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

Sign /-
(Dr. S.P. Jagadale, Principal)
(The editor and publisher may not agree with the views expressed in articles.)

SPACE -Plant Biology Program

What We Study

At NASA Space Biology, conduct functional and plant biological experiments to better understand the basics of physiology—how plants grow and acclimate—in conditions of microgravity and spaceflight. Is the lack of gravity encouraging or inhibiting plant growth? Are plants acclimating to microgravity onboard the ISS? Can we improve their genes? What does it take to get plants to grow in space? These are the questions we strive to answer.

Seed to Seed: Growing Multiple Generations of Plants in Space

Over the last half century, researchers have pushed back many of the barriers to the successful growth of plants in space regarding lighting requirements, humidity and temperature control, and atmospheric considerations (the lack of convective mixing, elevated CO2 levels, ethylene and other volatile organic compounds present in cabin air).

Scientist have confirmed that photosynthesis proceeds normally under microgravity conditions when adequate light, water, and nutrients are provided to the plants, and NASA-sponsored ground studies have shown that hydroponically grown crops can surpass world record yields, with commercial growers adopting some of these methodologies. Several plant species have been grown "seed-to-seed" in space (e.g., Arabidopsis, wheat, and soybean), and some plants seeds were returned to Earth and then sent back to space for second-generation studies. (Mashinsky, et al., 1994: PMID 11540174; Levinskikh, et al., 2001: PMID 11668959; Link, et al., 2003: PMID 14686438).

Watering systems for plants have been designed, and validated in space, but this is an area where major challenges still remain for the optimization of plant growth in microgravity since the lack of convective mixing has implications for the movement of water, oxygen and solutes through the root zone. As a consequence, most plants returned from microgravity have experienced some degree of hypoxia stress, and diffusion-limited movement of solutes have been shown to affect nutrient uptake by the roots.

Fundamental Research: Unlocking the Secrets of Botany

NASA has awarded numerous research studies during the last few decades that have contributed a wealth of knowledge of how plants respond and acclimate to the

conditions of spaceflight. Additionally, the ability to incorporate the unique treatment of microgravity into experimental designs, which is not possible on Earth, has also allowed NASA-funded researchers to discover new aspects of plant physiology and metabolism heretofore unknown (with implications for enhancement of agriculture on Earth).

As a result, NASA researchers have uncovered new aspects of the basic perception, transduction, and response of plants to gravity. For example, by conducting experiments with plant tissue retrieved from spaceflight, space biologists have been able to detect differences in gene expression between the microgravity environment of space and 1-G environment of Earth and draw inferences on the types of enzymes and metabolic responses that occur in plants during growth and development in space.

Developing New Technology to Grow Plants in Space

Applied science at NASA takes our existing scientific knowledge and applies discover in space to practical applications on Earth. New technology coming out of the Space Biology program includes the Advanced Plant Habitat (APH). The APH is a large plant growth facility capable of long-duration plant development studies. This facility is a closed, controlled system that can monitor and measure temperature, relative humidity, carbon dioxide, and oxygen.

The APH has a sophisticated air filtration system, imaging capabilities, and a growth light assembly configured with red, blue, green, white, and far-red LED lights. The LED lights can be adjusted with varying intensities and scheduled to mimic the day-and-night cycles plants experience here on Earth.

The APH was built from its predecessor, Veggie, a self-contained fresh food production system. Veggie combines an array of red, blue, and green LED lights; a root mat; plant "pillows" containing seeds; and a special nutrient-enriched substrate mix devised by NASA. Our goal is to grow healthy food with minimal requirements. What they discover on the ISS using Veggie is telling us how to get the greatest plant yield using the least amount of soil, water, and nutrients in the least amount of space.This will have a major impact on food production by indoor growers back on Earth, who can use these technologies to accommodate extremes of climate and produce more nutritious food using less water and energy in a controlled environment.

Reference:

https://science.nasa.gov/biological-physical/focus-areas/plant-biology/focus-areas/

Article by
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Department of Botany

Adding Tomato Pigment To Solar Panels Increases Their Efficiency

Simulated images of the carbon nanotube Möbius strips

Scientists and researchers are constantly striving to enhance the efficiency and sustainability of renewable energy sources, and a recent breakthrough involving tomatoes and solar panels has sparked great interest. An investigation has unveiled that the inclusion of lycopene, the pigment accountable for the striking red hue of tomatoes, within perovskite solar cells can substantially enhance their efficacy.

