Faculty of Pharmacy
RAMAIAH UNIVERSITY OF APPLIED SCIENCES
ज्ञानं विज्ञानं च भक्तिसहितं

Volume 02 Issue 03
July - September 2022

Centenary Celebrations

Dr. M. S. Ramaiah
Karmayogi (1922-2022)

SCINTILLA

QUARTERLY E-NEWS LETTER

DEPARTMENT OF PHARMACEUTICS

http://www.msruas.ac.in/academics/pharmacy

SCINTILLA

QUARTERLY E-NEWS LETTER

Scintilla is the quarterly E-news letter of Department of Pharmaceutics, FPH, RUAS which seeks to provide to world outside, News, Views, and Creative expressions from the members of the department. Scintilla comes directly from Latin, where it carries the meaning of "spark" - that is, a bright flash such as you might see from a burning ember or spark of specified quality or feeling, which is almost synonymous to department's intent, hence the name SCINTILLA

EDITORIAL BOARD

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EDITORIAL

Warm greetings!!

I at the outset express my gratefulness for the opportunity to continue working in the Ramaiah community serving in order to meet societal concerns through academic plan, growth strategy and faculty's-vision & mission.

This quarterly newsletter is inimitable and a special time to commemorate **'Karma yogi – A great visionary Dr. MS Ramaiah' s Centenary celebrations**

Also, I would like to reiterate our goals to drive creative innovation and community engagement through teaching and research. I can promise you, with the dedicated commitment of our faculties, we are on the journey of accomplishing the visions and dreams of our visionary leader and founder – Dr. MS Ramaiah. I take this opportunity to submit gratitude on behalf of our department to this organization.

Learning is a continuous process that is neither confined to educational institutions alone nor to the culmination of a person's career. It is a process that lasts lifetime. In this quarterly issue, there are a total of 7 articles focusing on theme "**Current trends in pharmaceutical formulation technology**".

I extend my sincere appreciation to all the authors, they indicated to coordinate their ardent efforts in shaping the manuscript for publication in this edition. I express my gratitude to the editorial team for their unwavering efforts and unstinting dedication.

Hearty congratulations to the winners of best article and puzzle punch of previous edition. We look forward for your similar active participation in forth coming editions as well, as we have come up with another mind storming activity – Find the word.

Final words – I want to convey to you all that, individuals of good character uphold their morals. And they are devoted to being true in speech and deed. What you are is God's gift to you, but what you become is your Gift to God.

Find a reason and have a reason to live vibrantly.

Bring forth your finest self.

Feel free to write to us if you have any queries or concerns about the newsletter.

Dr. S. Bharath
Chief Editor

BRINGING HUMANITY TOGETHER TO KEEP MAGIC OF SOIL ALIVE

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Mrs. Shwetha K
Asst. Professor – Dept of Pharmaceutics

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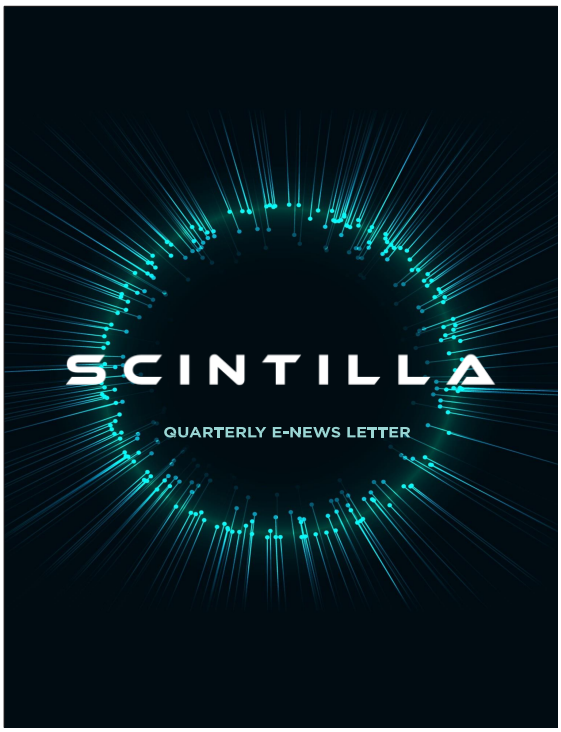

We invite interesting articles for next Scintilla edition,
Volume 2, Issue 4 (Oct – Dec 22)

Best article (3000 words)

There are surprising prizes to be won!!
(submit your article before September 30th,2022) HURRY!!!
Submit your entries, queries and/or feedback to
Executive editor, bvbasu@gmail.com

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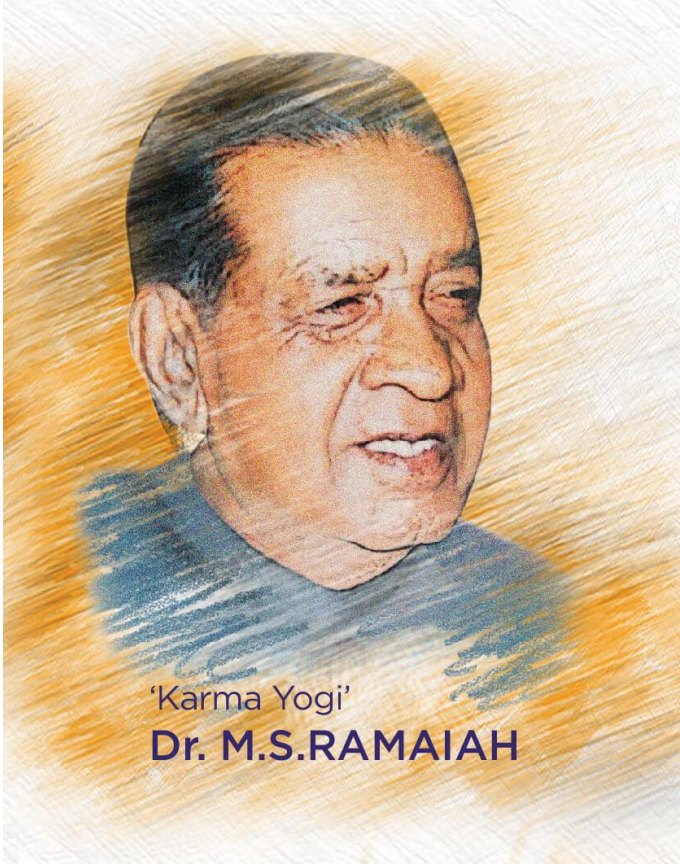


Celebrating the

100th Birth Anniversary of Dr. M.S. Ramaiah

1922-2022

A great visionary, who saw the distant future & achieved the impossible

Visionary Ideas **that transformed** millions **of lives**

On the birthday centenary of our visionary founder, Dr. M.S. Ramaiah, we pledge to continue to work towards transforming the lives of our fellow citizens. We are indebted to you, forever.

Postage Stamp to commemorate the birth centenary of Dr. M.S Ramaiah released on 22-04-2022

SCINTILLA

Centenary Celebrations

2022

Centenary celebration for

Karmayogi

Dr. M S Ramaiah

2011 - 2020

- **2012** – MSR Advanced learning center
- **2013 – MSR University of applied sciences**
- **2014** – Hon. Doc from VTU awarded to MS Ramaiah Posthumously

1999 - 2010

- **1999** – MSR School of Advanced studies
- **2004** – MSR college of education
- **2006** – MSR International medical school

1994 - 1997

- **1994** – MSR Arts, Science and commerce college
- **1995** – MSR institute of management
- **1997** – MSR Polytechnic school

1991 - 1993

- **1991** – MSR Dental college
- **1992 – MSR college of pharmacy**
- **1993** – MSR common junior college

1981 - 1990

- **1985** – MSR Teaching hospital
- **1987** – MSR Institute of nursing education and research

1971 - 1980

- Establishment of MSR medical college

1951 - 1970

- **1956** – Acquired Thainadu daily
- **1962** – Gokula education foundation, marking beginning of MSRIT

1922

Birth of

Sri. Mathikere Sampangi Ramaiah

DEPARTMENTAL PRIDE

Faculty Development Programme Details

- **Dr. Aswathi R Hegde** attended the 2nd International Faculty Development Program "Emerging Trends in Pharmaceutical Research" organized by Dr. D. Y. Patil Institute of Pharmaceutical Sciences and Research, Pimpri, Pune - 411 018 (MH) INDIA from 26 February to 28 May 2022
- **Dr. Basavaraj BV** attended the 2nd International Faculty Development Program "Emerging Trends in Pharmaceutical Research" organized by Dr. D. Y. Patil Institute of Pharmaceutical Sciences and Research, Pimpri, Pune - 411 018 (MH) INDIA from 26 February to 28 May 2022
- **Dr. Sandhya KV** attended a two week long "Patent Analytics Course" organized by Turnip Innovations and facilitated by Dr. Rahul Kapoor from

Publications

- **Dhrubojyoti Mukherjee**, Shvetank Bhatt (2022) Biocomposite-based nanostructured delivery systems for treatment and control of inflammatory lung diseases, Nanomedicine (Future Medicine), April 2022 (Article in press), pp. 1-19. https://doi.org/10.2217/nnm-2021-0425
- Jithu Jerin James, **Sandhya Kadamboor Veethil**, Joysa Ruby Joseph Rajarathinam (2022) Formulation and Evaluation of Topical Preparations Containing Pyrolytic Oil Obtained from Local Biomass. Indian Journal of Pharmaceutical Education and Research, 56(2).
- **Ghosh T**, R. Deveswaran, Manikanta M, S Bharath. (2022) Development and characterization of copper cross-linked freeze dried bioscaffolds for potential wound healing activity. Journal of pharmaceutical innovation. https://doi.org/10.1007/s12247-021-09613-x

