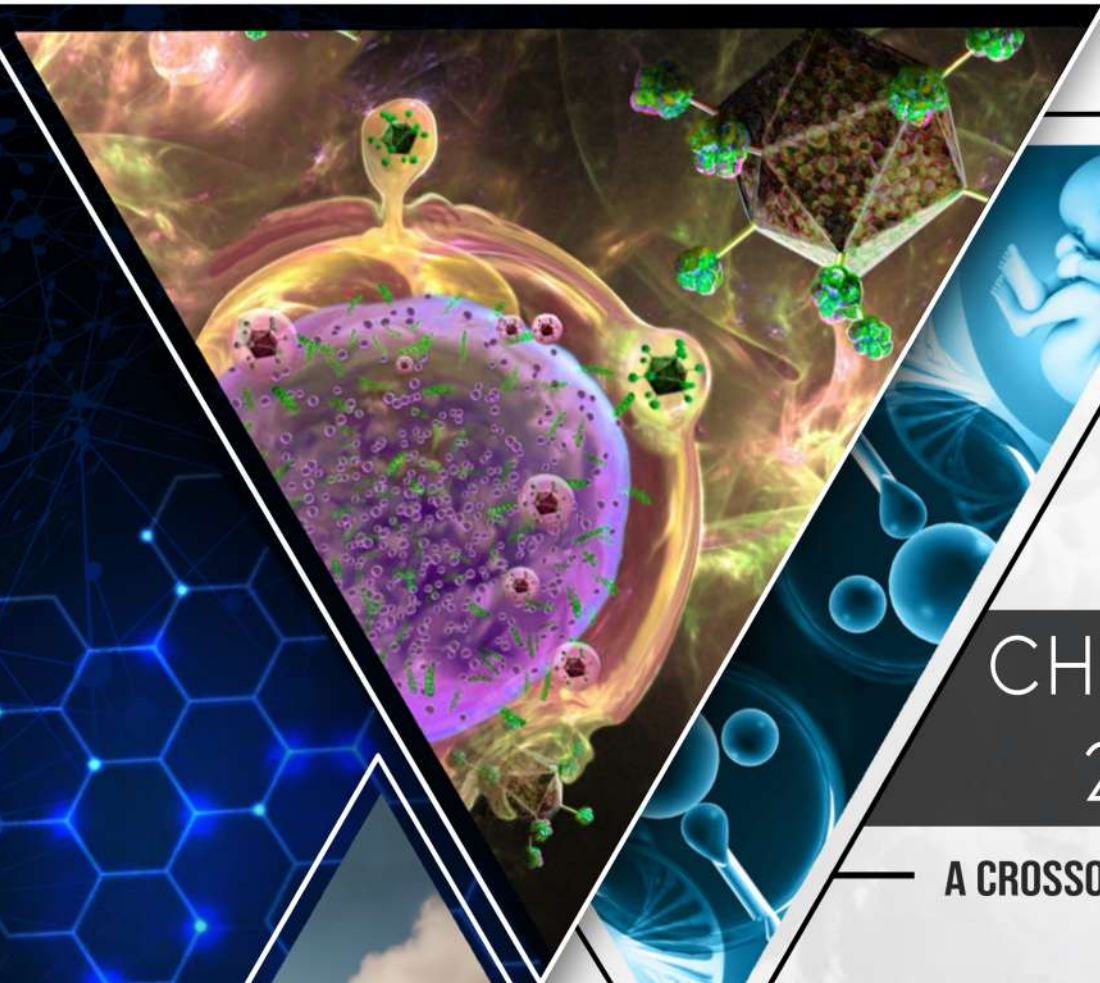
St. Xavier's College (Autonomous), Kolkata

POSTGRADUATE & RESEARCH DEPARTMENT OF BIOTECHNOLOGY



CHIASMA 2023

A CROSSOVER OF MINDS

TECHTONIC

HARNESSING THE POWER
MANAGING THE FALLOUT/OUTREACH

EDITION XIII

St. Xavier's College (Autonomous), Kolkata

POSTGRADUATE & RESEARCH DEPARTMENT OF BIOTECHNOLOGY

CHIASMA 2023

A CROSSOVER OF MINDS

EDITORIAL BOARD

DISCLAIMER

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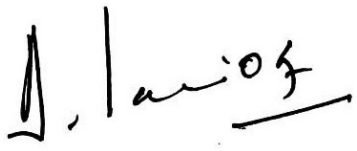
MESSAGE FROM
THE PRINCIPAL

I am glad to know that the Postgraduate & Research Department of Biotechnology at St. Xavier's College (Autonomous), Kolkata, remains dedicated to publishing its annual magazine Chiasma in 2023. This endeavour serves as an effective means of facilitating the exchange of scientific ideas and thoughts among young individuals. Since its establishment in July 2006, the Department has played a crucial role in providing high-quality education, evident in the impressive achievements of its students on both national and international levels. The faculty members actively engage in rigorous research and have made impressive advancements in their respective fields. This alignment of scientific research with teaching is a source of inspiration for students to pursue further research following their post-graduation from the Department. I comprehend and value the unwavering commitment exhibited by the magazine committee in meticulously editing articles and giving shape to the final version of the magazine. I acknowledge their steadfast dedication and strenuous efforts. I congratulate all the faculty members, support staff, and students of the Department, and I offer my best wishes for their collective endeavours. May success accompany all of your efforts.

Nihil Ultra!



