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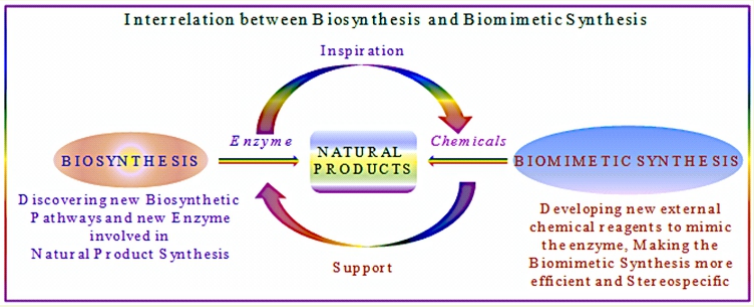
Biomimetic Chemistry

Chemistry Inspired by Nature

"Nature always makes the best of possible things"

-Aristotle

The idea of looking to Nature to solve problems is undoubtedly as old as humanity itself. Observations of Nature, particularly of its biological face, have impacted the development of every facet of human society, from basic survival tactics to art, and from fashion to philosophy. Indeed, as a part of the biosphere ourselves, we cannot help but frame our conceptual understanding of ourselves and our environment in terms of biology. Bioinspiration and biomimicry, are ancient processes that take advantage of millions of years of evolutionary experimentation to help us address the many challenges that affect human well-being. Biomimetics chemistry is a new field in Chemical Sciences that concerns with synthesizing product/s that could imitate (mimics) biological function and processes. The dazzling mechanisms by which nature effortlessly knits together molecules often inspires biomimetic syntheses that not only lend credence to the proposed biosynthetic mechanism but considerably advance synthetic organic chemistry.

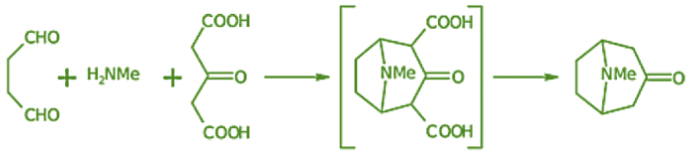


Bios = the living world
Mimicry = to emulate

Dr. Lav Varma
Department of Chemistry

The beginning of biomimetic synthesis

The term biomimetics was suggested by Schmitt in the early 1960s. Biomimetic synthesis is so named in 1917 by the English organic chemist and Nobel laureate Sir Robert Robinson. The earliest generally cited example of a biomimetic synthesis is Robinson's organic synthesis of the alkaloid tropinone. Tropinone is an alkaloid, a synthetic precursor to atropine, a scarce commodity during World War I.



Scheme Synthesis of Tropinone

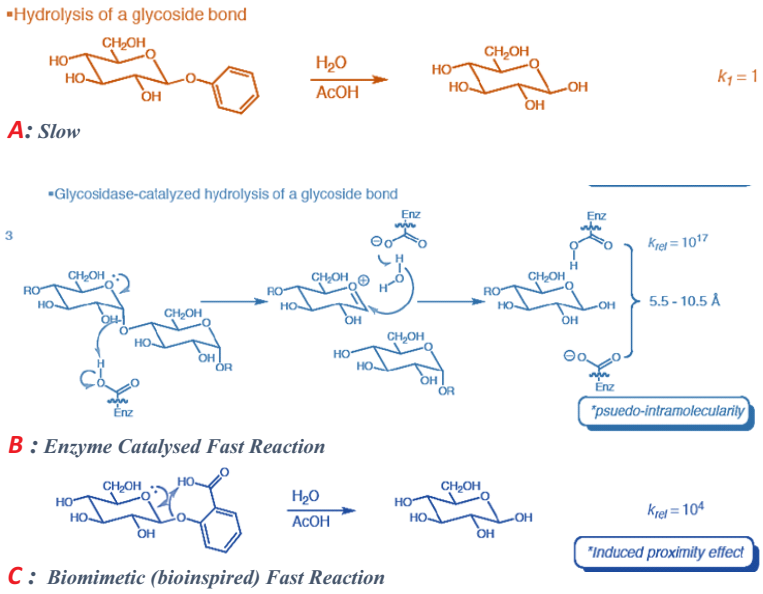
It is considered a classic in total synthesis due to its simplicity and biomimetic approach. Tropinone is a bicyclic molecule, but the reactants used in its preparation are fairly simple: succinaldehyde, methylamine and acetonedicarboxylic acid (or even acetone). The synthesis is a good example of a biomimetic reaction or biogenetic-type synthesis because biosynthesis makes use of the same building blocks. It also demonstrates a tandem reaction in a one-pot synthesis. Furthermore, the yield of the synthesis was **17% and with subsequent improvements exceeded 90%.** The first synthesis of tropinone was by Richard Willstätter in 1901. It started from the seemingly related cycloheptanone, but required many steps to introduce the nitrogen bridge; the overall yield for the synthesis path was **only 0.75%.**

"In biomimetic chemistry, we take what we have observed in nature and apply its principles to the invention of novel synthetic compounds that can achieve the same goals ... As an analogy, we did not simply make larger versions of birds when we invented airplanes, but we did take the idea of the wing from nature, and then used the aerodynamic principles in our own way to build a jumbo jet."

-Ronald Breslow

Inspiration from Enzymes

Enzymes teach us many other inspiring principles. One is that proximity and orientation can affect chemical reactivity. One such example is hydrolysis of a glycoside bond.



In biological systems this hydrolysis is catalysed by enzyme Glycosidase and it is very fast.

Reaction C is inspired by the biological reaction B. In reaction C, after incorporating the COOH group this reaction becomes much faster.

An increasing number of total syntheses have been termed 'biomimetic' or 'biosynthetically inspired' and so on. While biomimicry formally involves a direct replication of processes or techniques that are employed by Nature, bioinspiration involves a more indirect "drawing of ideas" from Nature. Here Nature serves as a rich and readily accessible source of new concepts and approaches. Of particular interest are approaches that have the potential to help solve intractable and challenging problems. Bioinspiration is mostly concerned with understanding the principles that underlie natural processes and then applying these principles in nonbiological settings.

Biological entities and processes have evolved over billions of years to achieve forms and functions that are often remarkable, both for their efficacy and their efficiency. Humanity has a lot to learn from Nature. Nature provides inexhaustible wealth to humankind.

The inspiration that will be gleaned from the earthly biosphere over the coming years is vast and we may never discover all its secrets, much less elucidate the web of synergistic interactions that makes it all work. It is breath-taking to realize that our world is but one among a vast number of likely worlds, many of which will surely have evolved their own biospheres with their own unique materials and interconnected processes. In the fullness of time bioinspiration and biomimicry may ultimately grow to encompass an interplanetary aspect. Perhaps this will one day turn out to be the best justification for humankind to reach for the stars..