DEPARTMENTAL PRIDE

Granted Patents

- **Dr Sandhya K.V**, Ms. Sumedha S Kulkarni, Dr Bobby T Christy, and Mrs. Vijaya Madhavi M, An Image Processing System and Method for Salivary Glucose Diagnosis, Australian Innovation Patent 2021104837, Date of Grant 02.03.2022
- **Dr. Basavaraj BV,** Dr. Srinivasan S, Chethana R, Keertana K, *In-situ* cervix plug as a contraceptive device, Indian Patent 395891, Date of Grant 29.04.2022
- Sathiya, R, **Tanmoy Ghosh**, Devanand K, Komala, M., Radhika, M. N., Ramya, L., A Method and Composition for an Anti-Blemish Cream, Indian Patent 397852, Date of Grant 27.05.2022

Webinar attended

- **Dr. Sindhu Abraham** attended an international webinar on "Systematic Review and Meta-Analysis" by Dr. Arun Kumar organised by Department of Pharmacology, Faculty of Pharmacy, RUAS

Online courses completed

- Shwetha K completed a course on "An Introduction to Ethical Publishing Behaviour" organized by Web of Science Academy on 1st July 2022

MESENCHYMAL STEM CELL CULTURE FOR ARTICULAR CARTILAGE

Ms. Sahana H U – II M.Pharm
Edited by – Dr. Aswathi R Hegde

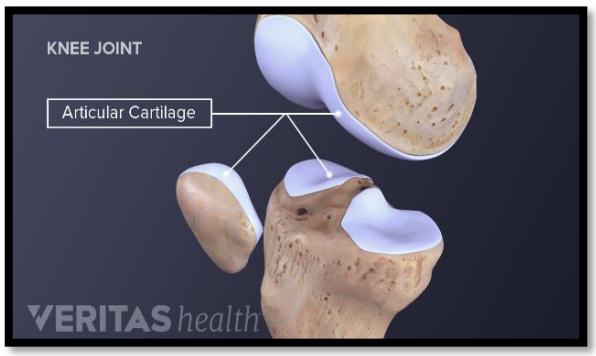
Defects in articular cartilage are a predictor of subsequent osteoarthritis (OA) and degenerative joint disease progression. Accepting the fact that there exist multiple therapies that can provide short-term pain relief and restore limited mobility, still, these treatments do not help in hyaline cartilage regeneration at defect sites.

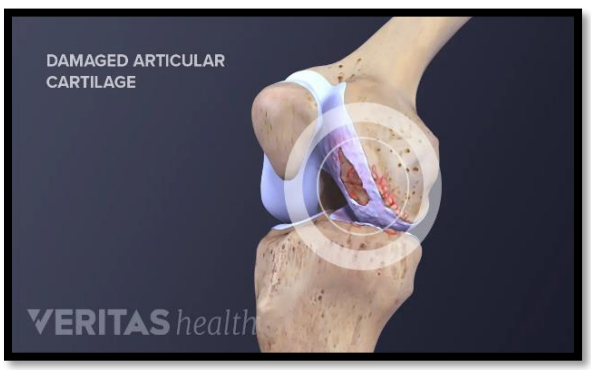
Tissue engineering

Basically, it defines the collaboration of life sciences and therapeutics with the idea of engineering. Tissue engineering can be explained as the design and implementation of living, vital functions in the research lab which can be used for tissue maintenance, regeneration, or replacement. Majorly it includes the cells, signals and scaffolds. The working principle behind tissue engineering is as follows: cells are collected and introduced with or without modification of their properties into the injured tissue or in a porous 3D material where they are maintained in an environment in which physicochemical and mechanical parameters are kept stable. After reaching their maturity, these tissues or cells can be grafted.

Hyaline Cartilage

Hyaline bone tissue is a vascularized and aneural tissue that lines articulating surfaces including the knee and has a limited ability to regenerate on its own.





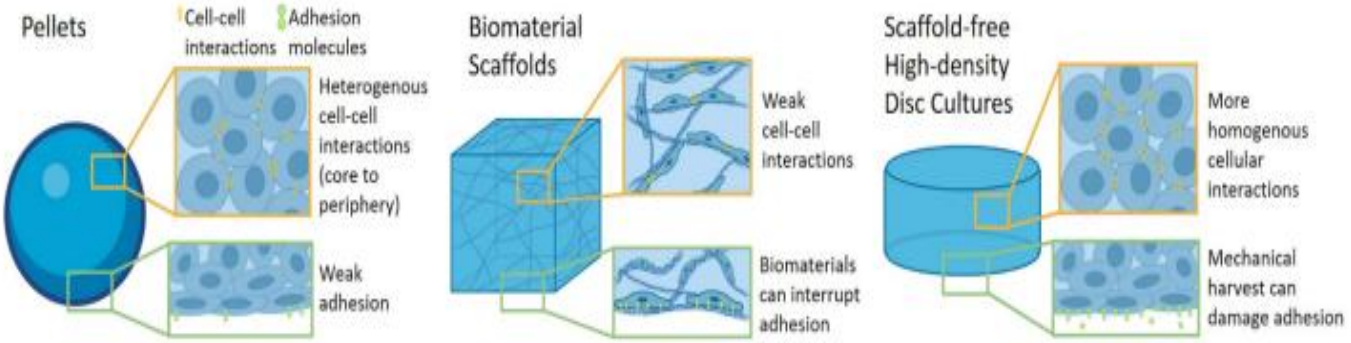
Mesenchymal stem cells

Because of their ease of access, increased in vitro expansion functionality, and chondrogenic lineage capacity, MSCs have been widely investigated as cell sources for tissue engineering applications. MSC's being pluripotent, it is considered as quiescent, but it has the ability of self-renewing, also produces one identical stem cells due to their asymmetric divisions, and hence researched as sources for cartilage tissue engineering.

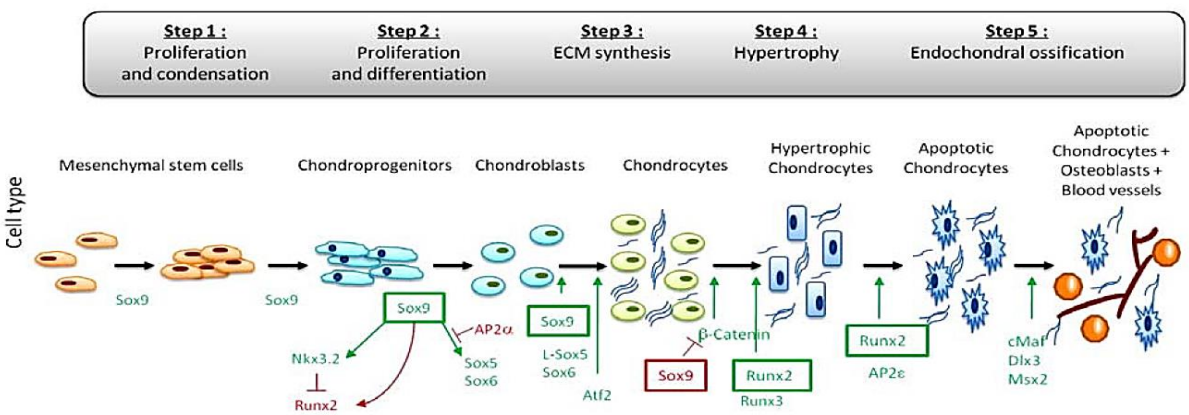
Considering its limitations of poor survival and fate of chondrogenic differentiation, distinctive method has been used to prepare MSC-derived cartilage. This cartilage gives texture of hyaline like characteristics during transplantation and replacement of damaged tissues.

Advanced tissue engineering strategies of using allogeneic MSCs seek to create three-dimensional (3D), chondrogenically differentiated structures for clear and obvious replacement of hyaline cartilage, develop local site tissue connectivity, and optimise treatment outcomes. Emphasis was placed here for creating "ready-to-use" hyaline-like cartilage.

Three-Dimensional Culture for MSC Chondrogenesis



Cellular interactions (yellow linkers) and surface interface adhesion molecules (green markers) among the constructs varies in response to biomaterials and construct cellular organization.