Perovskite solar cells have garnered considerable interest in recent times for their capacity to transform the realm of solar energy. These cells are economically viable, lightweight, and can be manufactured through relatively uncomplicated procedures. However, their efficiency has been a major challenge, with researchers tirelessly exploring ways to optimize their performance.

In this study, scientists found that by incorporating lycopene into the perovskite material, they were able to enhance the absorption of sunlight and improve the efficiency of the solar cells. Lycopene, a powerful antioxidant abundant in tomatoes, efficiently captures sunlight in the red and near-infrared spectrum.

The implications of this breakthrough hold great significance for the prospective advancements in solar energy. The addition of lycopene to perovskite solar cells could lead to a substantial increase in their efficiency, making them even more competitive with traditional silicon-based solar cells. It also presents an innovative approach to harnessing the power of natural pigments for renewable energy generation.

Furthermore, the use of lycopene derived from tomatoes offers an environmentally friendly solution. Tomatoes are a widely available and sustainable source of this pigment, making it a cost-effective and easily accessible option for large-scale implementation

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Article by
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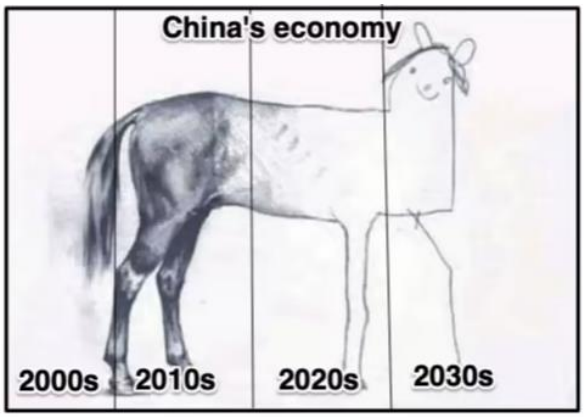
Japanification of China???



Whether China is about to enter a "balance sheet recession" is the biggest unanswered topic in global macroeconomics at the time.

Richard Koo of Nomura was the first to use this attractive economic buzzword to refer to Japan's lost decade(s), but it is more frequently called "Japanification."It can be summed up as a protracted period of deflation, economic stagnation decreases in the real estate market, and financial hardship as people, businesses, and governments attempt in vain to deleverage following a debt binge.

China has lowered one benchmark lending rate while maintaining another, despite market expectations. The economy grew by only 0.8% in Q2 2023, compared to the previous three months. The government is pressured to lower interest rates and boost demand due to a slowdown in the housing market, a drop-in export, and rising youth unemployment. Growth has been constrained despite the easing of pandemic restrictions. A reminder that China has been slowly posting fewer and fewer economic indicators in recent years as the data has been less optimistic comes at the same time as China says that it would stop providing young unemployment data (due to the rate being extremely high!).

However, earlier this month, JPMorgan analysts Haibin Zhu, Grace Ng, etc. published an intriguing in-depth analysis on the subject in which they claimed to have found "enough differences to suggest the 'balance sheet recession' diagnosis and policy recommendations that flow from it, is/are not correct," despite finding some unsettling parallels between China today and Japan in the 1990s.

China's housing market correction since 2021 is structural and cyclical, similar to Japan's 1990s correction. China's total non-financial credit/GDP ratio approached 297% of GDP by end-2022, similar to Japan's 1990s ratio. Both countries have high domestic debt and high saving rates. The issue of population ageing is similar, with Japan having a 12.7% aged population in 1991 and China having a 12.6% aged population in 2019. Japan's trade surplus with the US led to trade conflict, exemplified by the 1985 Plaza Accord and the 2018 US-China tariff war. Japan and China's rise to challenge the US's global economic status prompted US fight-back focusing on reducing bilateral trade imbalance.

But there are some differences as well some of which are better for China while others can prove themselves ugly. China's urbanization ratio in 2022 was 65%, with a hukou ratio of 47%. This suggests a potential for productivity increase due to labour migration. China may face housing demand from 250 million people, or 100 million families, due to the 18% gap between urban and hukou populations.

China's larger domestic market, STEM graduates, and manufacturing sectors offer the potential for technology upgrades and commercialization, particularly in new energy and vehicles, despite facing a more challenging external environment. China's housing price overvaluation is less severe than Japan's in the 1990s, partly due to administrative control and income growth. Housing affordability remains a major issue in tier-1 cities, with a decrease in affordability in tier-2 and tier-3 cities. This is due to improved housing affordability.