Source : Bioinspiration and Biomimicry in Chemistry-Jean-Marie Lehn & Janine Benyus

What Are Olympic Gold Medals Made Of ?

They Olympic gold medals are not completely made of gold. In fact, they are made of at least 95% of silver, containing a minimum of 6 g of gold.

Gold is much more expensive than silver. However, thanks to this "tricky" alloy, a golden medal isjust worth about $550, while silver medal is around $300.

Gold is around 100 times more expensive than silver, so a full-gold Olympic medal would cost$30.000! That's why they only add enough amount of gold to give the medal the characteristicgolden color.

A bronze medal, made of cheap copper and zinc, is actually worth only $2.

Source : Visualcapitalist

Unprecedented Resolution of Novel Microscope Pins Down the Miracle of Molecular Oxygen

Chandani Mathur
Department of Chemistry

Researchers at the University of Regensburg track the first step of the reaction of one single dye pigment with oxygen at unprecedented resolution.

Why is it that the colors of a t-shirt fade over time in the sun? Why do you get a sunburn, and why do the leaves of a tree turn brown in the autumn? These questions all have one theme in common, the interplay between dye pigments and ambient oxygen. Every child learns about this chemical reaction in school, the oxidation process in the air that we breathe, so what could possibly be left to research?

Oxygen is an astonishing molecule in that it is magnetic. In liquid form, at very low temperatures, it can be picked up by a magnet much like iron filings can. This property is related to the electrons in the oxygen. All molecules are made up of atomic nuclei and electrons, which in turn tend to behave like minuscule needles of a compass. Usually, these needles arrange in pairs pointing in opposite directions, so that their magnetic forces cancel out. In an oxygen molecule consisting of two oxygen atoms, however, the two compass needles point in the same direction, making oxygen magnetic.

Dye molecules, such as those used to color a t-shirt, are not magnetic because the compass needles of the electrons point in opposite directions. When light shines on such a molecule, a certain color of the light will be absorbed, giving the dye its characteristic appearance. In this process of light absorption, the energy of the light is transferred to an electron in the dye molecule, breaking the original pairing of two electrons and allowing the compass needle of the excited electron to spontaneously change its alignment. When this process happens, the electron can no longer return to its original state. The dye molecule becomes magnetic, entering what is referred to as a triplet state.

An international research team directed by Prof. Jascha Repp has now succeeded in revealing how this triplet energy is transferred from one single dye molecule to one single oxygen molecule. This process is of central importance in everyday life, where many oxidation reactions proceed via the excited triplet state. As long as the molecule resides in this state, it retains the energy imparted on it by the light, thereby facilitating chemical reactions. Most chemical reactions, such as combustion, require some initial energy, such as a spark, to begin.

A complete dissipation of the energy within the dye molecule necessitates another reversal of the alignment of the electronic compass needle, which is a slow and improbable process. Alternatively, the light energy within the dye molecule, which corresponds to a magnetic energy, may simply transfer to a further magnetic molecule, such as oxygen – a process much like flipping one bar magnet by rotating another one nearby. This transfer of energy deexcites the dye molecule, but it tends to make the oxygen molecule itself highly reactive, ultimately destroying the dye molecule. This effect is well known from bleached t-shirts or sunburns, where the dye molecules are the pigments in the skin.

The team now succeeded in tracking this transfer of energy between dye and oxygen molecule directly in space, without destroying the dye molecule. To do this, single molecules were placed on a surface and cooled to very low temperatures close to that of the universe. Using a so-called atomic force microscope consisting of a very fine needle with just one single atom at its tip, the researchers were able to image the individual atoms of the dye molecule by scanning the tip across it. By employing a clever sequence of electrical pulses applied to the dye molecule, it could be driven into the magnetic triplet state in a controlled fashion. The energy transfer from this excited triplet state to oxygen molecules nearby was then tracked in time by measuring minuscule changes in the force acting on the tip.

This novel approach, reported in the leading journal Science, allowed the researchers to probe many different geometries of the arrangement of dye molecule and oxygen. In this way, the interplay between molecular arrangements on the atomic level and the speed at which such energy transfer occurs could be resolved for the first time. The scientists now aim to finally be able to formulate an underlying microscopic framework of fundamental oxidation reactions.

Besides the inconvenient fading of t-shirts, such an interplay between molecular triplet excitations is of central significance to a range of technological developments such as in organic light-emitting diodes (OLEDs) and organic solar cells, in photocatalytic energy conversion and photosynthesis, and in photodynamic cancer therapy.

Source : https://scitechdaily.com/

Molecular Diagnosis of COVID-19

Anshika Sharda
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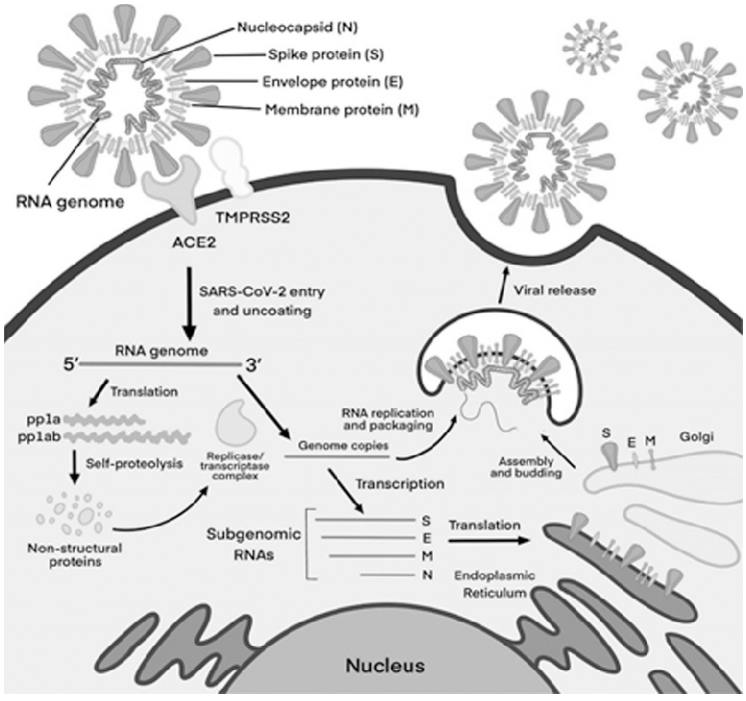
The detection of RNA of the SARS-CoV-2 virus, the pandemic's causative infectious agent, is used to make a molecular diagnosis of COVID-19.

