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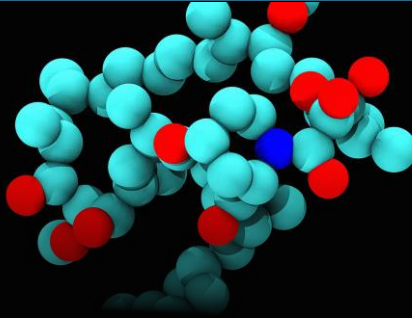
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Mr. Sunil S Chiplunkar

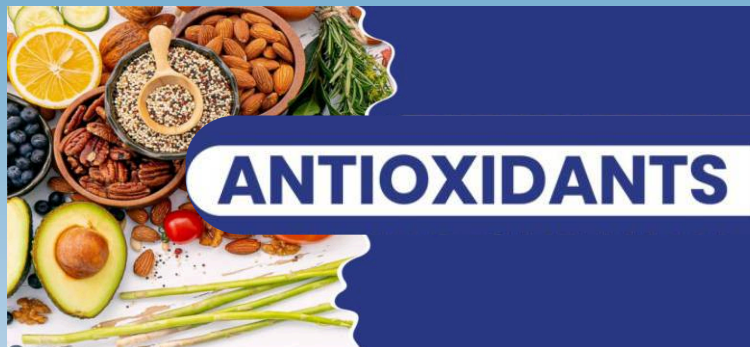
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AN INSIGHT INTO STEM CELLS THEIR SIGNIFICANCE AND THEIR PRESERVATION

Pallavi

Pharm D Intern, SAC College of Pharmacy,
B.G Nagara, Mandya, Karnataka



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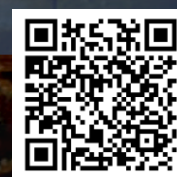
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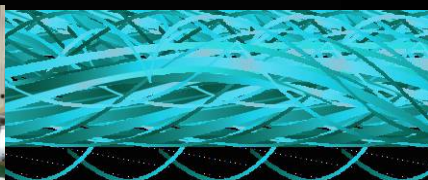
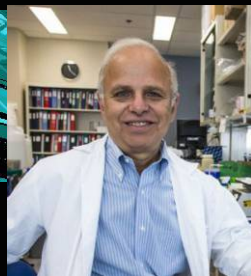
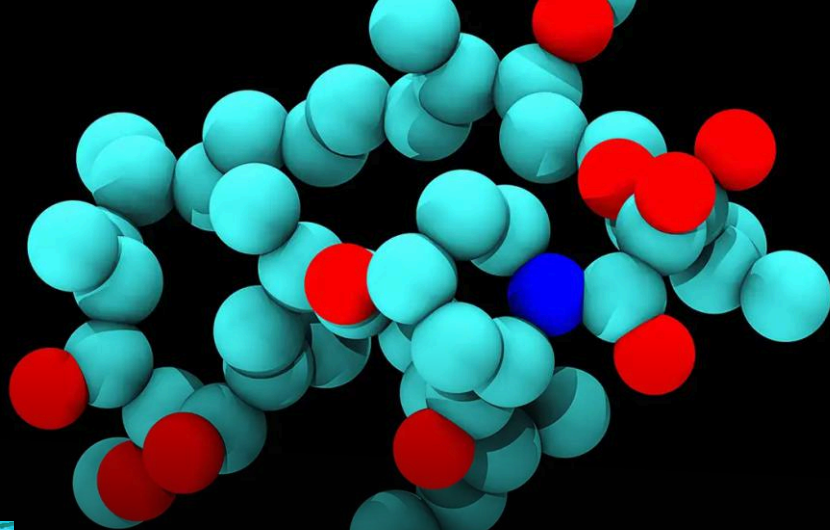
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EXCITING RAPAMYCIN

A Pharmacist's Winning Contribution



Have you heard of rapamycin – and its connection with an Indian pharmacist!? Well hold on – here is an exciting and inspiring story – this drug rapamycin may well lead to an antiaging elixir of youth too!