China's capital account is not fully liberalized, reducing the risk of a fire sale of domestic assets for overseas investment. However, the government's stronger control over the asset and liability sides of the debt problem may reduce the probability of a sudden-stop crisis but may intensify the moral hazard problem and weaken structural reforms.

JPMorgan's major worry, though, is that China is ageing more quickly than Japan did, which has led to forecasts that it will "grow old before it grows rich" — a sort of middle-income trap brought on by demography. Japan's population aged 65 and above reached 14% in 1994, while China's population increased from 10% to 14% in just 7 years. The birth rate fell from 12.7 to 10.0 during this period. China's total population began to decline in 2022, similar to Japan's in 2020. Additionally, China's GDP per capita was lower than Japan's in 1991, suggesting that China is becoming old and high-indebted before becoming rich. This suggests that China is becoming older and more indebted before becoming rich.

China faces a more complex external environment due to strategic competition with the US, technology decoupling from the US, and slowed globalization. The Russia-Ukraine war in 2022 further accelerates global supply chain relocation, impacting China's growth potential. Macro policy stimulus is limited in China, with government debt reaching 95% of GDP by end-2022, compared to Japan's 131% by 2000.

But the fact that China's debts have increased and will likely continue to do so for the foreseeable future—and that the real estate market hasn't collapsed yet—isn't exactly a defence of China's Japanification. In fact, it can just point to the fact that a full-scale version hasn't yet begun. Furthermore, no two economic crises will ever be the same. Of course, China won't exactly or even loosely follow Japan's economic trajectory. Both the countries and the periods they live in are vastly different.

However, there are enough general similarities to believe that the overall disease—a lengthy period of declining demographics, economic stagnation, deleveraging, and deflationary pressures—might wind up being rather similar.

All-in-all keeping a close eye on China in the coming months would be quite interesting and of immense relevance to everybody who lives on this planet!!

Article by
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Cyber Crime in India

With the increasing use of computers in society, cybercrime has become a major issue. The advancement of technology has made man dependent on internet for all his needs. Internet has given man access to everything while sitting at one place. Social networking, online shopping, online studying, online jobs, every possible things that Man can think of can be done through the medium of internet.

The cyber crime is different from any other crime happening in the society. The reason being, it has no geographical boundaries and the cyber criminals are unknown. It is affecting all the stakeholders from government, business to citizens alike. In India cybercrime is increasing with the increased use of information and communication technology (ICT). Therefore, this article tries to study a brief introduction of cybercrime, different types, Amendments, and analyse the cyber crime happening in India. Further he discusses some steps to overcome cybercrime in India.

Introduction:

What is cybercrime? Cybercrime is a broad term that is used to define criminal activity in which computers or computer networks are a tool, a target, or a place of criminal activity and include everything from electronic wracking to denial of service attacks. It is a general term that covers crimes like phishing, Credit card frauds, bank robbery, illegal downloading, industrial espionage, child pornography, kidnapping children via chat rooms, scams, cyber terrorism, creation and or distribution of viruses, spam and so on.

It also covers that traditional crimes in which computers or networks are used to enable the illicit activity. Cyber crime is increasing day by day, nowadays it has become a new fashion to earn money by fraud calls or to take revenge through hacking other accounts.

Types Of Cybercrimes:

Cybercrime ranges variety of activities. Cyber crime can be basically divided into three major categories:

Cyber crimes against persons like harassment occur in cyberspace or through the use of cyberspace. Harassment can be sexual, racial, religious, or other.

Cyber crimes against property like computer wreckage (destruction of others' property), transmission of harmful programs, unauthorized trespassing, unauthorized possession of computer information.

Cyber crimes against government like Cyber terrorism

A. Crimes against persons are:

Cyber-Stalking:

It means to create physical threat that creates fear to use the computer technology such as internet, e-mail, phones, text messages, webcam, websites or videos.

Dissemination of Obscene Material:

It includes Indecent exposure/ Pornography (basically child pornography), hosting of web site containing these prohibited materials. These obscene matters may cause harm to the mind of the adolescent and tend to deprave or corrupt their mind.

Hacking:

It means unauthorized control/access over computer system and act of hacking completely destroys the whole data as well as computer programmes. Hackers usually hacks telecommunication and mobile network.

Cracking:

It is one of the serious cyber crimes known till date .Cracking means that a stranger has broken into your computer systems without your knowledge and consent and has tampered with precious confidential data and information.