The RNA dependent RNA polymerase (RdRP), nucleocapsid (N), envelope (E), and spike (S) proteins of the virus are all encoded by reverse transcription polymerase chain reaction (RT-PCR), which allows for sensitive detection of particular gene sequences.

Despite the widespread use of RT-PCR tests and the development of numerous alternative assays, current testing capacity and availability are insufficient to meet the unprecedented global demand for rapid, accurate, and widely available molecular diagnosis. From the selection and treatment of specimens to the amplification and detection of viral RNA and the validation of clinical sensitivity and specificity, challenges persist in the analytical process.

The ingenious infectious agent is the severe acute respiratory syndrome coronavirus (SARS-CoV-2). This virus is named as 'corona' (Latin word), meaning crown, which comes from its appearance determined by electron microscopy and its capabilities for causing acute respiratory distress syndrome (ARDS).



SARS-CoV-2 is a blanketed positive sense single-stranded RNA (ssRNA) virus, which means that the viral capsid is encased in a lipid bilayer and that viral proteins are encoded by the viral genome rather than its complementary sequence. The genome sequence of coronavirus ranges from 26kb to 32 kb, which is the highest of any RNA virus. The 29,903 nucleotide (nt) RNA genome of a contagious SARS-CoV-2 virion is packaged with four structural proteins: envelope (E), nucleocapsid (N), membrane (M), and spike (S). N-proteins bind to the RNA genome in helical symmetry, similar to beads on a string, and this genome structure is surrounded by a lipid bilayer containing E, M, and S proteins.

The spike protein binds to angiotensin-converting enzyme 2 (ACE2) receptors on the surface of host cells, allowing SARS-CoV-2 to infect them. SARS-CoV-2 RNA genome is repeated in the host cells, and the four structural (E, M, S, N) and 25 non-structural proteins are metabolised.

Coronaviruses use only RNA templates to replicate RNA genomes and subgenomic RNAs, and their viral life cycle does not include a DNA stage. The 3′ to 5′ exonuclease activity of non-structural protein 14 (Nsp14), which is unique to coronaviruses, confers proofreading, thereby improving genomic replication fidelity.

There were many challenges faced in the molecular diagnosis of this virus. For example: From sample selection, storage, and treatment to analytical specificity and limit of detection, the variable and very low viral loads in separate types of specimens obtained at different times during the course of the virus present incorporates a wide range of challenges. Additionally, microbiological testing is complicated by the complex humoral response to SARS-CoV-2 infection. The validity of molecular diagnosis is directly impacted by these methodological problems, which include questions about clinical sensitivity and specificity.

1. Du, L.; He, Y.; Zhou, Y.; Liu, S.; Zheng, B.-J.; Jiang, S. The spike protein of SARS-CoV-a target for vaccine and therapeutic development. Nat. Rev.Microbial 2009, 7 (3), 226– 236
2. Kim, D.; Lee, J.-Y.; Yang, J.-S.; Kim, J. W.; Kim, V. N.; Chang, H. The architecture of SARS-CoV-2 transcriptome. Cell 2020, 181 (4), 914– 921
3. https://pubs.acs.org/doi/10.1021/acs.analchem.0c02060
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7346719/

Climate Change Mitigation

Ragini Agrawal
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Source : enr.com

Climate change is one of the most difficult situations facing us today. It is global problem, felt on local scales and it will remain around us for decades and centuries, if we are not going to stop emitting greenhouse gases in excess.

In climate change mitigation, the goal is to reduce our permeability to harmful effects of climate change. The aim of climate change mitigation is to avoid remarkable human interaction with the climate. Climate change has been responsible for the rise and fall of civilizations. Mitigation strategies include adopting renewable energy sources like solar, wind and small hydro that helping cities develop more sustainable transport such as buses, e-vehicles etc. climate change mitigation aims support developing countries to make transformational shifts towards low-emission. Mangroves protect communities from storms. Efforts to maintain coastal wetlands that include local communities that depend on the ecosystems for their homes and livelihoods. The renewable energy sources like wind, solar energy, they reduce our dependency on fossil fuels. Thus, they reduce carbon dioxide emissions into atmosphere. Carbon dioxide can be removed from waste gases. Carbon dioxide is converted into dense liquid and can be stored in safe places example underground in old coal mines. This method can reduce 90% released of carbon dioxide from fossil fuel. Planting trees helps into climate change mitigation. As trees absorb carbon dioxide as the part of the process of photosynthesis. International agreements "The Kyoto Protocol" is an international law in which countries signed up to reduce their carbon emissions by 5 percent that came into effect from 16th February 2005. The Kyoto Protocol expired in 2012. The recent UN climate talks were held in Paris in 2015. The aim of this protocol was to agree to limit global temperature change to below 2 degree Celsius. Adaptation strategies respond to it by reducing its negative effects. Change is agricultural systems has impact on climate change mitigation as well as farmer's farming practices. There is must need to develop water circulation protocols. Water should transfer from area of more water than is used to areas of water deficit. It can be done by pipelines. 'Kielder water transfer scheme' in the north-east England. Reducing risk from rising sea levels involves coastal flooding. The purpose of this is to reduce the risk of land being eroded away. Environmental Agency and local councils are developing Shoreline Management Plans to manage the threat of coastal change. NASA is a world leader in climate studies and earth science. NASA provides the robust scientific data needed to understand climate change.

Climate change mitigation involves reducing the flow of greenhouse gases into atmosphere. Greenhouse gases like carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), chlorofluorocarbons (CFCs) and ozone (O_3), warms the earth's surface by absorb and emit infrared radiation. Due to greenhouse gas effect, there is rapid change in climate. The cause of GHG effect is that human activities, burning fossil fuels like coal, oil and natural gas resulting increasing the concentration of greenhouse gases in atmosphere, which is contributing to global warming.

