levels there are special types of orbitals.
- Each orbital can contain two electrons

❖ References:

- Atomic Theory Timeline

- https://www.sas.upenn.edu/~dbalmer/eportfolio/nature_timeline.pdf
- <https://www.lincolnparkboe.org/userfiles/33/Classes/239/Atomic%20Theory%20Information%20Book.pdf>
- The history of an atom Notes-condensed
 - https://www.sisd.net/cms/lib/TX01001452/Centricity/Domain/1297/The_history_of_the_atom_Notes-_condensed.pdf
- Website of Chemistry Libertexts
- <https://www.youtube.com/watch?v=XU8nMKkzbT8>
- <https://www.youtube.com/watch?v=kHaR2rsFNhg>

Article By-

Mr. S. S. Marathe

Department of Chemistry

DUBSSC, Dapoli

The Nobel Prize in Physiology or Medicine

Har Gobind Khorana

Khorana was born on 9 January 1922 in Raipur in Punjab, which is now in Pakistan. He was the youngest of five children. He started showing a flair for science at a very young age and this was nurtured by his father, who helped him and his siblings read and write. He lived in India until 1945.

According to Google, scholarships helped propel the budding scientist through his scholastic journey, obtaining his doctorate in organic chemistry in 1948.

Khorana studied for a PhD at the University of Liverpool, then spent some time at the Eidgenössische Technische Hochschule in Zurich. Post that, he spent some time in India before returning to Cambridge to continue his research on proteins and nucleic acids. He conducted his research at universities in England, Switzerland and Canada. Eventually, at the University of Wisconsin along with two other biochemists, Khorana's work won him the Nobel prize.

Khorana was a pioneer. Spanning chemistry, biology and physics, he was doing interdisciplinary research before the current trend. In 1968, he wrote about gene manipulation before individual genes from any organism had been characterized. And in 1971, he wrote about the need to amplify the synthetic gene, using a series of steps that looks eerily similar to the technique for this now known as PCR.

A deep thinker, Khorana put much thought into choosing a problem to work on. He was not influenced by its difficulty or the time needed to solve it, as long as it was of fundamental importance. He often said: "If you want to get far, you have to travel alone." Yet he was always well prepared, making "pilgrimages" to work in laboratories — ranging from Stanford

University in California to the National Cancer Center of Tokyo — before undertaking new projects.

As a mentor, Khorana set high standards. He was loyal to the people who helped him and to the institutions at which he worked. He could be demanding, but he was no more so of others than he was of himself. One associate said: "He showed us what excellence in science was and we learnt to recognize it."

Gobind was modest, humble and avoided publicity. He loved music, swimming and long walks, and had a curiosity that lasted until the end. Three days before he passed away, I was by his hospital bed and we talked about glucose and the brain.

Khorana won the Nobel prize in Physiology or Medicine in 1968 for his work on discovering that the order of nucleotides in our DNA determine which amino acids are built. These amino acids, in turn, form the proteins which are responsible for the essential cell functions. Khorana shared this Nobel award with two other biochemists from the University of Wisconsin, namely Marshall W Nirenberg and Robert W Holle.

Gobind used the solitude of hiking to think about scientific problems, and always carried a pen and notecards to write down his thoughts. On the day of his Nobel prize announcement, he was among the last at the university to hear about it. As he often did, he had gone to a rented cottage by a lake outside Madison with no telephone or radio, to write papers. His wife Esther had to drive over to give him the news.

In addition to sharing the Nobel prize (while he was working at the University of Wisconsin–Madison in the U.S.), Khorana was elected as Foreign

Member of the Royal Society (ForMemRS) in 1978. In 2007, the University of Wisconsin–Madison, the Government of India (DBT Department of Biotechnology), and the Indo-US Science and Technology Forum jointly created the Khorana Program. The mission of the Khorana Program is to build a seamless community of scientists, industrialists, and social entrepreneurs in the United States and India. But that wasn't the end of it. Khorana is also credited with another scientific breakthrough when he constructed the first synthetic gene. He was also awarded the National Medal of Science during his lifetime.

Gobind was at heart an experimental scientist. With him gone, we have lost an extraordinary man. Khorana passed away on 9 November 2011.

Reference –

1. <https://www.firstpost.com/tech/news-analysis/har-gobind-khorana-nobel-prize-winning-biochemist-remembered-on-96th-birth-anniversary-on-google-doodle-4293899.html>
2. <https://www.nature.com/articles/480322a.pdf>

Article by:

Miss. Awale S. M.

Department of Botany
DUBSSC, Dapoli