Dr. Suren Sehgal: the determined pharmacist (BHU alumnus)

The man to bring wonder drug rapamycin out to the world through sheer perseverance, scientific temper and tact was Dr. Suren Sehgal, a pharmacist and microbiologist. Dr. Suren Sehgal (born 1932) – the son of a pharmaceutical businessman of the 1940s, completed his B Pharm in 1952 from Benaras Hindu University (BHU). Dr. Suren then did his post-graduation M Pharm from BHU itself in 1953. When Dr. Suren was 21 years old, with a burning desire to accomplish scientific feats, joined Bristol University, England for his PhD (1957). Dr. Suren then went on to Canada where he joined National Research Council for his post-doc work. Eventually, Dr. Suren took up Canadian citizenship. His noteworthy contribution in pharmaceutical sciences – is bringing out the breakthrough drug rapamycin. Dr. Suren passed away in 2003, at night – while working on a research paper publication. Truly, Dr. Suren – a dedicated pharmacist to the core – upto his last breath.

Rapamycin: immunosuppressant (useful in renal transplants and drug eluting stents), anti-fungal, anti-cancer (cytostatic) and anti-aging molecule of great study interest

Many countries launch scientific expeditions in quest of knowledge for the benefit of humankind. So basically, scientists go yonder to various lands or scour the seas to gain data and cull knowledge nuggets and provide insights that can help humankind. For example, we have the various Indian Antarctica scientific expeditions for gaining knowledge – the first Indian Antarctica expedition led by Dr. Syed Qasim was in 1981. Incidentally, the first pharmacist to go on an official Indian govt. Antarctica scientific expedition is Prof. Dr. Krishnamurthy Bhat M Pharm PhD of Manipal College of Pharmaceuticals Sciences, in 2019. In a similar manner, Canada, way back in 1964 – sent a group of 40 doctors and scientists to Easter Island on a scientific expedition, they traveled by a ship of the Royal Canadian Navy called Cape Scott. The purpose of the 1964 Easter Island Canadian study tour was to collect various samples of soil, flora and fauna, study the native population, disease profile and heredity factors for further analysis.

Easter Island or Rapa Nui is a special territory island of Chile. Easter Island is a very famous tourist destination, people flock to see the monumental and large statues of ancestor worship called moai. At one time in history, Easter Island had a thriving economy and population – dating from 1st century AD. However, over-cultivation, deforestation and introduction of the Polynesian rats (that ate up the seeds of various flora) led to low land productivity and deaths. Further European conquests of 1860s including slave trading reduced the population to just 111 (1877). Hence, this boom to bust story of Rapa Nui or Easter Island is fascinating and tragic, which impels people to go there as tourists. The Canadian scientific expedition of 1964 was to this very Easter Island to study the Rapa Nui people, disease pattern and heredity factors of natives.

Two inquisitive scientists Stanley Skoryna (a surgeon) and Georges Nogrady (a microbiologist) were also in the 1964 Canadian Easter Island expedition. Georges was truly curious to understand why the barefooted natives of Easter Island did not suffer tetanus (though in such locations where there is a large horse population, tetanus cases ought to be commonly seen since horses are prone to injuries, however, the barefooted natives and horses of Easter Island did not suffer tetanus). Georges Nogrady collected 67 soil samples for analysis and isolated tetanus spores in only one sample. He was wondering why there were no tetanus spores in the soil. He suspected that the soil could contain medicinal compounds. On returning from the Canadian scientific tour to Easter Island, and some study on their own at University of Montreal, these soil samples were then given for further study, in 1969, to scientists of Ayerst Pharmaceuticals (now Pfizer). Dr. Suren Sehgal the pharmacist - was on this Ayerst Pharmaceuticals scientist team!

Arduous research efforts of two years followed in the labs of Ayerst to isolate microbes that were of medicinal interest from the soil samples - in this team intrepid and dedicated pharmacist Dr. Suren Sehgal worked - they stumbled on *Streptomyces hygroscopicus* that produced an antifungal macrolide compound (generally all macrolides from tetracycline onwards are effective in treating tetanus. *Clostridium tetani* is Gram positive bacterium). The novel macrolide antifungal compound was named rapamycin after the native Rapa Nui people of Easter Island, Chile. Dr. Suren Sehgal, pharmacist scientist discovered rapamycin had antiproliferative properties too, hence he sent the rapamycin and soil samples to National Cancer Institute where rapamycin was found to have antitumour activity, and researched as anticancer drug - on priority.