Source : https://www.worldwildlife.org

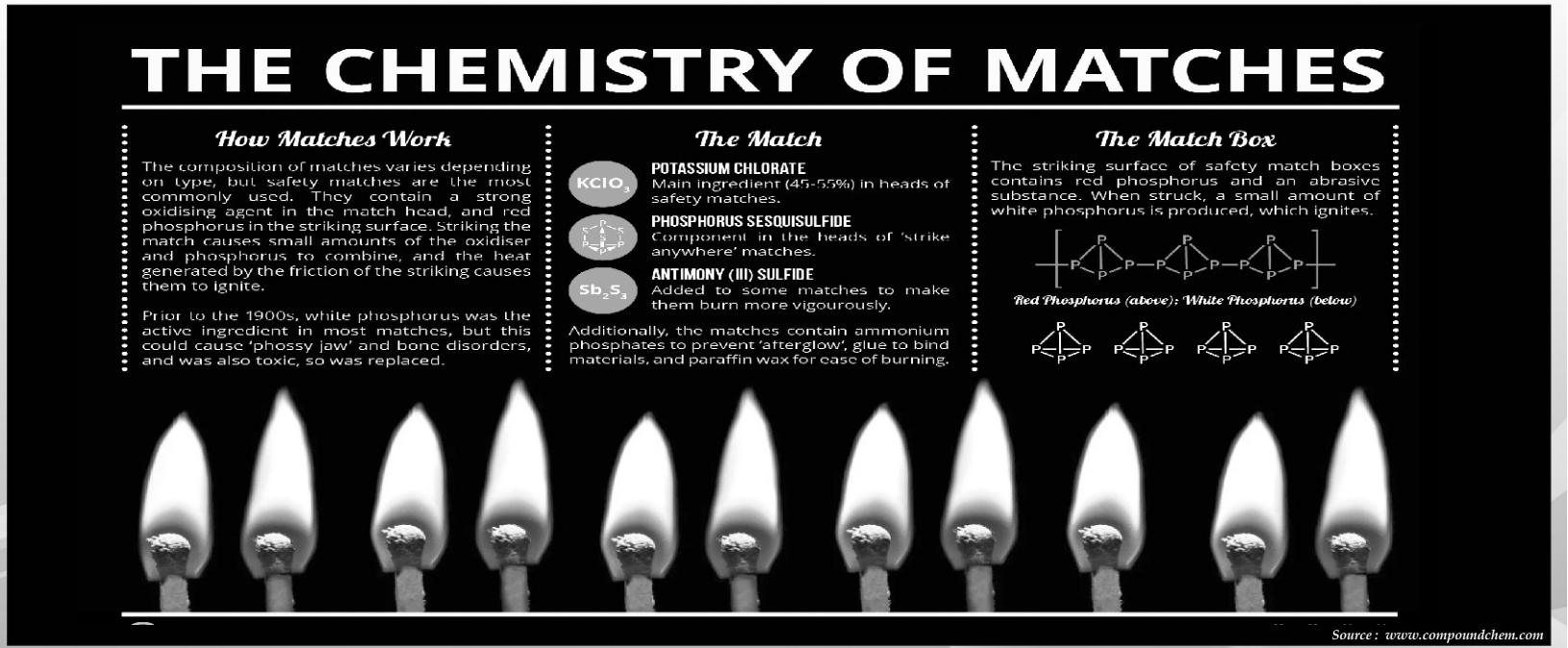
COVID-19 VACCINES CAN GET US TO HERD IMMUNITY DESPITE THE VARIANTS

Dr. Neelu Kanwar Rajawat
Department of Zoology

The world is currently witnessing a dramatic disruption of everyday life owing to the rapid progression of the coronavirus disease 2019 (COVID-19) pandemic. As the pandemic evolves, there is an urgent need to better understand its epidemiology, characterize its potential impact, and identify mitigatory strategies to avert pandemic-related mortality. Therefore various scientists are involved in searching the tools for protection against COVID-19 and vaccines can be a potential tool for getting over from this pandemic. Vaccines train our immune systems to create proteins that fight disease, known as 'antibodies', just as would happen when we are exposed to a disease but – crucially – vaccines work without making us sick. Vaccinated people are protected from getting the disease in question and passing on the pathogen, breaking any chains of transmission.

Scientists say current vaccines can get us to herd immunity despite growing concerns over the emergence of many COVID-19 variants. Researchers said that even if the effectiveness of vaccines decreases to 70% the world will still be able to achieve herd immunity and end the pandemic. More people will have to be vaccinated to achieve the same population wide protective effects. The percentage of people who need to be immune in order to achieve herd immunity varies with each disease. For example, herd immunity against measles requires about 95% of a population to be vaccinated. The remaining 5% will be protected by the fact that measles will not spread among those who are vaccinated. For polio, the threshold is about 80%. The proportion of the population that must be vaccinated against COVID-19 to begin inducing herd immunity is not known. This is an important area of research and will likely vary according to the community, the vaccine, the populations prioritized for vaccination, and other factors. Achieving herd immunity with safe and effective vaccines makes diseases rarer and saves lives. Researchers said that up to 70% of the population would have to be vaccinated in order to create herd effects. Herd immunity also known as population immunity is the direct protection from an infectious disease. It happens when a population is immune either through vaccination or immunity developed through a previous infection. Vaccine greatly reduces severe disease and death. The remaining cases would be mild and asymptomatic cases and similar to common cold. Vaccines are able to decrease or destroy different variants of the virus. Much attention has focused on how antibodies boosted by vaccination, target their attack on the virus's spike protein. But the Immune system has different defenses that vaccination also used including antibodies that attack other parts of the virus. It also includes T-cells that attack the infected cells that virus needs in order to replicate. This means that we have important backup plans that will continue to provide protection against these newly emerging variants. The World Health Organization supports achieving "herd immunity" through vaccination. They believe that not allowing the disease to spread through new segments of the population would result in the reduction of unnecessary cases and deaths. Therefore herd immunity against COVID-19 should be achieved by vaccination not by exposing people to the pathogen that causes the disease

Source : www.who.int



Condition of students during Covid- 19 pandemic

Riya Jiyani
M.Sc., Department of Biotechnology

"Gone are the days when we used to go in class
Make friends and had a good laugh
Stories of life are taught there
But now the eyes are yearning for those little affairs"

The whole world has come to a stand still and so do the schools and the reason is just a few nanometer sized "virus." At first it was just thought of as a disease a mere infection but now it is being realized that its expense far more than that. Now we see that it has impacted us in every sphere our lives.

The petrifying and severe impact of Covid-19 has shaken the world to its core. And this has led to the nationwide closures of all schools and educational institutions temporarily as a consequence of which 600 million learners across the world ranging from school going children to a Ph.D. scholar are affected.

"Everything is just the same
And this is what which makes me insane
We wake up and get ready
But we pick our phones to continue online study"

From a big sized white board to the screen of mobile phones and large and big classrooms to a small comfy room the means of study has changed as all.

The endless screen time, the tiring lecture and the annoying network all of this has taken a huge toll on the student's mental health, not to mention the physical harm.

Work from home or study from home are the terms they use but is it as simple as that??

'Study from home is no piece of cake.'

Despite all these hard times this lockdown has recreated the bonding with our parents which was lost somewhere in that hard and fast life long ago. It has made us acknowledge their hardwork to fulfill our reasonable and unreasonable demands every now and then.

Watching Mahabharta, Ramayana and playing Ludo with them gives us the beautiful glimpse of their past life.