E-Mail Spoofing:

A spoofed e-mail may be said to be one, which misrepresents its origin. It shows itsorigin to be different from which actually it originates.

SMS Spoofing:

Spoofing is a blocking through spam which means the unwanted uninvited messages. Wrongdoer steals mobile phone number of any person and sending SMS via internet and receiver gets the SMS from the mobile phone number of the victim. It is very serious cyber crime against any individual.

Carding:

It means false ATM cards i.e. Debit and Credit cards used by criminals for their monetary benefits through withdrawing money from the victim's bank account mala-Fidel. There is always unauthorized use of ATM cards in this type of cyber crimes.

Cheating & Fraud:

It means the person who is doing the act of cyber crime i.e. stealing password and data storage has done it with having guilty mind which leads to fraud and cheating.

Child Pornography:

It involves the use of computer networks to create, distribute, or access materials that sexually exploit underage children.

B. Crimes against Property:

As there is rapid growth in the international trade where businesses and consumers are increasingly using computers to create, transmit and to store information in the electronic form instead of traditional paper documents.

There are certain offences which affects persons properties which are as follows:

Intellectual Property Crimes:

Intellectual property consists of a bundle of rights. Any unlawful act by which the owner is deprived completely or partially of his rights is an offence. The common form of IPR violation may be said to be software piracy, infringement of copyright, trademark, patents, designs and service mark violation, theft of computer source code, etc.

C. Cybercrimes against Government

There are certain offences done by group of persons intending to threaten the international governments by using internet facilities. It includes:

Cyber Terrorism:

Cyber terrorism is a major burning issue in the domestic as well as global concern. The common form of these terrorist attacks on the Internet is by distributed denial of service attacks, hate websites and hate e-mails, attacks on sensitive computer networks etc. Cyber terrorism activities endanger the sovereignty and integrity of the nation.

Cyber Warfare:

It refers to politically motivated hacking to damage and spying. It is a form of information warfare sometimes seen as analogous to conventional warfare although this analogy is controversial for both its accuracy and its political motivation.

Analysis Of Cybercrimes In India:

India is the second largest online market in the world with over 560 million internet users, Ranked only behind China. And it is estimated that by 2023, there would be over 650 million internet users in the country. According to the latest national crime records bureau NCRB data, a total of 27, 248 cases of cybercrime where registered in India in 2018.

Total number of cybercrimes reported in India from 2012-2018

Number of cyber crimes

2018 27,248
2017 21,796
2016 12,317
2015 11,592
2014 9,622
2013 5,693
2012 3,377

The above table clearly shows the increasing number of cybercrimes cases in India. The top 5 popular cybercrimes are- Phishing scams, identity theft scams, online harassment, cyber stalking, invasion of privacy.

Origin Of Cyber Crime:

At the beginning of 1970s, criminal regularly committed crimes via telephone lines. The perpetrators were called Phreakers. Actually, there was no real cybercrime until the 1980s. One person had another person's computer to find, copy or manipulate personal data and information. The first person to be found guilty of cybercrime was Lan Murphy, also known as Captain Zap, and that happened in the year 1981.He had hacked the American telephone company to manipulate its internal clock, so that users could still make free calls at peak times.

Cyber Laws:

Cybercrimes are a new class of crimes which are increasing day by day due to extensive use of internet these days. To combat the crimes related to internet The Information Technology Act, 2000 was enacted with prime objective to create an enabling environment for commercial use of I.T. The IT Act specifies the acts which have been made punishable. The Indian Penal Code, 1860 has also been amended to take into its purview cybercrimes.

The various offenses related to internet which have been made punishable under the IT Act and the IPC are enumerated below:

Cybercrimes under the IT Act:

Tampering with Computer source documents - Sec.65

Hacking with Computer systems, Data alteration - Sec.66

Publishing obscene information - Sec.67

Un-authorised access to protected system Sec.70

Breach of Confidentiality and Privacy - Sec.72

Publishing false digital signature certificates - Sec.73

Article by -
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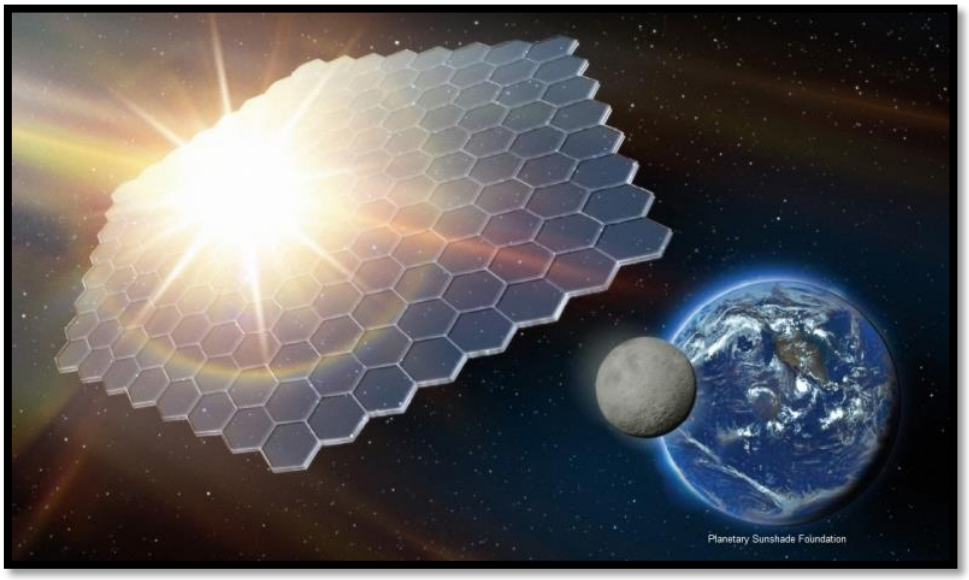
Creating a Solar Shield to Help Save the Planet



In 2015, the global community agreed to pursue efforts to limit average global temperature rise to less than 1.5 °C above pre-industrial levels. Experts agree that this limit would prevent some of the most catastrophic impacts of global climate change. While many experts publicly champion initiatives designed to meet the 1.5 °C limit, some experts say that exceeding the limit is unavoidable given the carbon emissions already in the atmosphere, according to Scientific American. Low-key acknowledgment of this reality has given credence to controversial proposals focused on engineering our way out of a global climate crisis. These "geoengineering" or "climate intervention" proposals generally fall into two categories: remove greenhouse gases from the atmosphere or reduce warming from the sun.

Although the technology for these proposals does not currently exist at the scales needed, and some proposals potentially carry significant adverse side effects, it does not stop them from being taken seriously. The study authors outline the challenges of developing and installing a solar shield. The most practical approach based on existing literature, the authors say, is using a massive dust cloud that orbits between the Earth and the Sun. One of the biggest challenges with this approach is getting a dust cloud to track Earth's orbit. In addition to battling gravity, a dust cloud would have to withstand radiation pressure from the Sun. The study team said establishing a cloud inside the LaGrange point 'L1' would allow it to track our planet on an Earth-synchronous orbit. LaGrange points are points relative to the Earth and Sun where the gravitation forces of the two bodies cancel each other out to allow for a stable orbit. This orbit would allow the dust cloud to resist the gravitational pull of the Sun and the Earth and the physical force of the Sun's radiation.

The study team then assessed the various shadows that would be created by different types of dust cloud. In addition to blocking out radiation, the dust must be made of highly refractive material to resist radiation pressure from the sun. When an object deflects radiation rather than absorbs it, the pressure of photons is minimized. The biggest challenge is creating a large enough cloud to have the desired impact on climate

Ultimately, the study team concluded that the most practical approach would be to mine the fluffy dust covering the Moon's surface, called regolith. Moon dust could feasibly be launched along a solar orbit within the L1 point. With this approach,

every photon deflected or absorbed by the dust cloud would have been earthbound. If the cloud were launched farther or closer, this efficiency would decrease. Because the biggest, most reflective dust cloud will not have much of an impact if it does not last very long, the study team determined that launching it from the L1 point at speeds of around 10 meters per second would help the cloud to resist the effects of solar radiation. At this point, the development is very much in the theoretical stage, and it is unclear if the study team's proposal would be effective or have unintended consequences. The study published in the PLOS Climate journal opens the door to further scientific inquiry and discourse, stimulating innovative thinking and collaborative efforts to confront the global climate crisis.