In the meantime, Ayerst was to merge with Wyeth Pharmaceuticals - so as part of consolidation strategy, the Montreal research facility was to shut down, there were orders to destroy all samples including the *Streptomyces hygroscopicus*. However, a tactful Dr. Suren Sehgal knowing the real value of this medical compound took risk - and kept some *Streptomyces hygroscopicus* samples in the freezer of his home. Dr. Suren literally took the bacterial samples from the dustbin and took it home. He also ensured that a large batch of rapamycin was prepared at the Montreal fermenter before closing the research facility. Ayerst Wyeth in its consolidation strategy moved all the Montreal facility scientists to Princeton, New Jersey - and thus Dr. Suren Sehgal the pharmacist, and the rapamycin, came to USA. Subsequently, in 1994, Dr. Suren Sehgal took up dual citizenship: USA and Canada - basically due to the corporate merger and his transfer to USA.

Rapamycin: unique mode of action and versatile applications

The global scientific community got excited with rapamycin, a lot of research work started on rapamycin mode of action. Michael Hall, University of Basel, Switzerland and other scientists elsewhere in the world, like George Livi, Stuart, David Sabatini, and Robert Abraham discovered the target protein of rapamycin - this target protein was named TOR (Target Of Rapamycin), first seen in yeast cells. Later when the target protein of rapamycin was discovered in mammalian cells, this target protein was called mTOR. Thus, the mTOR (mammalian target of rapamycin) signaling pathway in helping produce cytostatic action of rapamycin was deciphered.

mTOR is found to have other signaling activity. mTOR is found to play a major role in autophagy (where in times of starvation the cell digests itself). Autophagy and fasting help in lengthening life span of cells - this is mediated by mTOR. This interaction between mTOR and rapamycin provides antiaging property. Rapamycin is thus an antiaging molecule.

Almost simultaneously, when rapamycin was found to be antifungal, rapamycin was found to have immunosuppressant property too. Renal transplant doctors started giving rapamycin to kidney transplant recipients and this helped avoid donor kidney rejection. Rapamycin the mTOR protein inhibitor is used to coat stents that are used in heart patients, this avoids restenosis. Research is still on - mTOR inhibitor rapamycin is useful in transplant surgeries of beta 1 cells of Islet of Langerhans in diabetic subjects. Everolimus is another drug, mTOR protein inhibitor - thus different mTOR inhibitors are being researched now thanks to rapamycin that was responsible for discovery of natural cell protein mTOR.

The variegated uses of rapamycin (sold as Rapa, Rapamune, Sirolimus), and researched intensely by Dr. Suren Sehgal, pharmacist is a wonder molecule: antifungal, immunosuppressant, anti- solid tumor (anti-cancer) and anti-aging.

We - pharmacists can take pride and inspiration from the life story of Dr. Suren Sehgal (1932 to 2003) B Pharm and M Pharm from BHU. Dr. Suren Sehgal's research tryst with rapamycin has helped make a better world.

Gratitude: I thank my son Rushang Sunil Chiplunkar BE (Computer Science), who played a podcast on the rapamycin story in Radiolab @ Spotify to me, this listening inspired me to research and write this 'exciting rapamycin and the Dr. Suren Sehgal, pharmacist story'.

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AN INSIGHT INTO STEM CELLS

THEIR SIGNIFICANCE AND THEIR PRESERVATION

An undifferentiated cell of a multicellular organism which is capable of giving rise to indefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation are called stem cells. These are considered as the raw material of body cells from which all other cells with specialized function are generated under right condition in the body. Laboratory stem cells can be divided to form more cells called Daughter cells. No other cell in the body has capability to produce new type of cells but tiny daughter cells with great potential and have the ability to save lives. Stem cells are the master cells that act as basic building block of the human body. These cells have the unique ability to transform into new stem cells or specialized cells such as blood cells, brain cells, bone cells which have a specific and differential function.

According to the researchers, it is one of the passion topic because stem cell mutation can be helpful for identification of various diseases (bone diseases, heart muscle and various forms of carcinoma), generating healthy cells to replace diseased cells (regenerative medicine) and to test new drugs for safety and effectiveness. According to their potency, stem cells are classified into totipotent stem cells, pluripotent stem cell, multipotent stem cell and unipotent stem cells such as zygote embryonic stem cells [ESCs] and induced pluripotent stem cells (iPSCs), hematopoietic stem cells [HSCs] and mesenchymal stem cell [MSCs] and spermatogonial stem cell [SPCs].