The epic Ramayana has taught a bunch of values that were unknown to a present day student like us

- One's duty is more important than one's emotions
- Forgiveness
- Love and respect for Parents
- Equality of race and creed
- Universal brotherhood

All these values can be a great assistance to the path of success in life ahead and the scarcity of those teachings in the educational institutions has been fulfilled during the lockdown.

"The place which I felt so tiring,
Has now become the thing that I am admiring!!
The fun we used to have with our friends,
The pandemic has brought all this to an end"

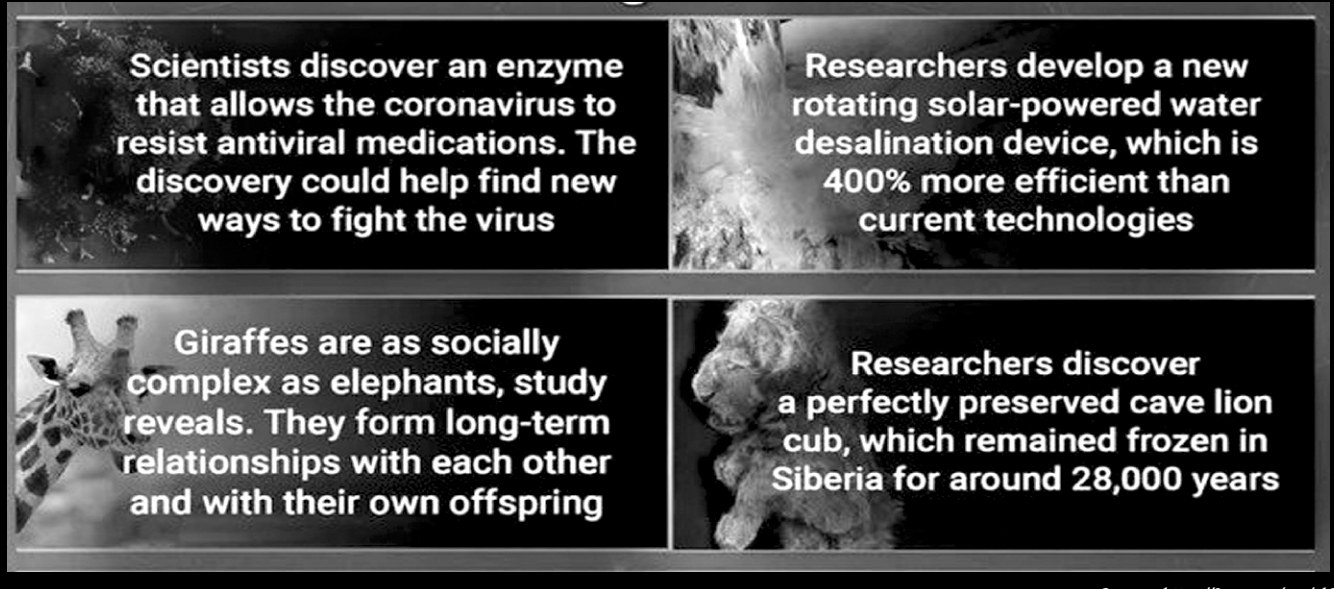
School is the place where a kid goes with tearful eyes but returns with a lot of new friends and mischievious memories. The deadly pandemic has made us crave for those days, that neverending fun, colourful uniforms, silly fights, teacher's scolding, eating under the benches, birthday treats- the last minute preparations and Princi's speech.

I still remember the bygones days when we used to stare each other- those mutual gazes and stupid activities. Those things are past now but I am still happy that I am one of those who carries such a beautiful past.

"When I will be free to roam around
Like a bird which has just left the ground"

I can only reminisce those days in words and memories…!!! I wish everything comes back the way it was.

Latest in Science



Source : https://9gag.com/gag/abVD5PO

THE SCIENCE BEHIND GOOD VIBRATIONS

"Everything in Life is Vibration" – Albert Einstein

Dr. Priyanka Jain
Department of Chemistry

The principle of vibration is one of the basic laws of the universe. Everything moves and nothing rests. Every single thing is an expression of vibration and a form of energy that we perceive consciously and unconsciously. Our bodies are molecular structures that vibrate at very high speed and our cerebral matter is a hub similar to an electronic switching station. In other words, our brains don't think; we think with our brains. As we activate our brain cells, we set up a vibration in our bodies. This results in the frequency with which we carry ourselves and creates the perception of our internal and external reality. Once we tune into our energy, we can connect with ourselves and others on a more profound level and improve our emotional, physical and spiritual wellbeing.

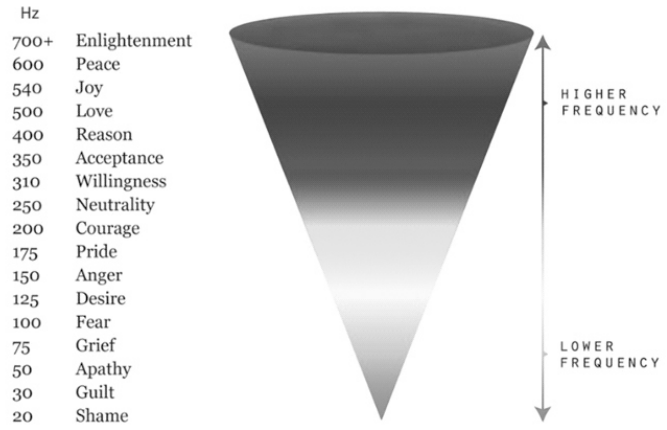
The law of nature that states everything has a vibration. Everything in nature vibrates at different frequencies. In fact quantum physics describes the universe as nothing more than vibrating strings of energy! In our junior classes we learn about atom and that everything is made up of atoms. These atoms are in a constant state of motion, and depending on the speed of these atoms, things are appear as a solid, liquid, or gas. Sound is also a vibration and so are thoughts. Vital regulatory systems in the body are associated with a variety of molecular electromagnetic emissions and absorptions. In many cells and tissues, molecules are arranged arrays resembling crystals. Because of this, molecular oscillations are organized and coherent. Molecular oscillations are absorbed by the living matrix (connective tissues, cytoskeletons and nuclear matrices) and conducted throughout the body. All forms of bodywork and movement therapy interact with this energy continuum in one way or another. Coherent molecular oscillations give rise to collective properties such as great sensitivity to environmental fields and radiation of energy from the body into the environment.

Everything that manifests itself in your life is there because it matches the vibration from your thoughts. There is agreement among science, medicine and metaphysics that certain frequencies can repel disease, and certain frequencies can destroy disease. Herein lies the link between frequency (vibration) and health. Scientific research has shown that different parts of our bodies have their own sonic signature. In other words the sound of the cells of your heart differs from the sound of the cells of your Lungs.