Reference:

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Article by -
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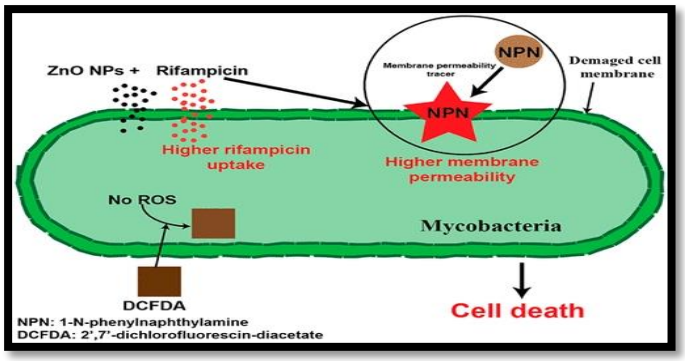
Antibiotics Rifampicin



Antibiotics are medicines that fight bacterial infections in people and animals. They work by killing the bacteria or by making it hard for the bacteria to grow and multiply. Antibiotics prepared from microorganisms to inhibit growth of other microorganisms.They show there activity by inhibiting bacterial cell wall Synthesis, Protein synthesis Nucleic acid synthesis such as DNA and RNA of bacterial cell. Different antibiotics have different activities they have various mechanism action on bacteria. From that one of the antibiotic is Rifampicin. Rifampicin rifampin is a bactericidal antibiotic drug of the rifamycin group.It is a semisynthetic compound derived from *Amycolatopsis rifamycinica* (formerly known as *Amycolatopsis mediterranei* and *Streptomyces mediterranei*).Rifampicin may be abbreviated R, RMP, RA, RF, or RIF. Rifampicin is also known as rifaldazine and rifampin in the United States. In 1957, a soil sample from a pine forest on the French Riviera was brought for analysis to the Lepetit Pharmaceuticals research lab in Milan, Italy. There, a research group headed by Prof. Piero Sensi (1920-) and Dr. Maria Teresa Timbal (1925 - 1969) discovered a new bacterium. This new species appeared immediately of great scientific interest since it Rifampicin was introduced in 1967 as a major addition to the cocktail-drug treatment of tuberculosis and inactive meningitis, along with isoniazid, ethambutol, pyrazinamide and streptomycin.Including tuberculosis (TB), *Mycobacterium avium* complex, leprosy. Rifampicin is used in the treatment of methicillinresistant Staphylococcus aureus (MRSA) in combination with fusidic acid, including in difficult to treat infections such as osteomyelitis and prosthetic joint infections.It is also used in prophylactic therapy against Neisseria *meningitidis* (meningococcal) infection. Rifampicin has some effectiveness against vaccinia virus. is on the World Health Organization's List of Essential Medicines The World Health Organization classifies rifampicin as critically important for human medicine. It is available as a generic medication.. It works by inhibiting the bacterial DNA dependent RNA polymerase enzyme so inhibit RNA synthesis so without RNA there is no synthesis of protein, and no growth, multiplication of bacteria.

Production:-

Manufacturing process of rifampicin consists of two stages,

i) Fermentation of *Nocardia mediterranei* (a micro-organism) to yield rifamycin B;

ii) Synthesis of rifamycin-B to rifamycin-O

to rifamycin-S to rifamycin SV to rifampicin.

1) Fermentation

Fermentation is carried out using a mutant micro- organism of *Nocardia mediterranei* under aseptic conditions. The micro-organism is grown by feeding the nutrient media. The whole fermentation cycle is completed in 160 to 200 hours. Rifamycin-B is separated from the mycelium by extraction and filteration.

2) Synthesis:-

Rifamycin B, in presence of sodium persulphate, is oxidised to rifamycin-O. Rifamycin-O is hydrolysed with sulphuric acid and tetra-hydrofuran to give rifamycin-S. rifamycin-S is first treated with t-butyl-amine and manganese-di-oxide and then reduced and hydrolysed by ascorbic acid and sulphuric acid to yield 3-formyl-rifamycin-SV(3FRSV). The penultimate stage of rifampicin consists of reacting 3FRSV with l-amino-4-methyl piperazinamine, and other solvents to give rifampicin.

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Article by:
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LIGO : LASER Interferometer Gravitational-Wave Observatory

Introduction:

LIGO, or the Laser Interferometer Gravitational-Wave Observatory, is a groundbreaking scientific project that has revolutionized our understanding of the universe.The history of LIGO can be traced back to the early 1960s, when Joseph Weber at the University of Maryland pioneered the effort to build detectors for gravitational waves. Weber's detectors were based on the principle of resonant bar detectors, which use large cylinders of aluminum that vibrate in response to a passing gravitational wave.

In 1962, Michael Gertsenshtein and Vladislav Pustovoit in Moscow, Russia, and independently several years later by Rainer Weiss in the United States, proposed a different approach to detecting gravitational waves using laser interferometry.