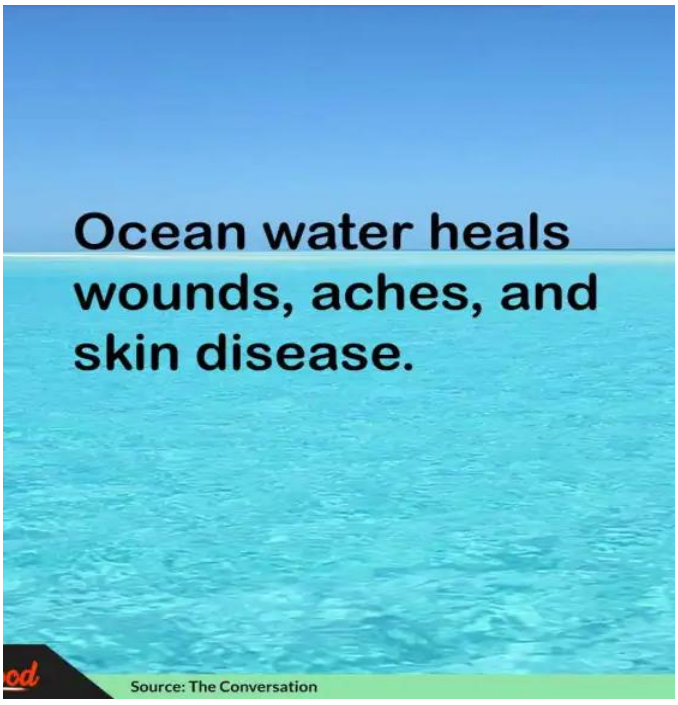


Conclusion

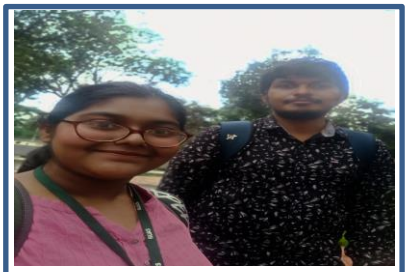
Hence, MSCs are a promising area of research which provides platforms for constructing MSC's cartilages in vitro and inducing the cellular interactions which are reliable, reproducible like hyaline cartilage to fix focal defects.

References

1. Caplan, A.I. (2007). Adult mesenchymal stem cells for tissue engineering versus regenerative medicine. Journal of Cellular Physiology, 213(2), pp.341–347. doi:10.1002/jcp.21200.
2. de Assis, A.C.C., Reis, A.L.S., Nunes, L.V., Ferreira, L.F.R., Bilal, M., Iqbal, H.M.N. and Soriano, R.N. (2022). Stem Cells and Tissue Engineering-Based Therapeutic Interventions: Promising Strategies to Improve Peripheral Nerve Regeneration. Cellular and Molecular Neurobiology. doi:10.1007/s10571-022-01199-3.
3. Thorp, H., Kim, K., Kondo, M., Maak, T., Grainger, D.W. and Okano, T. (2021). Trends in Articular Cartilage Tissue Engineering: 3D Mesenchymal Stem Cell Sheets as Candidates for Engineered Hyaline-Like Cartilage. Cells, 10(3), p.643. doi:10.3390/cells10030643.
4. Tuan, R.S., Boland, G. and Tuli, R. (2003). Adult mesenchymal stem cells and cell-based tissue engineering. Arthritis Research & Therapy, 5(1), p.32. doi:10.1186/ar614.



DAWN OF THE ERA OF DIGITAL PILL



Ms.Drithi & Mr. Shreyas
II Pharm D
Edited by – Dr. Sharon Furtado

"*Healthcare is the last industry that has not adopted digital technology in any major way to help deliver its services. And it's becoming challenging for physicians and consumers to actually manage care without those digital tools.*"

- David Schlanger, CEO, WebMD

With the ever-growing susceptibility of masses to disease in this era of modernisation, innovative digital are made which brings new changes in healthcare technology. Health care is becoming a data intensive environment where a huge amount of data is both produced and consumed.

What is digital pill?

Digital pill, also known as smart pill, a new kind of dosage form in pharmaceutical industry. Technology brought us something really interesting i.e., a sensor which is embedded inside the pill which travel safely through the body and help transmitting data after it is consumed. Digital Pills is an innovative drug – device technology in which traditional medications gets combined with monitoring system and data gets automatically recorded about medication adherence as well as patient's physical evidence.

How do digital pills work?

The pill contains a minuscule chip which is made of magnesium, silicon and copper that can send information from sensor to a wearable patch. The patch sends data to doctor and to the patient who wants to monitor themselves until the chip gets digested. Imaging capsules contain a small digital camera which generate images of microscopic structure of hollow organ such stomach and small bowl. Gas sensing capsule, utilizes a gas permeable membrane surrounding an electrochemical gas sensor and helps to detect pressure of different gases produced as a by product of metabolic reaction by bacteria. Earlier in digital pills pressure sensors were used, where the doctor demonstrated that received data is directly proportional to the pressure applied to patient stomach. i.e., when pressure is applied to the stomach the data which was received also changed.

Application of digital pills

Digital pills gaining popularity in medical field have lot many applications mainly to track whether or not the patient is actually taking their pills to avoid medication non adherence. Digital pills combine the second AI system along with the branded and generic drug to improve patient medication adherence and overcomes the loss of response to chronic medication. It is used in endoscopy to check inflammation and laceration in the oesophagus. The digital pills are used mainly for the people suffering from schizophrenia. Basically, the pill is used to send important information from patient's bloodstream or the digestive tract to let a medical professional know how the medication is working and mainly to check on patients having psychotic disorder.

FDA approved digital pill

The Food and Drug Administration approved first ingestible digital pill in 2017. The pill has a fixed sensor which is about the size of a grain of sand helps transmitting internal data to a patch attached to patient's body. The sensor within the pill named Abilify MyCite. It is first made in Japan by Otsuka Pharmaceutical with a brand name aripiprazole which is mainly an antipsychotic drug used mainly for the treatment of the patient having schizophrenia and also for the treatment of depression in adults. Proteus was the first company who designed this tiny sensor used in digital pill, which gets activated when it comes in contact with fluid inside stomach. Recently, FDA – approved etectRx gives patients more control when monitoring starts. Their solution involves a removable lanyard rather than a patch, which patients can remove after taking medication.

Conclusion

Digital technology helps transforming unsustainable healthcare system into sustainable ones. Digital Pills enables the collection of important information and improves medication adherence. These technologies, signal the new age of healthcare in future.

References

1. Shewalkar SK, Kothawade SM, Patil RA (2021) Digital Pills: Impact of Rising Technology. Arch Med Vol. 13 No. 6:26
2. Robin Mitchell, 21-09-2020, Digital Pills - A journey though the body, http://www.electropages.com/blog/2020/09/digital - pills - journey – through – body

NEGATIVE PRESSURE THERAPY - AN EMERGING TREND IN WOUND HEALING

Mr. Amith Bhounsle – Ph.D Research Scholar
Edited by – Dr. B V Basavaraj

Negative Pressure Wound Therapy (NPWT), also known as vacuum suture, refers to a system of bandages continuously or intermittently applies sub-atmospheric pressure to the system, resulting in positive pressure on the wound surface. A highly successful method of wound healing developed by the 18th century was mouth sucking, also known as "lip service". Anel used this strategy to develop the suction syringe, which eventually replaced lip service and direct mouth contact with a suction syringe.

The Soviet-Afghanistan war was a significant catalyst for improvements in wound care during the 20th century. A negative pressure device was first employed by Soviet surgeon Dr. Nail Bagaoutdinov to treat infected battlefield wounds. In order to demonstrate the advantages, Dr. Katherine Jeter used wall suction in 1985 to apply negative pressure to a wound.

In the 1990s, the first iteration of the current NPWT system was developed in Wake Forest University School of Medicine's by Drs. Louis Argenta and Michael Morykwas. Since then, with the help of technology, NPWT has developed steadily and turned into one of the most promising wound care treatments.

Significance of Negative Pressure Wound Therapy

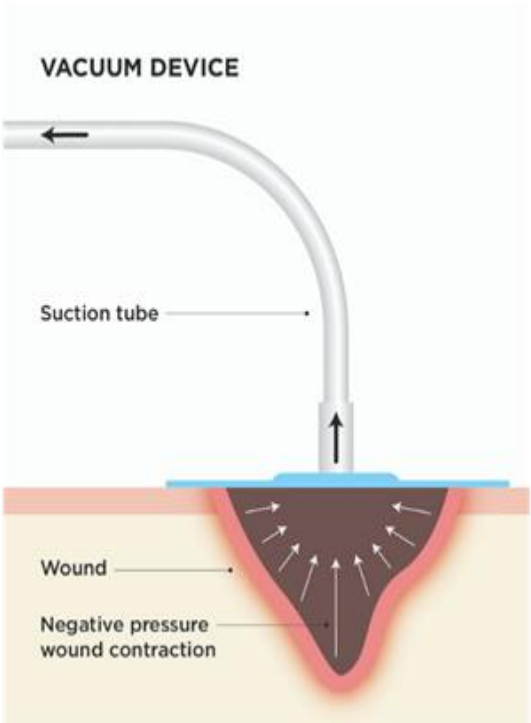
- Negative pressure promotes an active wound healing at the cellular level
- An airtight seal around the wound and a dressing interface separates the wound
- The compartment is linked to an external suction device and the pressure maintained at the range of 100 to 125 mm Hg
- Macro strain and micro strain with subsequent removal of exudates by an electromechanical pump
- Dressing is usually changed every 48-72h

Effectiveness

1. The wound bed's protection
2. The shortened healing time
3. Patient confidence and comfort

Benefits from NPWT

- Prioritized hospital discharge
- Too few wound dressing modifications
- Less invasive surgery
- Savings on nursing costs
- Transferring from the hospital to a less expensive healthcare setting
- Improved life quality



Disadvantages

- The unit must be connected for at least 22 hours per day
- In the first few minutes after negative pressure is applied, one may experience some pain

Conclusion

Negative pressure wound therapy (NPWT) can significantly reduce the risk of infection in patients undergoing open fracture treatment while also accelerating wound healing. In a short period of time, NPWT promotes the formation of infection-free scar tissue, making it a quick and comfortable alternative to traditional infected wound treatment methods.