Frequency, which is measured in hertz (Hz) units, is the rate at which vibrations and oscillations occur. Frequencies are used to determine and differentiate vibrational patterns. So, an atom that is vibrating at a faster rate would be considered a higher frequency than one that is vibrating at a much slower rate. Differentiating between high and low frequencies is important for understanding how the two interact with each other and can be beneficial or detrimental to your health.

How Vibration and Frequency Affect Your Wellbeing

Humans have an optimal frequency–as does everything else in the universe–that occurs when each of the cells in our body vibrates at the frequency it was designed to. Bruce Tainio, a famous researcher and developer of Tainio Technology, found that a healthy body resonates at a frequency of 62-70 MHz, and when your frequency drops to 58 MHz, that is when the disease starts. Bacteria, viruses, and disease each have their own, low frequency that influences your energy field.



Frequency Chart:
https://freeyourmindyp.wordpress.com/

As your frequency drops due to environmental and physiological factors, your immune system is compromised and opportunistic bacteria and viruses are able to wreak havoc on your body–making you more susceptible to disease. Trapped emotions stored in our organs, muscles and tissues as pockets of electromagnetic energy also have a negative influence our wellbeing. Disharmony and imbalance in the body's energy field shows up long before it becomes a physical problem.

Maintaining a High Vibrational Frequency

Ideally, you want to be a high vibrational being to attain peak health and wellness for your mind, body, and soul. So what can you do to raise your vibration? First, let's think about everything you come into contact with, ingest, listen to, think, etc…. Each of these things have their own vibrational frequency that affects your energy field! The good news is, we can actively make changes to raise or maintain a high vibration.

Start by cutting out toxic, low-vibrational people from your life that make you or your thoughts turn negative. Think positive! Our thoughts are vibrations too, we can change our frequency by reframing our perception into something more positive and of a higher vibration. Loving, Smiling, Blessing, Thanking, Playing, Painting, Singing, Dancing, Stretching, Meditating, Walking in the Sun, Exercising, Enjoying nature, etc.

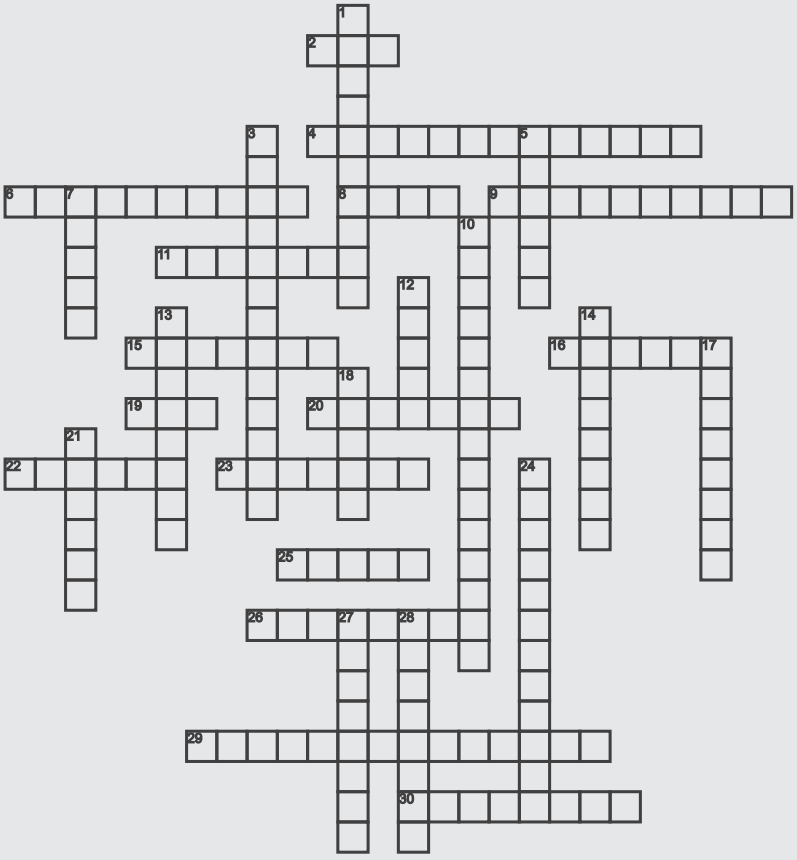
Foods that the Earth gives us: seeds-grains-cereals-legumes-fruits and vegetables-

Drinking water: help us vibrate higher ..... !!!

Be Healthy And Enjoy Your Life.

VIBRATE HIGHER

Crossword on
Atomic Structure and the Periodic Table



Across

2. Each _____ on the Periodic Table represents the number of "energy levels" an element has.

4. The elements are organized into this grid.

6. When elements react they form new _____.

8. The smallest unit of matter with all the properties of that substance.

9. Characteristics that are measurable or observable are called physical _____.

11. An element that can have a variable number of neutrons in its nucleus.

15. The "outer energy shell" of and atom

16. Each _____ on the periodic table represents the number of valence electrons in an element.

19. A charged particle.

20. A neutron has a _____ charge.

22. Atoms with full outer energy shells are known to be _____.

23. The center of an atom where the protons and neutrons are located.

25. Electrons are "stolen" in this type of bond.

26. Reactivity is a _____ property.

29. An abreviated way to name an element.

30. Subtract the atomic number from the atomic mass to find the number of _____.

Down

1. A "Family" of elements that do not typically react with other elements.

3. The location around the nucleus where electrons orbit.

5. This element is found in all organic matter and has four valence electrons.

7. The "electronic connections" between elements in a molecule.

10. NaCl is the _____ for salt.

12. Other than hydrogen and helium, the number of electrons needed to fill the valence shell.

13. The "Family" of elements that are very reactive.

14. Protons have a _____ charge.

17. Electrons have a _____ charge.

18. "Like" electric charges _____ each other.

21. A group of elements with similar properties are known as a _____.

24. This matches the number of protons in an atom.

27. A combination of one or more atoms.

28. Electrons are "shared" in this type of bond.

Answers will be published in the next issue of the Science Spectrum

PIONEERS OF CRISPR GENE EDITING WIN CHEMISTRY NOBEL

Emmanuelle Charpentier and Jennifer Doudna share award for developing the precise technology.

Jennifer Doudna and Emmanuelle Charpentier share the 2020 Nobel chemistry prize.

Nobel Prize 2020 in Chemistry was awarded jointly to Emmanuelle Charpentier and Jennifer A. Doudna **for discovering the CRISPR-Cas9 genetic scissors**, which allows scientists to 'cut-paste' inside a genetic sequence.