History of LIGO:

The first laser interferometer gravitational wave detector was built by Rainer Weiss in the early 1970s. This detector was not sensitive enough to detect gravitational waves, but it paved the way for the development of more sensitive detectors.The Laser Interferometer Gravitational-Wave Observatory (LIGO) was conceived in the early 1980s by a team of scientists led by Rainer Weiss, Kip Thorne, and Ronald Drever. LIGO is a pair of laser interferometers located in Hanford, Washington, and Livingston, Louisiana. The two detectors are about 3,000 kilometers apart, which allows them to detect gravitational waves from different directions.Construction of LIGO began in 1994 and was completed in 2000. The first scientific observations with LIGO began in 2002, but no gravitational waves were detected. In 2008, LIGO began a major upgrade project called Advanced LIGO.

LIGO Livingston control room as it was during Advanced LIGO's first observing run

Construction of LIGO :

LIGO consists of two 4-kilometer-long vacuum tubes arranged in an L-shape. A laser beam is split into two beams that travel down the two arms of the interferometer. If a gravitational wave passes through the interferometer, it will cause the two arms to lengthen or shorten by a tiny amount, which can be detected by the laser beam.The construction of LIGO was a major undertaking. The vacuum tubes had to be built in underground tunnels to protect them from vibrations and other disturbances. The mirrors at the ends of the tubes had to be made of extremely smooth and stable materials. And the entire system had to be kept extremely cold to reduce the effects of thermal noise.

Here are some of the key components of LIGO:

- **The vacuum tubes**: The vacuum tubes are the heart of LIGO. They are 4 kilometers long and are made of ultra-pure steel. The tubes are kept under vacuum to reduce the effects of air resistance and other disturbances.
- **The mirrors**: The mirrors are located at the ends of the vacuum tubes. They are made of extremely smooth and stable materials, such as silicon carbide. The mirrors reflect the laser beam back and forth, allowing the interferometer to measure the slightest changes in the length of the arms.
- **The laser**: The laser is used to create the light beam that travels through the interferometer. The laser is very stable and produces a beam of light that is very narrow and intense.
- **The control system**: The control system monitors the performance of the interferometer and makes adjustments to keep it operating at its best. The control system also analyzes the data from the interferometer to look for signs of gravitational waves.

Gravitational waves are ripples in space-time caused by the acceleration of massive objects, such as the collision of two black holes or neutron stars. The effect of a propagating gravitational wave is to deform space in a quadrupolar form. The effect alternately elongates space in one direction while compressing space in an orthogonal direction and vice versa, with the frequency of the

gravitational wave. A Michelson interferometer operating between freely suspended masses is ideally suited to detect these antisymmetric distortions of space induced by the gravitational waves; the strains are converted into changes in light intensity consequently to electrical signals via photo detectors.

Though Einstein predicted the existence of gravitational waves in 1916, the first proof of their existence didn't arrive until 1974, 20 years after his death. In that year, two astronomers, Russell Hulse and Joseph Taylor, using the Arecibo Radio Observatory in Puerto Rico discovered a binary pulsar 21000 light years from Earth. This was exactly the type of system that general relativity predicted should radiate gravitational waves. Knowing that the system could be studied to test Einstein's prediction, Taylor and two colleagues (Joel Weisberg and Lee Fowler) began tracking the radio emissions from the stars to measure how their orbital period changed over time.

After just four years, they first reported seeing a change in the period that verified that the stars were getting closer to each other at the rate predicted by general relativity (GR) if they were radiating gravitational waves (the rate predicted by GR agreed with the observed rate to within one half of one percent). In 1993, Hulse and Taylor would receive the Nobel Prize in Physics. These waves were first predicted by Albert Einstein's theory of general relativity in 1915 but remained elusive until the construction of LIGO.LIGO uses a sophisticated technique called laser interferometry to detect these waves.

Achievements of LIGO:

The historic detection of gravitational waves by LIGO in 2015 confirmed a century-old prediction of Einstein's theory and opened a new era of astronomy. Since then, LIGO and its European counterpart, Virgo, have made numerous detections of gravitational waves, revealing a previously hidden side of the universe. These detections have provided insights into the nature of black holes, neutron stars, and the fundamental properties of gravity itself. They have also allowed astronomers to observe events that were previously invisible, such as the merger of black holes and neutron stars, shedding light on the most extreme and mysterious phenomena in the cosmos.