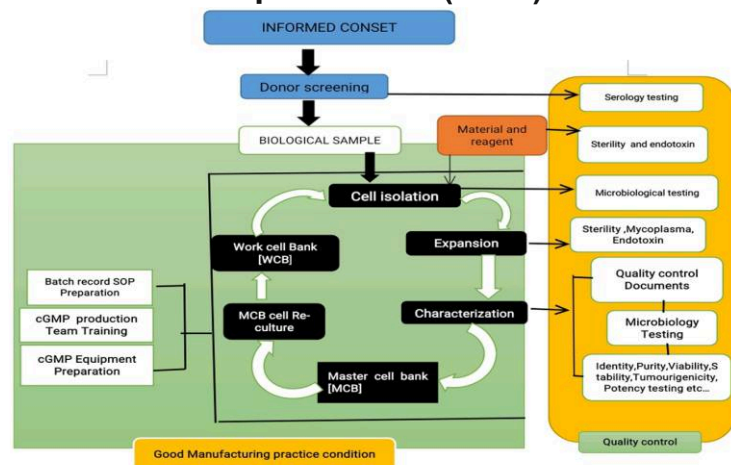
Stem Cell Banking

Stem cell banks are highly recognized as a rich resource of biological material for overview of both adult and embryonic stem cell research. The term stem cell bank can refer to a number of different bank and types of operations. It represents a collection biological material and the associated data stored within the organized system. Stem cells are highly promising deep pockets for application in cell therapy, regenerative medicine, drug discovery, toxicology and developmental biology research. All over the world stem cell banking is serving as a great source in order to preserve their cellular characteristic, prevent contamination and deterioration as well as their current and future clinical application.

Long term Maintenance & Preservation

Stem cells have broad application in research and clinical use for many years and appropriate technique cryopreservation is a traditional preservation of viable cells, tissues and organism in liquid nitrogen at terminal temperature -196°C . The storage procedure can be successfully applied to wide range of organisms and biological tissues.

Work flow for stem cells banking under GMP conditions:



Significant applications of stem cells

- Stem cells are rich in Umbilical cord blood that is used to treat more than 80 life threatening diseases and disorders. Such as blood disorder, genetic disorder and in the immunomodulation. Amyotrophic Lateral Sclerosis is one of the neurodegenerative disease and the first mesenchymal stem cells (MSC) transplantation in this disease in an in vivo model lead to the decrease in disease abnormalities along with the improvement in overall survivability of mouse. MSCs are used to treat various immune disorders as they have the capacity to regulate the immune response. In type 2 diabetes, MSCs can differentiate into insulin producing cells and have a capacity to regulate the blood glucose level in the body.
- Cord blood stem cells have potential siblings or family related application and it is also found that there is a 1:4 (25%) chance of being a perfect match with family members.
- Human bone marrow- mesenchymal stem cells could also protect the haematopoietic precursor from inflammatory damage hence can be an appropriate anti-inflammatory agent.
- Stem cell research is revealing exciting future applications. Nowadays, there are already a number of clinical trials which are being undertaken with umbilical cord blood and cord tissue stem cells these includes clinical trial for blood disorders as well as for neurological conditions such as cerebral palsy, autism, stroke, anoxic and traumatic brain, muscle repair in rheumatoid arthritis, etc.

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ANTIOXIDANTS

Natural and green products are assumed to be harmless in common belief. The general faith toward the health benefits of products containing antioxidants is partly because of misinformation conveyed by industries manufacturing these products, which promoted putative overuse of these products as dietary supplements. However, harmful effects of these products have remained masked for unknown reasons. In addition to promotion of potential benefits, it is also crucial to emphasize the harmful effects of the chronic consumption of antioxidants, including potential toxicity. On the other hand, there has been an effort by scientists to transverse these effects by exogenous artificial manipulations and interventions like antioxidant supplementation. Lack of appropriate knowledge and complexity of systems and its physiological pathways have exacerbated troubles of industrialized society, which is beyond the simplified approach is being currently utilized in resolving the complex dilemmas. Broad antioxidant treatment has been one of these manipulations that might be harmful rather than beneficial if prescribed without precise

consideration. In fact, in the average human diet, there would be no need for such a high consumption of supplements including antioxidants.