References

1. Putnis, S., Khan, W. S. and Wong, J. M.-L. (2014) 'Negative Pressure Wound Therapy – A Review of its Uses in Orthopaedic Trauma', *The Open Orthopaedics Journal*, 8(1), pp. 142–147. doi: 10.2174/1874325001408010142
2. Andersson, S., Monsen, C. and Acosta, S. (2018) 'Outcome and Complications Using Negative Pressure Wound Therapy in the Groin for Perivascular Surgical Site Infections after Vascular Surgery', *Annals of Vascular Surgery*, 48, pp. 104–110. doi: 10.1016/j.avsg.2017.10.018.
3. Huang, C. *et al.* (2014) 'Effect of negative pressure wound therapy on wound healing', *Current Problems in Surgery*, 51(7), pp. 301–331. doi: 10.1067/j.cpsurg.2014.04.001.

DECORATIVE AND PROTECTIVE NAIL LACQUERS - A Creative Method for Drug Delivery

Mr. Mridushman, Mr. Lejin, Mr. Kishore – IV - PharmD
Edited by – Mr. Tanmoy Ghosh

The human fingernail, which is comparable to other species' unguis and hoofs, altered as human handiwork advanced and served to protect the soft ends of the fingers and toes, enhancing our sense of touch and enabling us to pick up and manipulate objects.

Nail diseases

Congenital defects, a skin condition affecting the nail bed, a systemic illness, local trauma, a drop in blood flow, tumors of the nail, fold or nail bed, and infections of the nail plate can all cause the nail plate to appear unusual. The strength, health, and appearance of fingernails and toenails can be affected by a variety of nail illnesses, such as nail psoriasis, brittle breaking nails, onychogryphosis, and ingrown toenails, nail fungal infections, onycholysis, paronychia, etc.

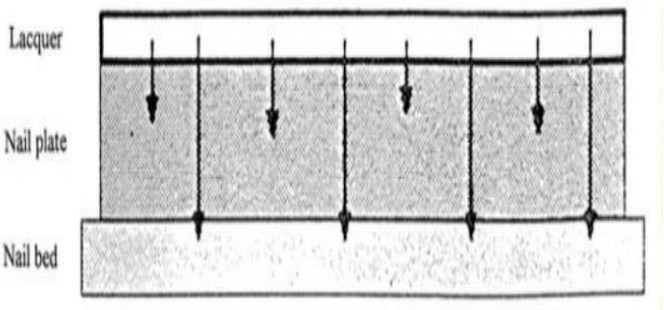
Trans means through in this medication delivery mechanism, and unguis means nail. The medication was able to pass past the nail plate because of this. In order to treat fungal nail illnesses and produce an effective therapeutic result, this system is linked to the administration of the medicine over the nail barrier.

The nail plate may appear strange due to a diminished glow brought on by the involvement of the nail bed, which also reduces the amount of blood available and alters the physical or chemical characteristics of the nail bed. As a result, many diseases could manifest. Then, by receiving the required medical care through the nail drug delivery system, these disorders can be addressed.

Nail lacquers

Nail lacquers are most commonly used in the ungual drug delivery system. Nail lacquers (enamel) are normally applied to protect nails and for decorative purposes.

It contains drugs of new formulations, and it is termed as trans ungual delivery systems. The function scheme for nail lacquer is Release, Penetration, and Permeation of drug



Formulation

- Film former: These are the chemical entities that lead to the formation of a film over the nail plate. Examples- cellulose acetate butylate cellulose acetate, ethyl cellulose, and vinyl polymer.
- Resin: It imparts adhesion, improves the shine, and improves the resistance to detergents solution. Example- Santolite MHP, urea-formaldehyde, santolite MS80 %, acrylics
- Plasticizer: It is used to provide flexibility and structure for the film adhesion Examples Camphor, castor oil, benzyl benzoate, and tributyl phosphate
- Solvent: Its main property is brushability and regulates the drying time
- Pigment - This is used to provide a color to the nail lacquer, to easily differentiate it from the different products. Example- Red iron oxide, yellow iron oxide, Titanium dioxide
- Suspending agent: It is used to prevent the setting of insoluble and inorganic matter. Example- dimethyl dioctadecyl ammonium bentonite, benzyl dimethyl hydrogenated tallow

Marketed Preparations

Some of the most common marketed preparations include Penlac and Loceryl.

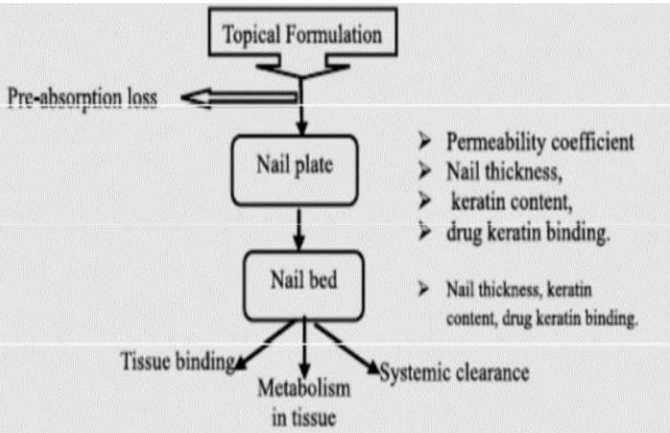
The initial marketed preparations in 1992 were Loceryl. This preparation was a colorless and clear liquid that contained anti-fungal amorolfine (5%), Eudragit RL 100, Butyl acetate, Glycerol triacetate, Ethanol, and Ethyl acetate. The preparation was used by applying the lacquer 1-2 times a week on the infected nail plates for a period of 6 months (fingernails) and for 9-12 months for the toes.

Penlac was only approved by the FDA in 1999. This clear, colorless liquid contains antifungal agent ciclopirox (8%), ethyl acetate, isopropanol, and butyl monoester (methyl vinyl ether / maleic acid). Penlac is to be used once a day, for up to 48 weeks. The film is then removed every 7 days using alcohol and a scraper before re-applying the lacquer again.

Drug delivery

The drug is delivered through these lacquer formulations which are organic in nature and are non-polar solutions having film-forming polymer. Evaporation of the solvent takes place leaving a polymer film of the drug when applied on the nail plate. Slow release of the drug takes place on the nail plate and nail bed from the film.

These formulations should have chemical and physical stability and consistency between the ingredients shall be maintained. The lacquer should possess proper rheological properties (viscosity) enabling the free flow of the formulation covering each and every part of the nail for easy application.



The lacquer should dry quickly within 3-5 min and the uniformity of the film must be maintained. The film must be properly attached to the nail plate and should not be lost during daily activities. However, it should be removed in a clean manner with a scraper and the film should be well endured in place. These lacquer formulations should be colorless and not shiny so that the male patients can accept it

Conclusion

Thus, working on certain aspects of the nail barrier is essential for the successful delivery of the drug to the nail. The penetrative features of the nail plate are well understood. So, the topical formulations (nail lacquers) can be designed in such a way that it further improves the delivery of the drug to the nail.

References

1. R Popat, R., R Rathi, A., S Adhao, V. And N Shrikhande, V. (2020). Nail drug delivery system a review. International Journal of Pharmaceutical Chemistry and Analysis, 7(1),pp.9–21.Doi: 10.18231/j.ijpca.2020.002.

2. Akhtar, N., Sharma, H. And Pathak, K. (2016). Onychomycosis: Potential of Nail Lacquers in Transungual Delivery of Antifungals. Scientifica, 2016, pp.1–12.

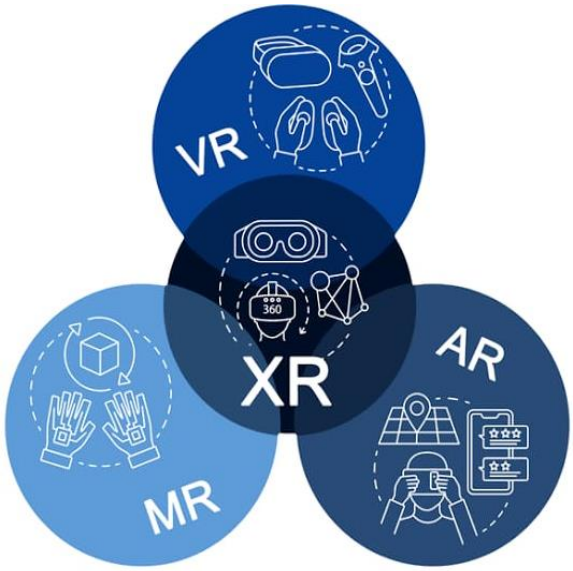
EXTENDED REALITY (XR) : A Revolutionary Cutting-edge Technology in Pharma Industry

Ms.Anuhya, Ms. Bhavana & Ms.Akshitha – I B.Pharm
Edited by – Mrs. Shwetha K

In today's world, Extended Reality has soaked most industries and pharma is not an exception. Extended Reality technologies are overcoming traditional 2D challenges in the complex process of drug development. It has enabled increased efficiency and comfort for both scientists and specialists and has made their lives much easier and more convenient.

XR (Extended Reality) comprises both Virtual Reality (VR) and Augmented Reality (AR). Virtual Reality entirely immerses the user into virtual surroundings (the user usually wears a VR headset that projects images to human eyes). On the other hand, Augmented Reality adds virtual elements to real-world imagery (usually, a camera takes a picture that is analyzed in real-time and enriched with additional information). Extended Reality is both VR and AR

As more and more XR solutions are becoming available, the XR market is forecasted to be worth $10.82 billion by 2026.