About the discovery

• TRACRRNA: During Emmanuelle studies of streptococcus pyogenes, one of the bacteria that cause the most harm to humanity, she discovered a previously unknown molecule, tracrRNA.

O Further studies revealed that this tracrRNA was part of the bacteria's immune system and it helps the bacteria destroy viral DNA.

REPROGRAMMED CRISPR-CAS9: Both succeeded in recreating the bacteria's scissors and reprogramming it and then proved that they can now use these scissors to cut any dna molecule at a required site.

Genome editing

● Genome editing is a technology that gives scientists the ability to change an organism's DNA.

● This allows genetic material to be added, removed, or altered at particular locations in the genome.

● It is a three-stage complex mechanism of unwinding, cleaving and rewinding of DNA to bring desirable changes in the genome of any living beings.

o Cleaving of the DNA includes editing of genes (cut paste of the DNA).

● **Other genome editing systems** include TALENs and Zinc-Finger Nucleases.

Clusters of Regularly Interspaced Short Palindromic Repeats (CRISPR)

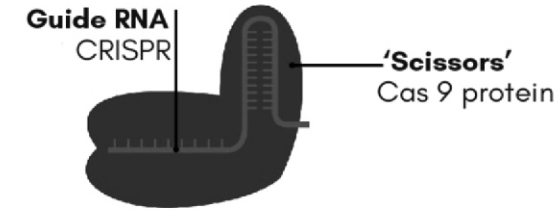
- **CRISPR:** They are specific segments in the bacterial DNA that contain palindromic repeats inter spaced with pieces of DNA (called spacer) that bacteria snip off from attacking viruses.

  o Rodolphe Barrangou discovered that CRISPR is the natural defence mechanism of Bacteria against virus attack.
- **Cas9:** It is a CRISPR-associated (Cas) endonuclease, or enzyme, that acts as "molecular scissors" to cut DNA at a location specified by a guide RNA.
- CRISPR-Cas9: It is a unique genome editing technology that enables geneticists and medical researchers to edit parts of the genome by removing, adding or altering sections of the DNA sequence.

THE CRISPR/CAS GENETIC SCISSORS

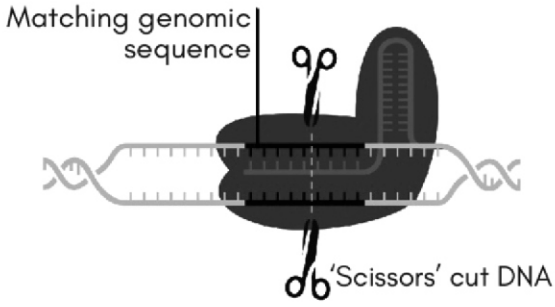
CRISPR/CAS system

An artificially constructed gene editing tool



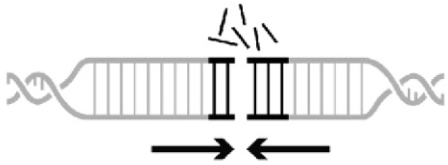
How the genetic 'scissors' work

1. Double strand DNA break



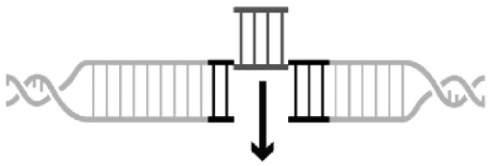
2. DNA editing

A) Deletion of a DNA section



B) Insertion of a single DNA building block

C) Integration of a new DNA section



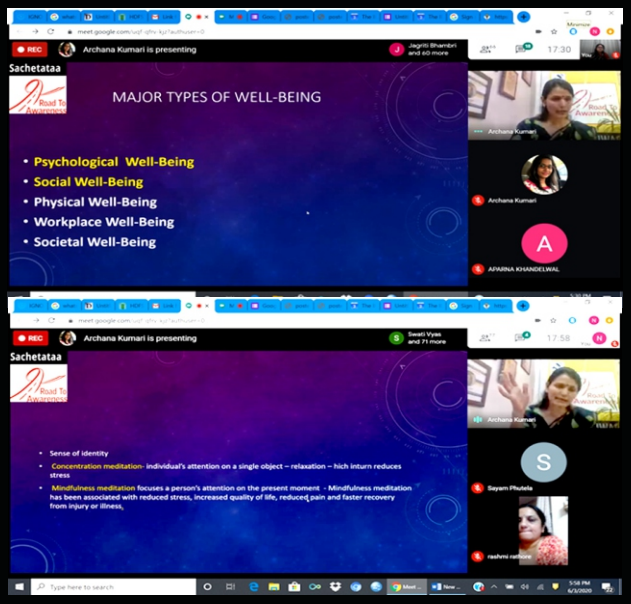
Significance of the discovery

- CRISPER cas9 tool **is easier to adapt and genes could be edited within few weeks** with this tool.
- It has contributed to **discoveries in basic research**, and plant researchers have been able to develop crops that withstand mould, pests and drought.
- In medicine, **clinical trials of new cancer therapies are underway**, and it can help cure inherited diseases.
- These genetic scissors have **taken the life sciences into a new epoch** and, in many ways, are bringing the greatest benefit to humankind.

Source : www.visionias.in

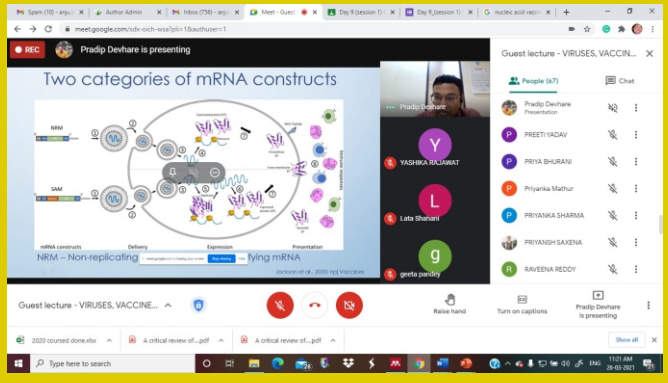
Two Days Webinar on Nutrition and Wellness During Covid 19