Researchers reported the existence of increased risk of teratogenicity or birth defects among babies born from women who took more than 10,000 IU vitamin A per day in the form of supplements. Indeed, excessive dietary vitamin A intake has been associated with birth defects in humans in several studies reported in the past years. A controlled clinical trial found that people who took 25,000 IU of vitamin A per day for a median of 3.8 years had 11% increase in triglycerides, 3% increase in the total cholesterol and 1% decrease in high-density lipoprotein (HDL) cholesterol, unlike those who did not take vitamin A. In fact, it has been reported that excessive vitamin A intake can accelerate bone loss and risk of hip fracture, possibly due to vitamin A-induced osteoclasts stimulation, besides it inhibits new bone formation, increasing osteoporosis risk. Vitamin C can be metabolized to oxalate and might increase kidney oxalate excretion. Several studies suggest that vitamin C supplements may increase urinary oxalate concentrations, doubling the risk of calcium oxalate kidney stones. A study defined that high vitamin C intake from supplements is associated with the rise of cardiovascular disease mortality in postmenopausal women with diabetes but this has never been confirmed. Theoretically, vitamin C may cause too much iron absorption but this is likely to be significant only in persons who have high iron stores or in patients with iron overload, such as hereditary hemochromatosis, where an increasing iron toxicity risk may exist.

A study reported that dietary vitamin E supplementation significantly increases prostate cancer risk among healthy men. A meta-analysis renders more evidence of vitamin E adverse effects on stroke subtypes. Indeed, the study defined a 22% increased hemorrhagic stroke risk and a 10% decreased ischemic stroke risk with vitamin E supplementation, although the absolute effects are minor. Still, a study underlined that 22–30 mg/day of vitamin E in human pregnancy may be associated with birth weight decrease. To minimize chronic redox imbalance damages, it is best to follow a balanced and varied diet, including in its composition many grains, legumes, fruits and vegetables of different colors. In addition, healthy lifestyle habits should be included, such as exercise training on a regular basis to avoid obesity, not smoking and reducing alcoholic beverages intake. The intake of antioxidant supplements would only make sense in a case of deficits, trying to normalize their levels, but not as a usual intake. In addition, antioxidants therapeutic usefulness against cancer still has many open fronts that should be investigated in the future. In conclusion, oxidative stress and inflammation are not as harmful as it has been assumed. They are natural defense systems in the human body working against infectious diseases as well as malignancies. Oblivious antioxidant therapy could be harmful rather than beneficial for health.

Product	Possible Side effects on Misuse
Amla, Indian Gooseberries	Liver damage (unclear), Increased risk of bleeding, decreased sugar levels
Alpha Lipoic Acid	Tension headache, platelet disorders, purpura, urticaria, eczema, muscle cramps
B-carotene	Carotenodermia, Diarrhea, Leucopenia, Arthralgia



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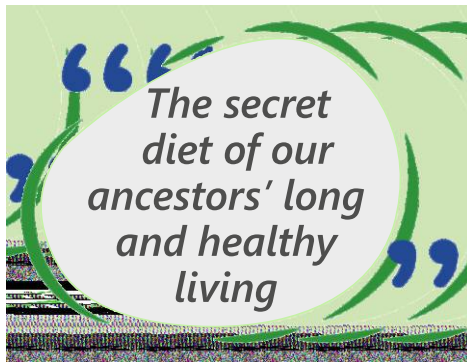
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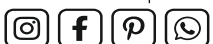


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Department of Pharmacology has organised
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“Role of Pharmacologist in Research”
on 22 December 2022.

Resource person:
Dr. Shivakumar Swamy,
Ex-Chairman PG BOS RGUHS
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Department of Pharmacology has organized
"AN INTERACTIVE REGIONAL WORKSHOP ON
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RESEARCH METHODOLOGIES, SCIENTIFIC WRITING,
AND PUBLISHING" on 15.12.2022.

Resource Persons- Dr. G. Jagadeesh,
Dr. P. Balakumar, | Dr. K Byrappa, | Dr. B.N. Srikumar,
and Dr. N. Raghavendra Naveen
from National and International Universities have
delivered their knowledge and skill on the theme
of the workshop. 200 candidates participated and benefited.