The pharmaceutical business, according to experts, operates amid one of the most intricate, stringent, and regulated systems of any sector. As a result, XR in pharma is an excellent response and solution to the problems facing the sector. Many well-established businesses, academics, digital startups, and major IT firms have swiftly incorporated Extended Reality into their daily operations.

Some examples of AR and VR in pharma

- Patients recover and train using XR in a motivated, task-focused, and supervised virtual environment for stroke rehabilitation.
- In the pharmaceutical industry, XR is utilised for surgeon training; this type of training is even 20% quicker than standard on-site training.
- Patients are often treated with calming and meditative VR experiences in pharma, which has already proven considerable benefits in pain levels.

Several other extended applications of XR in Pharma industry includes –

- Data visualization - Enables Scientists and Engineers to inspect data in a spatial context and visualize their models at full scale. They have an amazing opportunity to immerse themselves in the world of pharmaceutical data, assess the look and feel, scale, and spatial elements of the drug or other pharma product in a more intuitive

- Virtual learning and training - The use of simulation processes reduces the requirement for real equipment while also improving knowledge retention. The learning process in XR is more interesting and encourages users to retain more information. Different VR settings may be accessed and interacted with remotely by students, allowing distance learning or training
- New drug manufacturing – It is used to visualize target proteins' molecular structures. The lead generation process may benefit greatly from the useful insights that XR offers, which might lead to new medication trials and releases going more smoothly.
- Quality - Any error may harm a brand's reputation and the entire product development process. In the pharmaceutical industry, XR reduces human error while enabling high levels of product regularity. Among other things, auditors and specialists can view manufacturing processes in real-time from distant places

One of these cutting-edge technologies that improves procedures in all facets of our life is extended reality. As a result, it has aided in the development of novel drugs. It has increased the R&D teams' productivity and sped up the way processes are handled.

XR – EXTENDED REALITY IS INDEED A REVOLUTIONARYCUTTING-EDGE TECHNOLOGY!!!

References

1. Mazer. 2022. Extended Reality (XR) in the Pharma Industry - Mazer. [online] Available at: <https://mazerspace.com/extended-reality-xr-in-the-pharma-industry/> [Accessed 1 July 2022].
2. Rock Paper Reality. 2022. Augmented Reality in the Pharmaceutical Industry. [online] Available at: <https://rockpaperreality.com/ar-use-cases/augmented-reality-pharmaceutical/> [Accessed 1 July 2022].
3. Kalypso. 2022. Extended Reality (XR) for Pharma &… | Kalypso. [online] Available at: <https://kalypso.com/industries/pharma-biotech/xr-pharma-biotech> [Accessed 1 July 2022].

IN - SILICO TESTING FOR COSMETICS

Ms. Priyanka C– II M.Pharm
Edited by – Dr. Sindhu Abraham

In silico refers to simulation or mimicking of experimental conditions using a computer. These kinds of simulations are done with the help of virtual screening tools and software to predict the behavior of different test molecules or compounds. In silico testing is mainly based on interactions between the test molecule (chemical entity) and its biological targets.

Approaches used for in silico testing:

- Ligand based virtual screening
- Structure based virtual screening

If the structural data of both ligand and target molecules are available, then both approaches could be combined.

These *in silico* screening methods are helpful in cosmetics product development and can be utilized throughout the research process for,

- Identifying active molecules
- New application of known molecules
- Discovering new targets for the existing molecules
- Discovering new molecules that can interact with specific targets
- Determining the application or biological activity of the test molecule
- Selecting relevant *in vitro* assays

QSAR methods are extensively used in the early stages of drug development process in pharmaceutical research. Besides QSAR methods, there are few other methods that are based on the molecular interactions and the 3D structures of target proteins along with the ligand molecules.

Alternative methods to assess the safety of all the ingredients used for the formulation of a cosmetic product are required due to numerous bans on animal testing. However, many new innovative ingredients used for cosmetic formulations can only be evaluated for safety using these in silico methods of testing. The application of these in silico methods requires better knowledge of their biological pathways as well as their molecular mechanism. Some of these approaches are computationally expensive.

"A test without the tube" – safety testing of the new chemical entity could be done by in silico methods along with a thorough review of the literature.

Non-testing methods: According to the European Chemicals Agency (ECHA), the data of non-testing methods could be generated by the following ways:

- Grouping approaches, which include grouping according to the chemical category
- Structure–activity relationship (SAR) and quantitative SAR

The similarity principle hypothesis states that compounds that are similar and have similar biological activities, reinforce the progress and application of all types of non-testing methods.

In silico approaches have many specific challenges. More than regulatory decision making, currently it is widely used only for internal purposes. These in silico methods should be considered as part of a weight of evidence (WoE) approach and with all available data, rather than as a stand-alone method to meet regulatory requirements.

References

1. Raunio, H. 2011. In Silico Toxicology – Non-Testing Methods. Frontiers in Pharmacology. 2, (2011).
2. Madden JC, Enoch SJ, Paini A, Cronin MTD. A Review of In Silico Tools as Alternatives to Animal Testing: Principles, Resources and Applications. Alternatives to Laboratory Animals. 2020;48(4):146-172. doi:10.1177/0261192920965977
3. 1) Gellatly, N. and Sewell, F. 2019. Regulatory acceptance of in silico approaches for the safety assessment of cosmetic-related substances. Computational Toxicology. 11, (2019), 82-89.

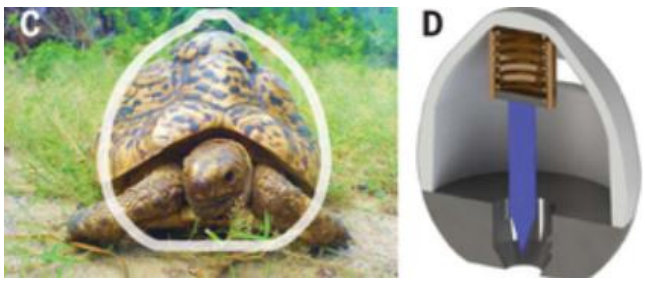
INSULIN IN A PILL: A possibility in the near future

Ms. Anusha – IV Pharm.D
Edited by – Dr. R Deveswaran

Why can't insulin be given orally? (Though many of us know why). Every diabetic patient taking insulin or any laymen would have questioned this, well it is quite a possibility now to administer insulin via the oral route. If INSULIN IN A PILL becomes a success it could change the dimensions of Diabetes mellitus treatment.

In 2019 a research team in MIT developed a novel oral drug delivery capsule, which could deliver macro molecules into the stomach lining. The new device is "ingestible, Self-Orienting Millimeter-scale Applicator (SOMA)" that physically inserts a drug-loaded millipost (needle containing drug like insulin) into the GI mucosa .The research of using insulin in the novel capsule was successful in swines and rats . Based on this recently Novo Nordisk announced a clinical trial studying the safety and performance of this device for the delivery of macro molecules, RNA etc.

The problem for any therapeutic proteins to be given by oral route is its degradation in the GI due to protease rich environment, pH etc. The novel solution to this is "ingestible, self-orienting millimeter-scale applicator (SOMA)".The device/capsule is named SOMA and the design for this capsule was inspired by the self-orienting leopard tortoise (*Stigmochelys pardalis*) (like the weeble - wobble toy , this tortoise has a similar , shifted centre of mass and upper curvature however the weeble- wobble could be easily tackled down but this tortoise has lower curvature features which enables them to self orient to preferred upright position) .

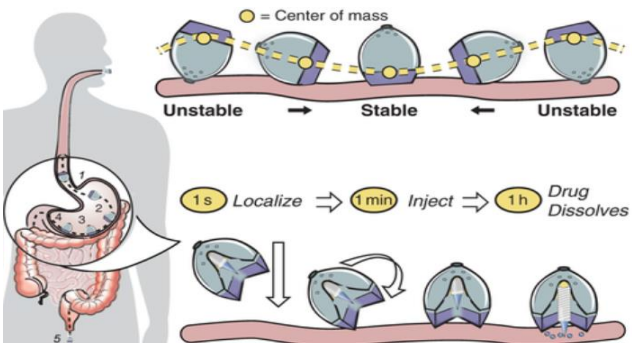


C <- The shape of the tortoise and SOMA are compared

D<- The inside image of SOMA showing the compressed spring (brown) that provides the force for the drug loaded millipost (blue) insertion into the stomach lining ;

Structure and functioning of SOMA

The SOMA is monostatic body which is optimized for rapid self orientation, with its ability to resist external forces like peristaltic movement, gastric flow, patients movement etc. and upon reaching a stable point, this shape ensures that the millipost would not misfire into lumen though the patient changes the position during the actuation of device. The SOMA's small size and shape makes it easy for its ingestion and also prevents it from getting obstructed in the lower GI tract. The stomach's 4-6 mm thick wall provides a protective area and more space to inject the drug and thus they have used 5-mm 25-gauge Carr-Locke needles, which gastroenterologists prefer for GI procedures and it is safe and effective.



Using angular kinematic equations, the team designed SOMA to reduce the mean self-orientation time towards the stomach wall and maximized the force required to tilt the device to its preferred orientation. Finally they hollowed the top of the capsule to accommodate the actuation mechanism and API milliposts.

When computer simulation was done, it predicted that the SOMA orients most rapidly between the angles of 0° and 45° and the angles of 100° and 180° when measured from the preferred orientation. The time for self orientation from 85% all initial position was within 100ms.