In addition to its scientific achievements, LIGO has been able to measure the spins of black holes involved in mergers. This information provides insights into the formation and evolution of black holes. LIGO's detection of the binary neutron star merger event, GW170817, was historic. It was the first time both gravitational waves and electromagnetic radiation (gamma-ray burst and optical light) were observed from the same astrophysical event. This event confirmed that neutron star mergers are responsible for the creation of heavy elements like gold and platinum. While the processes that generate gravitational waves are extremely violent and destructive, by the time the waves reach Earth they are thousands of billions of times smaller, diminishing over time and space just as the waves from a pebble dropped in a pond get smaller and smaller as they move away from the source.

LIGO and India:

The impact of LIGO in India is still unfolding, but it is clear that the project has the potential to make a significant contribution to science, technology, education, and international co-operation. LIGO-India is a joint project between India and the United States. The collaboration has already led to the establishment of several new research groups in India. It will be located in the Hingoli district of Maharashtra, about 450 km east of Mumbai. In April 2023, the Cabinet of India approved the project to build the advanced gravitational-wave detector in Maharashtra at an estimated cost of Rs 2,600 crore. The facility's construction is expected to be completed by 2030. It will be the fifth node of the planned network and will bring India into a prestigious international scientific experiment. These groups are working on a variety of projects related to gravitational wave astronomy, including the development of new detectors, the analysis of gravitational wave data, and the study of the astrophysical sources of gravitational waves. The collaboration between the two countries is expected to strengthen scientific ties and promote the exchange of ideas and technology.

LIGO-India is expected to have a positive impact on education in India. The project will provide opportunities for students and teachers to learn about gravitational waves and their importance. It will also help to raise awareness of science and engineering careers. The project is also expected to create jobs in the Indian economy. The construction and operation of the detector will require the skills of engineers, physicists, and other technical professionals.

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Medicinal values of leeches

Given the lengthy history of complementary health practises, contemporary medicine has only recently focused on their potential mechanisms of action. Numerous studies have looked at the benefits of medicinal leech therapy (MLT), also known as hirudotherapy, on a variety of illnesses, including osteoarthritis and inflammatory diseases, as well as following various procedures. Among leeches, Hirudo medicinalis has the most widespread therapeutic use, although other other species have also been tried and studied internationally. More than 20 known bioactive compounds, including antistasin, eglins, guamerin, hirudin, saratin, and bdellins, as well as complement and carboxypeptidase inhibitors, are secreted by leeches. In addition to extracellular matrix degradative and antibacterial actions, they exhibit analgesic, anti-inflammatory, platelet inhibitory, anticoagulant, and thrombin regulating properties. However, with more research, the range of effects may broaden.MLT, also known as hirudotherapy, is a type of alternative and integrative therapy that uses leeches to draw blood. In order to potentially benefit from the leech saliva secreted when the leeches are feeding, one or more leeches are connected to the skin of the problematic location. MLT has been in use for millennia, and the name "leech" was derived from it (physician).

Leeches are segmented, hermaphrodite, predatory worms that inhabit freshwater. They are sensitive to touch, light, heat, sound, water movements, and a variety of substances. They are split into many different sections, including "brain parts," and each portion contains unique organs like ganglions and testicles. For crawling and adhesion, two sucker pieces are used; the anterior one has three jaws and numerous teeth. They often bite the warm areas of the host and contract rhythmically to draw blood. 3, 5 A leech consumes 10-15 mL of blood per feeding, and feedings typically last for close to 40 minutes. Numerous enzymes and companion microbes, like Aeromonas hydrophila and Pseudomonas hirudinia, work together to accomplish digestion.

After plastic, reconstructive, and microsurgical procedures, MLT is frequently used to treat conditions

including deep vein thrombosis, postphlebitic syndrome, problems of diabetes mellitus, tinnitus, acute and chronic otitis, and osteoarthritis pain. 4, 8 There are more than 600 different leech species, but the ones that are used the most frequently worldwide are Hirudo medicinalis, Hirudo troctina, Hirudo nipponia, Hirudo quinquestriata, Poecilobdella granulosa, Hirudinaria javanica, Hirudinaria manillensis, Haementeria officinalis, and Macrobdella decora.

Leech secretions contain a variety of beneficial compounds, according to numerous research. There are many more compounds awaiting investigation, although more than 20 molecules and their modes of action have already been identified. These compounds also exhibit antibacterial and extracellular matrix degrading properties in addition to analgesic, anti-inflammatory, platelet inhibitory, anticoagulant, and thrombin regulating actions

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