Department of Pharmacy Practice,
Adichunchanagiri College of Pharmacy

18 students from Vth Year Pharm.D and faculty
from Department of Pharmacy Practice has attended the
NATIONAL CONFERENCE ON PHARMACOVIGILANCE
AND OUTCOMES RESEARCH on the theme
"Ensuring Patient Safety Through Quality Use of Medicines"
from 2-3 December 2022 jointly organized by ISPOR Nitte
(Deemed to be University) Student Chapter &
Dept. of Pharmacy Practice, NGSM Institute of
Pharmaceutical Sciences, Mangaluru



JSS College of Pharmacy

Dr Sarah McMullen, Country Director, United States Food and Drug Administration India Office, inaugurated the "Centre of Excellence in Regulatory Sciences" at JSS College of Pharmacy, Mysuru on 30th November 2022. The US-FDA India Office team presided over the occasion: Mr Gregory Smith, Dr Sudheer Kulkarni and Mr Dhruv Shah. Dr C.G. Betsurmah, Executive Secretary, JSS Mahavidyapeetha; Dr Surinder Singh, Vice Chancellor, JSS AHER and Dr Prashanth Vishwanth, Dean-Research, JSS AHER graced this historic day



Government against Drugs campaign organised by Vijaya Karnataka newspaper, Government of Karnataka and other associations as a part of NSS activity we are participating in awareness campaign at Kote Anjaneya swamy temple..

LUMOS 2k22 - FRESHER'S DAY

Mr Fresher Poornachadra
Miss Fresher Preena
Mr Fashion icon Gagan
Miss Fashion icon Rohini





Al-Ameen College of Pharmacy, Bangalore

Happy to Inform that IIC of Al-Ameen College of Pharmacy, Bangalore has secured ☆ ☆ ☆ stars from the Ministry of Education's, Institution Innovation Council (IIC), Govt of India for promoting Innovation & Start-up activities in the campus during the calendar year 2021-22. A great team work & excellent support from Staff & students has led to achieve this laurels. Thank you to each & everyone for the kind support & Encouragement.



Completion of TWO weeks Internship & Certificate distribution at Arcolab Pvt. Ltd, Bangalore to our 6th year Pharm-D Interns that gave students an insight on experiential learning aligned with the objectives of their Course: With a clear intention of Al-Ameen to provide ready to employ graduates to Pharma field. A MoU signed between Al-Ameen College of Pharmacy, Bangalore & Arcolab Pvt Ltd, Bangalore has helped our Pharm-D students to get onsite training in Industry.



NCOPS NSS Wing Unites with UNICEF for a Healthier World

“NCOPS NSS – UNICEF Unit brings out social responsibility in young minds”

Nitte College of Pharmaceutical Sciences, Bengaluru in partnership with UNICEF executed a project on Social & Behavior Change Among the Communities to Avail Health & Nutrition Services in Karnataka. It sparked off with the inaugural ceremony on 6th of May, 2022 where Dr. Kusum Devi, Principal, NCOPS emphasized on the importance of nutrition and immunization for the well-being of the community. NSS Officer, Dr Ashwini. M highlighted the essence of the project and the qualities and nature of an NSS volunteer. NSS volunteers were carefully and rigorously trained before they could offer their impeccable services to the outside world.

Moulding Young Minds

First the volunteers were oriented to take up the project, where various activities and training was conducted to create awareness and inculcate leadership skills among the NSS volunteers. Among all activities notable were poster designing events which emphasized the significance of nutrition and immunization. The first event was devoted to NSS volunteers designing posters and placards amplifying the importance of anaemia management and effects of malnutrition. This was followed by another poster event on Poshan Abhiyan which focused mainly on spreading awareness to prevent stunting, under-nutrition, anaemia and low birth weight babies. Once the grooming was completed, the NSS volunteers were equipped enough to offer their services to the community.





Extending their services to the outside world *All set to fly*

The second phase was initiated by NCOPS NSS volunteers taking off to Gantiganahalli village and counseling the residents and emphasizing the importance of taking booster dose with the help of pictorial charts and pamphlets. They also stressed the importance of consuming healthy, immune rich foods in the daily diet. A walkathon was also held in to spread awareness on routine immunization. The students interacted with the villagers and distributed immunization schedule charts and educated the parents who refrained from vaccinating their children.