Millipost

During designing the team compressed a mixture of up to 80% human insulin with 200,000 molecular weight poly (ethylene) oxide under pressures of 550 MPa and they loaded up to 0.5 mg of insulin in a sharp, conical structure. Through compression they connected the insulin tip to a shaft (prepared from biodegradable polymer) and the final length of millipost was 7mm.

Mechanical and chemical characterization studies were done on milliposts and it all supported insulin stability. Raman spectroscopy validated the protein structure of the insulin after high-pressure exposure. Dissolution studies (in-vitro) showed complete dissolution within 60 minutes. The stability studies of millipost at 40°C showed that it remained stable for 16 weeks.

Spring and Energy

SOMAs loaded with stainless steel springs that were used as power source due to its ability to release energy along one axis instantaneously providing 1.7 to 5 N of force at full compression.

For a controlled actuation to take place in stomach, they used sucrose and isomalt to form a hydration dependent actuator with sufficient strength to hold the spring in compression and to avoid breaking of capsule. Thus when a capsule is ingested it perfectly orients itself on the stomach lining towards the tissue wall and injects the insulin. Then the compression of the spring pushes millipost into the mucosal layer and insulin will release. After this the spring remains inside the capsule and further it goes for excretion.

Experiment on swine

Milliposts loaded with 0.3 mg of human insulin was inserted into SOMA and administered to swine. The SOMA's localized towards stomach wall and self-oriented itself before injecting milliposts into mucosa. When histology was performed it confirmed that the SOMA delivered milliposts through the mucosa and did not injure the outer muscular layer. The milliposts of this experiment released drug at a zero order kinetic rate. The API levels were measured throughout the 3.5 hours of sampling period in the swine's plasma and it ranged between 10 -70 pM. This dose of drug yielded a blood glucose lowering effect. Compared to this when the swine's were dosed with SOMAs which were designed to localize the milliposts to the stomach wall but insulin was not released into the tissue ,these swines neither had uptake of insulin nor blood glucose lowering effect.

After one week of administering the SOMAs, endoscopies were performed and it showed no signs of tissue damage or any abnormalities from the needles injected. Veterinary staff monitored the swine twice daily and they did not observed any signs of distress or changes in feeding and stooling patterns.

There were no evidence regarding millipost misfire or device retention. The Integrity of the SOMA after GI transit was confirmed by examining SOMAs recovered after excretion.

In 2021, the researchers showed that they could use this SOMA capsule for administering macro molecules such as monoclonal antibodies in liquid form. Other than this when the RNA was mixed with polymeric nanoparticle and was delivered through the capsule in mice, it was observed that the RNA had been taken up by the organs of the body and the genes were produced according to the administered RNA. In pigs too this was a success.

Thus SOMA presents us a promising drug delivery system, which delivers a broad range of biologic drugs (protein and nucleic acid based therapies), but not limited to only these. The efficacy of SOMA device in drug delivery suggests that this could replace subcutaneous injections for insulin and the experiments

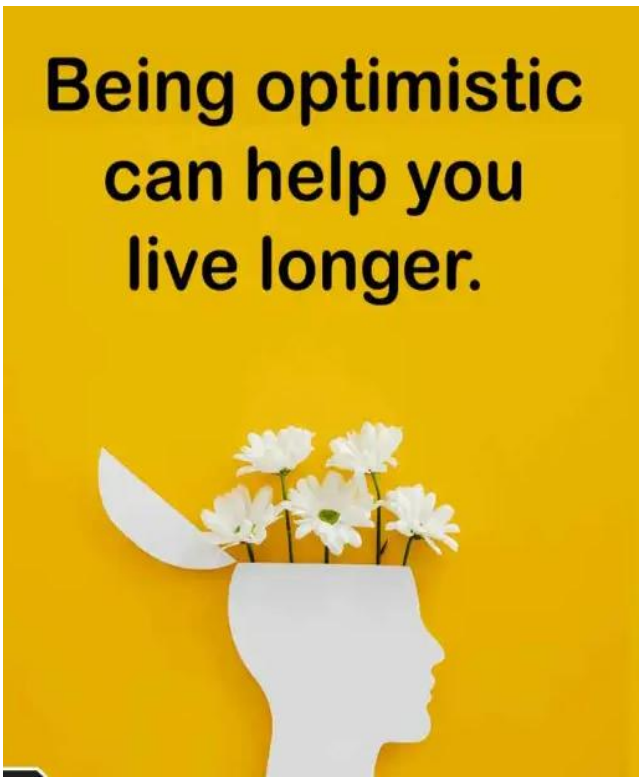
done justifies further evaluation of SOMA for other macromolecules and its efficacy in humans.

Novo nordisk, has started trials for this device and if it becomes a success, then the needles and syringe use will be a past thing; might also be a turning point in pharmaceuticals. The economic burden could be reduced on healthcare system and the medication adherence could be increased and many ADRs due to tablets could be decreased.

If INSULIN IN A PILL is successful in humans, then it will be “GAME CHANGER PILL”!

References

1. Abramson, A. et al., 2019. An ingestible self-orienting system for oral delivery of macromolecules. Science(New York, N.Y.).Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6430586/
2. Langer, R. (2019) “Controlling the movement of molecules,” Quarterly Reviews of Biophysics, Cambridge University Press, 52, p. e5.[online] Available at:< https://doi.org/10.1017/S0033583519000040
3. MIT News | Massachusetts Institute of Technology. 2022. Drug delivery capsule could replace injections for protein drugs. [online] Available at: <https://news.mit.edu/2021/monoclonal-drug-delivery-capsule-0830>



Ongoing Events

Faculty of Pharmacy (FPH), RUAS

Faculty of Pharmacy (FPH; formerly M.S. Ramaiah College of Pharmacy) was established in 1992. Ranked 52nd in All India NIRF-2021, FPH imparts quality pharmaceutical education with student centric learning pedagogy to meet the increasing demands for skilled health professionals meeting global standards. The Faculty offers a 4-year UG program leading to the Bachelor of Pharmacy degree (B.Pharm), 2 year PG program in 5 specializations leading to Master of Pharmacy degree (M.Pharm), 6 year Doctor of Pharmacy program (Pharm D) and also full time and part time doctoral research program (Ph.D).

Department of Pharmaceutics

As an integral and flagship wing of FPH, Department of Pharmaceutics at RUAS is committed to providing excellent academic and pharmaceutical industry-oriented professional training and promoting drug development research. Department's mission is to keep pace with a rapidly changing scientific environment in order to develop efficient drug delivery systems beyond the needs of modern society.

Research at FPH

Research Centers

Faculty of Pharmacy has two research centers—Drug Design and Development Center (DDDC) and the Pharmacological Modeling and Screening Center (PMSC). Both centers adopt a unique, multidisciplinary approach to the development of novel pharmaceutical dosage systems, emphasizing drug discovery and drug repurposing through biological action mechanisms and simulation models.

Consultancy Projects

Faculty of Pharmacy works closely with leading pharmaceutical companies and healthcare sector. This ensures that industry-problems are resolved using a comprehensive approach that spans academic, research, and industry perspectives. Such collaborations also encourage sharing of knowledge and resources with channeling of efforts towards common goals.

https://pharmacy.msruas.ac.in/

linkedin.com/in/faculty-of-pharmacy-msruas-954965204

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

FACULTY OF PHARMACY

DEPARTMENT OF PHARMACEUTICS

Organizing

EARLY CAREER SCI-TALK

Educational Webinar Series -1

June 18th - July 23rd, 2022

Open for UG students/ PG students/ Research Scholars/ Faculty

₹

Last date for registration: June 13, 2022

For details contact: Dr Aswathi R Hegde

About the seminar series

Department of Pharmaceutics, FPH is organizing Early Career Sci-Talk Series – 1, a month-long online seminar series which will host enriching talks by young scientists and researchers from academia as well as industry to encourage undergraduate and post graduate students to pursue careers in Pharmaceutical Research and Development.

Objectives of the series

To deliberate and understand various facets of pharmaceutical profession in the areas of:

- Drug delivery
- Drug discovery and development
- Regulatory process
- Career map
- Research ethics

Envisaged outcomes

Participants will be able to:

- Examine various approaches to drug discovery and development, and drug delivery
- Understand the process of regulatory submissions
- Develop an attitude for overall professional development

Patron
Dr. Kuldeep Kumar Raina
Vice-Chancellor, RUAS

Advisor
Prof. M Sai Baba
Registrar, RUAS

Convenor
Dr. S Bharath
Dean, FPH

Chief coordinator
Dr. B V Basavaraj
Professor and Head

Faculty Co-ordinator
Dr. Aswathi R Hegde
Assistant Professor

Faculty Co-coordinator
Dr. Sandhya K V
Assistant Professor

Who can attend: Students, research scholars and faculty members of Pharmacy colleges

Registration fees: 250 INR (including GST)

Mode of payment:
Online/ NEFT transfer to
Bank: AXIS BANK LTD
A/c No.: 914010033410631
A/c Name: Faculty of Pharmacy - MSRUAS
Branch: Rajajinagar
IFSC Code: UTIB0000559

Attach screenshot of payment details to registration form link
https://forms.gle/KKAyhuAUMwgv2K9

SPEAKERS

Dr. Vivek Ghate
Junior Formulation Scientist
Yenepoya Foundation for Technology Incubation,
Mangaluru, Karnataka
"Transdermal route and the skin microbiome: Are they interlinked to achieve optimal drug delivery"?