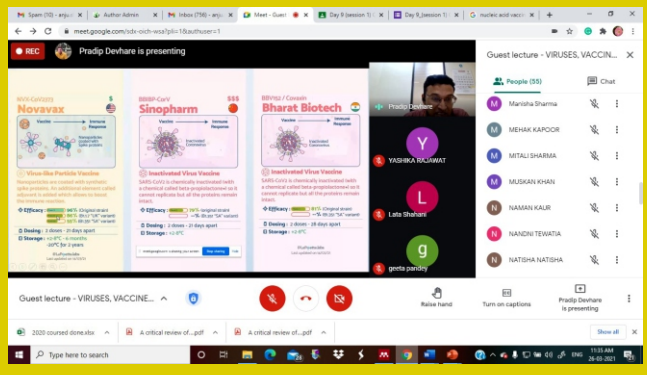
The Department of Home Science, IIS (deemed to be University), Jaipur has organised two daywebinar on 'Nutrition and Wellness during Covid 19' on 2-3 June , 2020.
A total of 230 candidates were registered foe the webinar but due to some technical error 153 participants could attend the first session and 170 participants attended the second session. The expert for the first day session was Ms. Neha Tiwari. She is the founder Director of 'Sachetataa' and also an Audiologist and Speech Language therapist. The topic for her talk was "Maintaining Wellbeing during Covid 19". Second session of Webinar entitled 'Nutrition and Wellness during Covid 19' was conducted. The Resource person for second day was Dr Medhavi Gautam and topic of her talk was 'Diet, Nutrition and Immunity during Pandemic'.



Guest Lecture On Viruses, Vaccine Innovations and Nucleic Acid Vaccine

The Department of Zoology, IIS (deemed to be University) Jaipur organized a Guest Lecture on VIRUSES, VACCINE INNOVATIONS AND NUCLEIC ACID VACCINE for research scholars, students of science faculty and staff members. Lecture was delivered by Dr. Pradip B. Devhare on MARCH 26, 2021 from MANIPAL INSTITUTE OF VIROLOGY.





One day interaction/ technical talk on "Energy Swaraj: Essence of Sustainability"

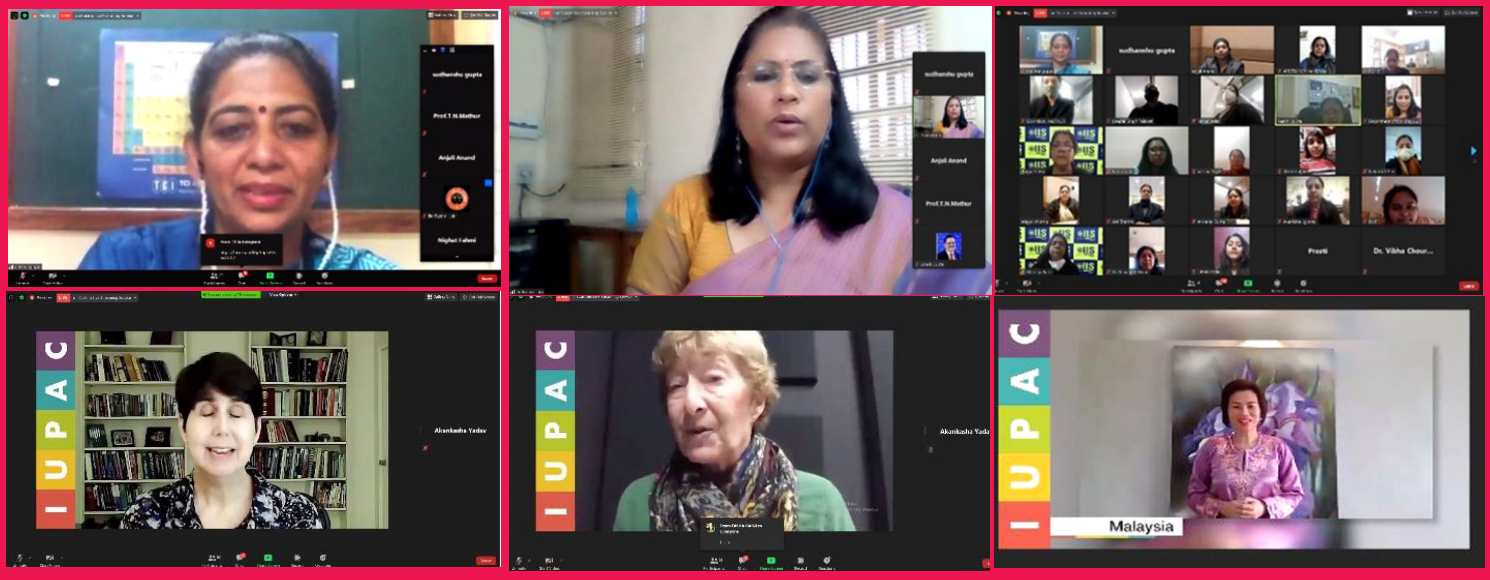
IIC Council and Department of Physical & Computing Sciences, IIS (Deemed to be University), Jaipur organized a one day interaction/ technical talk of Prof. Chetan Singh Solanki, IIT Bombay on "Energy Swaraj: Essence of Sustainability" on 24th Feb. 2021 in A.V. Hall at University campus. The session was headed by Prof Chetan Singh Solanki from the Department of Energy Science and Engg., Indian Institute of Technology (IIT), Bombay who is widely known as the Solar Man and Solar Gandhi for his endeavours to promote solar energy in India.

International Webinar on "Scientific Writing"

The Department of Chemistry, IIS (deemed to be University), Jaipur had organized a two day International Webinar on "Scientific Writing" on 27 and 28 November 2020 in collaboration with Association of Chemistry Teachers, Mumbai, to introduce the participants to the different facets of scientific writing, plagiarism and scientific misconduct. The webinar received overwhelming response from all over the world and in total 1145 delegates including 558 Undergraduate and Postgraduate students, 258 research scholars and 329 faculty members have been registered for this webinar. Speakers of the webinar were Prof. Gyorgy Keglevich, Prof. Martin Rudd, Prof. Sandeep Verma, Prof. R.K. Bansal, Prof. Ayaan Datta, Prof. Masaaki Yoshifuzi and Prof. S. D. Samant.

International Webinar on Research and Innovation: Exploring Gendered Challenges

In tune with the Global Women's Breakfast event being organized by the International Union of Pure and Applied Chemistry(IUPAC) on the theme of "Empowering Diversity in Science", the Departments of Chemistry, Sociology and Centre for Women's Studies, IIS(deemed to be University), Jaipur, in collaboration with Association of Chemistry Teachers(ACT) organized a global webinar on **"Research and Innovation: Exploring Gendered Challenges"** on February 9, 2021. Speakers were Dr. Rashmi Jain and Dr. Neelima Gupta. The webinar was attended by 264 registered candidates. The webinar enriched the knowledge of participants regarding contribution of women scientists and inculcated a better understanding of the challenges and barriers faced by women in the field of science. The webinar also promoted the notion that bridging the gender gap in science will have a high positive impact on development of society.



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