Further, a COVID-19 Precaution Dose Vaccination Drive in association with Bruhat Bengaluru Mahanagara Palike, Bengaluru was organized. A total of 300 members were vaccinated during the drive. NSS volunteers visited an old age home near Attur layout which had 30 elderly residents and the team explained at length the significance of COVID-19 booster dose. It was followed by entertainment activities after which they served food to the elders bringing a sense of belonging and well-being in them.

Another venture of the NSS volunteers was a school visit to Thimmasandra Government Primary School, where the volunteers entertained and educated the children on nutrition and the consequences of eating unhealthy food enacting a skit. They distributed fruits, measured height and weight and identified underweight students. Food charts to be followed for the improvement of weight in students were distributed. Sometime was taken to educate the nearby women engaged in labour work on maintaining hygiene and availing health related benefits under the “Integrated Child Development Scheme”.

Next, the NSS team visit to Gantiganahalli government primary school began with a role-play on healthy food habits, food nutritive value and eating practices. They shared information on nutrition through games, distributed fruits and taught them to identify healthy and unhealthy food based on nutritive values. The BMI of students was calculated and all were found within limits. The next event was at Thimmasandra Government Primary School on personal hygiene, and demonstration of hand washing steps. The students were educated using Nali-Kali concept, which is basically learning through playing. Finally soaps, hand washes and books were distributed.

All above activities are not only helpful for the community but also instill a sense of empathy and responsibility in the young minds thus contributing to the holistic development of students and society.



EMPHASIS ON THE IMPORTANCE OF CHILD NUTRITION AND IMMUNIZATION – NEED OF THE HOUR: DR. KUSUM DEVI



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COURSES OFFERED

- Clinical trial management (CTM)
- Clinical data management (CDM)
- Pharmacovigilance (PV)
- Regulatory affairs (RA)
- Medical writing (MW)
- Statistical programming – SAS
- Excel, Python and R.
- Clinical Pharmacology

Quiz

- The mechanism of action of Sofosbuvir is
 - NS5A inhibitor
 - NS3 inhibitor
 - NS3 protease inhibitor
 - Neuraminidase inhibitor
- Selective estrogen receptor down regulator is
 - Clomiphene citrate
 - Toremifene
 - Letrozole
 - Fulvestrant
- Which part of the plant 'opium poppy' is used for obtaining the active principles:
 - Dried latex from stem
 - Dried latex from capsules
 - Dried latex from root
 - Dried latex from shoots
- A Non-Steroidal Anti Inflammatory Drug derived from anthralinic acid:
 - Mefenemic acid
 - Ibuprofen
 - Indomethacin
 - Diclofenac Sodium
- A drug that inhibits spermatogenesis, used as male contraceptive _____
 - Tamoxifen
 - Norethindrone
 - Levonorgestrel
 - Gossypol
- Which among the following is used as a systemic acidifier
 - Potassium iodide
 - Potassium citrate
 - Ammonium chloride
 - Sodium acetate

RULES

- Correct answers will be rewarded 2 point each (20 marks)
- Answer of the quiz will be evaluated by panel of judges and their decision is final. (Max mark:20)
- Those who get the highest marks, their photo will be published in our next bulletin and also a cash prize of Rs.500/- will be rewarded to them
- The answer must be sent within 25th Jan. 2023 to this E Mail ID- krpaindia@gmail.com
- A confirmation mail will be sent to you on receiving your e-mail.
- Radioisotope P-32 is used for the treatment of
 - Hyperthyroidism
 - Carcinoma of bone
 - Thyroid cancer
 - Polycythemia vera
- Radiopaque contrast media used for the X-ray examination of Gastro intestinal tract is
 - Barium chloride
 - Barium sulphite
 - Barium sulphide
 - Barium sulphate
- Modified Brontagers test are used to identify which type of Anthraquinone glycosides
 - O- glycosides
 - N- glycosides
 - C- glycosides
 - S- glycosides
- Siam benzoin differs from Sumatra variety due to the insufficient content of
 - Benzoic acid
 - Cinnamic acid
 - Coniferyl alcohol
 - Coniferyl benzoate



Congratulations
to the winner of Thirty Three Edition

KRPA Quiz Competition



Ms Revati Dharampal Sagare,
Ph.D. Research Scholar -
KLE College of Pharmacy, Hubballi