Dr. Pratishtha Bhattacharya
Assistant Professor, Department of Psychology
School of Social Sciences, RUAS
Bengaluru, Karnataka
"Personal is professional: Self-management for professional growth"

Dr. Sushil Y Raut
Assistant Professor
Department of Pharmaceutics
DPU Pharmacy, Pimpri, Pune, Maharashtra
"Future medicines: A perspective on drug discovery and development"

Mrs. Shwetha K
Assistant Professor, Department of Pharmaceutics
Faculty of Pharmacy, RUAS
Bengaluru, Karnataka
"Research ethics and plagiarism"

Mr. Kasi Valaparla
Regulatory Professional II, RA Business Transformation
Novo Nordisk Global Business Services,
Bengaluru, Karnataka
"Regulatory submission process overview"

Mr. Anup Kumar
Regulatory Affairs Specialist
GRA CMC Regulatory Intelligence
Merck KGaA, Bengaluru, Karnataka
"Curious minds: A guide to career progression"

Instructions to participants:

- All sessions will be delivered online (via Microsoft teams)
- Detailed schedule of the seminars and MST link will be shared to registered participants only
- Certificates will be issued to participants

Dr. B V Basavaraj Dr. Aswathi R Hegde Dr. Sandhya K V

Upcoming Events

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

AIR # 52 NIRF India Ranking 2021

CENTENARY CELEBRATIONS

GOLD QS I-GAUGE INDIAN UNIVERSITY RATINGS

FACULTY OF PHARMACY

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Cordially invites you to join us for

EARLY CAREER SCI-TALK

Educational Webinar Series -1

Speaker

Dr. Pratishtha Bhattacharya

Assistant Professor,
Department of Psychology
School of Social Sciences, RUAS

"Personal is professional: Self-management for professional growth"

Saturday, 16th July 2022, 4.00 pm

Dr. Pratishtha has a PhD in Positive Psychology from the Indian Institute of Technology, Kharagpur. Her current research focuses on aspects of positive psychology, developmental psychology, industrial psychology, organizational behavior, and research methods in psychology. Her research work has appeared in peer-reviewed journals including Current Psychology, IIM-B Management Review, Human Resource International Digest, International Journal of Productivity and Performance Management, and The Qualitative Report.

Upcoming Events

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Top Pharmacy Institute AIR # 52 Ranked by NIRF India Ranking 2021

CENTENARY CELEBRATIONS

GOLD QS I-GAUGE INDIAN UNIVERSITY RATINGS

FACULTY OF PHARMACY

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Cordially invites you to join us for

EARLY CAREER SCI-TALK

Educational Webinar Series -1

Speaker

Mr. Anup Kumar

Regulatory Affairs Specialist
GRA CMC Regulatory Intelligence
Merck KGaA, Bengaluru, Karnataka

"Curious minds: A guide to career progression"

Saturday, 23rd July 2022, 5.00 pm

Anup is currently working as a Specialist in CMC Regulatory Intelligence for Merck KGaA. He has more than 7 years' experience together in characterization, formulation, product and process development and global regulatory affairs. He is an expert in understanding project requirements and working towards deliverables.

Pharmaceutical Industry – Academia Conclave

The Indian Pharmaceutical Association (KTK Branch) in association with KDPMA and Faculty of Pharmacy MS Ramaiah University of Applied Sciences, organised a one-day event on 9th April 2022 in the Ramaiah Medical college auditorium, Gnanagangotri campus in Bangalore. IPA National President T.V Narayana was the chief guest. Honourable Vice Chancellor of RUAS, Dr Kuldeep Kumar Raina addressed the gathering and congratulated the organised committee for such an event being conducted for the benefit and students and colleges. He urged the industry and academia to take the MoU's forward for mutual benefit. The event was a great success with over 450 delegates including students, faculty, industry personnel, entrepreneurs and academicians from across the state of Karnataka.

IPR Day Celebrations

In aligning with the World IP week celebrations, IPR Cell, RUAS organized a one day seminar (28th April, 2022) on IPR. **"IP and Youth: Innovating a Better Future"** is the theme for this year and the present focus is on youth-led innovation and creativity. The youth of today are an incredible and largely untapped source of ingenuity. The inaugural session was attended by our Honorable Vice Chancellor Prof. Kuldeep Kumar Raina, Registrar Prof. Sai Baba, Pro VC Research Prof. Govind Kadambi, Dr. Sharath Kumar, Director, Research and our Chief guest Ms Bindu Sharma, Patent Attorney, CEO, Oriigin IP, Bangalore. The session was well received by all the students and faculty across the organisation.

Guest Lecture

Dr. Kotamballi Chidambara Murthy, Professor & Dean from Neuberg Anand Academy of Laboratory Medicine, Bangalore, was invited on 17th May 2022 to enlightened about career options in less chosen paths. He discussed the need for doing research in collaboration with industry, and the flaws in the existing research practices followed by academic institutions. He offered suggestions for obtaining funding for research projects by focusing on ICMR thrust areas. He concluded the seminar by recommending that research be conducted through integration, collaboration, and association.

Guest Lecture

Department of Pharmaceutics organised a guest lecture on 27th may 2022. Resource person, Dr. Sameer Padhye Deputy Manager (Technical Services) at Arihant Innochem Pvt. Ltd Nanded, Maharashtra, India, described about the company and their services. He gave an idea regarding prototype formulations, suggested suitable excipients based on formulation need and functionality and aid in scale up troubleshooting. Arihant Innochem excipients provide product differentiation in the marketplace. The excipient basket of Arihant boasts of a unique combination of conventional and niche products and also they representing the world's leading speciality chemical producers, namely, Lubrizol, shin-etsu chemical co., ltd., nichirin/gotoku chemical industries ltd., pharmatrans in the pharmaceutical sector and Lubrizol, shin-etsu, rahn, thor, natura-tec, lessonia, huntsman in the Home and Personal Care sector.

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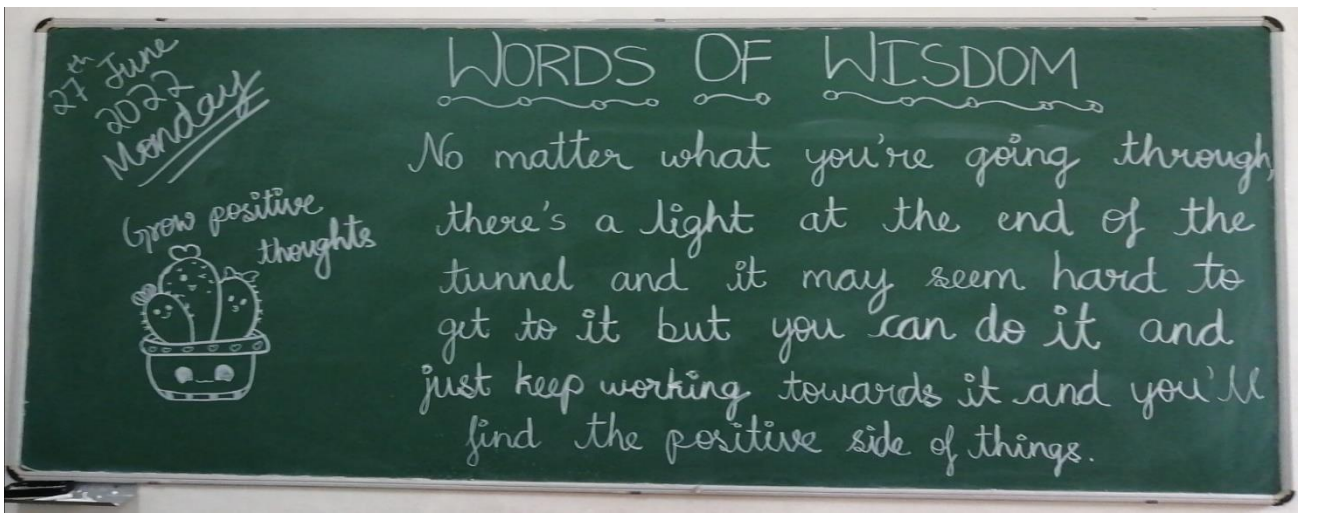
Guest Lecture

Department of Pharmaceutics organised a guest lecture on 1st June 2022. Invited speaker, **Dr. M.G. Jayathirtha** currently working as a teamlead (clinical data management) in Tata Consultancy Services, Bengaluru was invited as speaker to address Postgraduate students regarding career options in TCS. He shared his valuable insights about different positions in different pharmaceutical companies and CRO's and also explained about the TCS company and carriers in TCS. TCS advanced drug development has won an award in the category excellence in ancillary pharma services in 2019 and it provides best in the industry life science and health care consulting solutions, detection and management in pharmacovigilance in hybrid approach. TCS cloud based ADD suite received the recognition for leveraging automation, AI and IoT to digitally transform clinical trial He finally concluded the session by TCS building future proof technology platforms to transform drug development by harnessing their deep knowledge of the life sciences industry, coupled with expertise in digital and AI technologies.

KUDOS TO THE ACHIEVERS

To appreciate and honor the students for their academic feat and motivate the students for performing better in their forthcoming exams, Head of the Department, Department of Pharmaceutics presented **Certificate of Appreciation** for securing highest marks in the subjects handled by the Department of Pharmaceutics.