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INSPIRATIONAL PHARMACIST

PROF. M. N. GHOSH

A PHENOMENAL PHARMACOLOGIST

Late Professor Mandiranath Nath Ghosh was born in the year 1924. He was born into a family of pharmacologists. His grandfather, Dr. Rakhaladas. Ghosh, was the Professor and Head of the Department of Materia Medica, Calcutta Medical College, and had authored and edited "R Ghosh's Pharmacology, Materia Medica and Therapeutics" in 1901. His father, Prof. Birendra Nath. Ghosh was also closely connected with pharmacology for more than 50 years and was the author of the famous "Textbook of Pharmacology and Therapeutics" that first appeared in 1956. It was perhaps inevitable that pharmacology became the natural choice of specialty for young Manindra Nath.

Dr. M. N. Ghosh, like his father and grandfather became an eminent teacher and internationally famed researcher in medical pharmacology. After graduation in medicine from R. G. Kar Medical College and Hospital, Kolkata, in 1948, he joined as a PhD candidate in pharmacology at the University of London, where he worked with the eminent pharmacologist Prof. Heinz Otto Schild. After his return from England, Dr. Ghosh played a significant role in establishing the pharmacology departments of two well-known medical colleges in India. First, he was appointed as Professor and Head of Pharmacology at Medical College, Pondicherry in 1963. He raised the standard of the pharmacology department at JIPMER as one of the best in India for postgraduate teaching and research. During his period in JIPMER, he was requested to supervise and establish the Department of Pharmacology at the Himachal Pradesh Medical College at Shimla in 1966, where he remained as the founder head of the Department of Pharmacology in Shimla for 2 years from 1966 to 1968. After resuming his services in JIPMER, he was later appointed as the Director of the Institute from July 1978 to July 1982. In the same period, he was elected to serve as the chief editor of the Indian Journal of Pharmacology from 1978 to 1980 and then the President of the Indian Pharmacology Society (IPS) in 1982. During his term as President of IPS, he donated a corpus fund to the Society and instituted "Prof. B. N. Ghosh Oration" in memory of his late father. After retirement from the JIPMER in 1982, he joined the Indian Institute of Chemical Biology at Kolkata as a consultant in pharmacological research.

In all these three institutes, he established departments of pharmacology that excelled in research. As a teacher, Prof. Ghosh guided and inspired many research scholars and medical students by his scholarly grip in pharmacology.

His ability to make students understand the basic concepts of the mechanism by which drugs act, as well as his uncompromising stand on the quality of research and training is matchless. His textbook "Fundamentals of Experimental Pharmacology" is the outcome of his deep understanding and love for experimental pharmacology. The first edition, published in 1971, has been the sine qua non for young researchers and postgraduate students in pharmacology for more than five decades. The book reflects his grasp of the subject, his love for animal experimentation, and his ability to explain complicated concepts in a simple manner so that beginners in pharmacology do not get discouraged by the complexity of experimentation. Prof. H. O. Schild, the renowned pharmacologist from the University of London, wrote the introduction to the first edition, in which he observed, "books of this sort are rare and by no means easy to write because pharmacology, more than most natural sciences, lacks a well-established theoretical foundation. Yet, without theory, a subject, however rich in facts and observation, cannot truly advance and will eventually get bogged down." In the second edition brought out in 1984, Dr. Ghosh further updated the book based on the progress in biological techniques in the field of pharmacology incorporating newer topics and the help of other pharmacologists to write a few Chapters. He kept updating the book with the help of his former Students and colleagues until the last edition, the sixth, which came out in 2008.

Prof. Ghosh work was rewarded with many accolades and orations including the prestigious Dr. B. C. Roy Award of the Medical Council of India and was elected as Fellow of the National Academy of Medical Science.

He is one of the appreciable Indian pharmacologists known to be in the last generation, breathed his last on October 28, 2021, at his residence in Kolkata. He had been a motivator and role model for many students. Because of him many students had a dream to become a pharmacist. He will be greatly missed by his innumerable students and his followers, and his legacy will be fondly remembered by one and all. May his soul rest in paradise with eternal love

Sahana Narayan Harikantra
2nd B Pharmacy (3rd sem)
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