Toppers in Pharmaceutics I (I Semester Students)



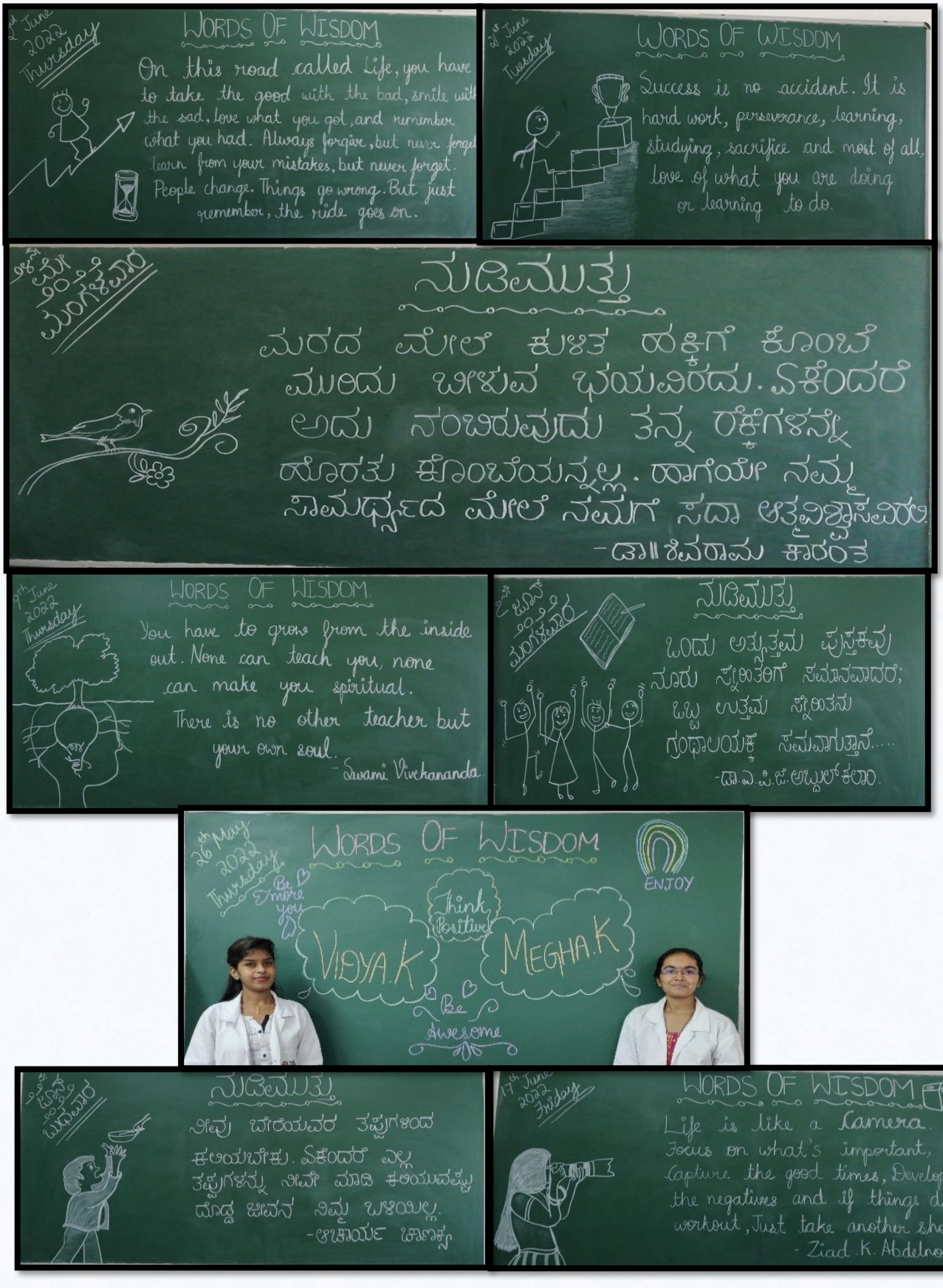
KUDOS TO THE ACHIEVERS

Toppers in Pharmaceutical Microbiology, Physical Pharmaceutics I & Pharmaceutical Engineering (III Semester)

Toppers in Industrial Pharmacy I & Pharmaceutical Jurisprudence (V Semester)

PANACEA 2022

Words of Wisdom



Santosh PS, Priyanka C &
Darshan H R
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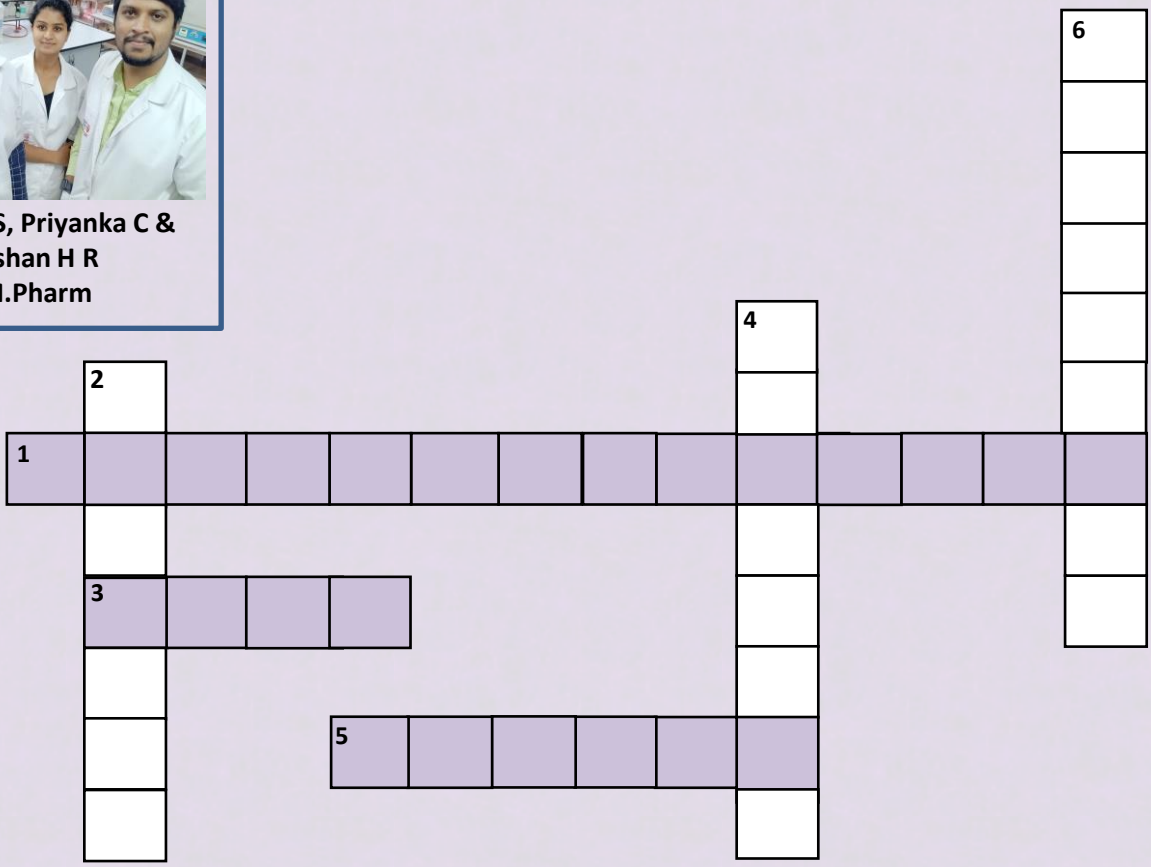
PUZZLE PUNCH



ACROSS

1. A cosmetic product that is purported to have therapeutic action capable of affecting the skin positively beyond the time of its application
3. In dissolution experiments, Which type of coated basket is preferred when acid medium is used.
5. I am a clear liquid preparation containing a low solubility drug solubilized by means of proper solvents like Hydro alcohol

DOWN

2. These are used for urethral applications
4. Lactose reacts with an amino group of drugs in the presence of metal stearate. Name the reaction?
6. Shrinkage of gel by extrusion of liquid is called as

Submit your answers to the Editorial team – prizes to be won
(shwetha.ps.ph@msruas.ac.in)

Shivani Srinivasan & Merin Sara Mathew
II M.Pharm

FIND THE WORD

S	Q	M	W	N	C	E	B	R	V	T	C	Y	E
X	I	Z	O	L	O	P	K	A	S	H	F	Q	F
H	X	E	M	D	S	I	A	P	L	V	M	I	F
A	P	Q	M	O	M	P	E	R	D	Z	O	V	E
I	P	R	O	P	E	L	L	A	N	T	Q	K	R
G	U	O	O	S	C	M	A	U	I	E	G	W	V
J	M	K	S	T	E	B	F	Y	N	H	O	Y	E
R	N	A	A	R	U	V	D	U	B	G	I	T	S
V	R	J	P	E	T	C	S	T	V	F	U	R	C
Y	B	H	T	H	I	X	O	T	R	O	P	Y	E
S	V	G	O	W	C	Z	A	R	C	D	A	E	N
Q	C	F	I	Q	A	L	P	E	X	S	R	W	C
O	X	N	E	W	L	O	N	I	A	N	A	Q	E
N	Z	D	U	M	S	K	O	W	Z	A	B	M	X
X	B	I	O	E	Q	U	I	V	A	L	E	N	T
P	L	S	Y	N	G	J	I	Q	L	P	N	F	W

CLUE – Find the 8 Pharmaceutical terminologies

Submit your answers to the Editorial team – prizes to be won
(shwetha.ps.ph@msruas.ac.in)

Congratulations

Best article award –
Ms. Puspanjali Sharma
for the article titled
'Vocal Biomarkers – Reshaping healthcare diagnostics'

Puzzle punch winner –
Ms. Tejaswini M

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