Rev. Dr. Dominic Savio, SJ
Principal
St. Xavier's College (Autonomous), Kolkata

MESSAGE FROM
THE VICE-PRINCIPAL (ARTS AND SCIENCE)

Chiasma, the annual publication of the Postgraduate & Research Department of Biotechnology, is now in its thirteenth year. The continuity stands as a compelling testament to the department's unwavering dedication to scholarly pursuits, advanced research, and dissemination of knowledge. Beyond its scholarly focus, the magazine serves as a platform not only for academic articles within the discipline but also as a canvas for literary and artistic expression. This unique amalgamation positions Chiasma as a periodical ingeniously crafted to foster a comprehensive and all-encompassing growth in the department's students. I am sure this will serve as a catalyst to inspire a many more students in the years to come.

I also appreciate the decision to enhance the publication's impact by introducing a companion website. I am sure this digital version has the potential to greatly amplify the magazine's visibility and extend its reach and influence. My sincere congratulations to the department for achieving yet another remarkable milestone.

Prof. Bertram Da'Silva

Vice - Principal (Arts and Science)

St. Xavier's College (Autonomous), Kolkata

MESSAGE FROM
THE DEAN OF SCIENCE

I want to offer my warmest congratulations to the Postgraduate & Research Department of Biotechnology on the release of the thirteenth edition of their annual magazine, 'Chiasma'!

Chiasma has truly evolved into an outstanding platform that not only celebrates scientific inquiry but also nurtures collaboration and intellectual growth within our academic community. The unwavering commitment to organizing this e-magazine exemplifies the remarkable spirit that drives the department's success. The publication beautifully encapsulates the multi-disciplinary nature of biotechnology through its rich array of articles.

I extend my heartfelt appreciation to the entire team behind Chiasma, whose tireless efforts have made this endeavour a resounding success. Your dedication to advancing knowledge in biotechnology is truly praiseworthy.

I am confident that the 13th edition of Chiasma will continue to enrich our scientific landscape and serve as a symbol of excellence in the field of biotechnology.

Indranath Chaudhuri

Dr. Indranath Chaudhuri
Dean of Science
St. Xavier's College (Autonomous), Kolkata

MESSAGE FROM
THE DEAN OF ARTS

It gives me great pleasure to know that the annual magazine of the Postgraduate & Research Department of Biotechnology Chiasma, 2023 is being published. I congratulate the students and faculty members of the department for their efforts in bringing this magazine to fruition. I am confident that this academic exercise has enabled students to identify, explore and articulate possibilities that the discipline offers for discovery and innovation. I congratulate the contributors, editors and the readers who collectively make this magazine a celebration of their shared passion for Biotechnology.

Farhat Bano

Dr. Farhat Bano
Dean of Arts
St. Xavier's College (Autonomous), Kolkata

MESSAGE FROM
THE HEAD OF THE DEPARTMENT

It is with great delight that I herald the unveiling of the 13th edition of our departmental periodical, 'Chiasma'. This publication serves as a vibrant forum for the dissemination of scholarly and literary articles, penned by our students, research scholars and faculty, covering a broad spectrum of topics from biology to general interest.

I extend my profound gratitude to Rev. Dr. Dominic Savio, SJ, our esteemed Principal, for his unwavering encouragement and guidance. My heartfelt thanks go to the Vice - Principal, Prof. Bertram Da'Silva, Dean of Science, Dr. Indranath Chaudhuri, and Dean of Arts, Dr. Farhat Bano for their relentless support. I would like to express my deepest appreciation and gratitude to Dr. Sudipa Saha, whose ceaseless guidance and tireless efforts have brought this magazine to fruition. I applaud the commendable efforts of our dynamic editorial board, whose dedication over the past few months has resulted in this year's edition, thereby continuing the decade-long tradition of the Postgraduate & Research Department of Biotechnology. I extend my sincere thanks to our entire departmental faculty, research scholars and students for their valuable contributions and enthusiastic support, without which this endeavour would not have been possible. May our journey continue!

Nihil Ultra!

Dr. Jhimli Dasgupta
Head of the Department
Postgraduate & Research Department of Biotechnology
St. Xavier's College (Autonomous), Kolkata

FROM THE EDITOR'S DESK

'Chiasma', our departmental magazine, in the truest sense is like our child, whose birthday is celebrated every year, not on any fixed date but, before we start our Festive Holidays. No time can be more ideal than this – rainy season fades away, we witness a few days of clear blue sky, weather not unbearably hot, a few steps away from the hustling-bustling city you can enjoy Kans grass (Kash phool in Bengali) and that special feel of the grand preparation for 'Durga Puja' celebration all around the city!

The theme is "Tech-tonic: Harnessing the Power & Managing the Fallout/Outreach". I perfectly understand that this convoluted theme title needs some explanation and that is exactly what I am going to do in the next few paragraphs.

In Science, from desk/bench-top research to commercialization of a product/technique, there are innumerable steps, but the story does not end there. This is just 'harnessing the power' of our natural resources, both animate and inanimate. The 'fallout' should be critically reviewed. Scientific discoveries should be for the benefit of humanity and not their destruction. 'Outreach' should be another criterion to rate a scientific product/technique. Target population should not be judged by their economic status. A beneficial product/technique should be made available to all, rich or poor, by gradually bringing down the cost of production and/or by supplementary aid to the needy. Unfortunately, rigid patenting laws, greed for more and more profit, unethical hoarding or uneven distribution of beneficial products, all have become stumbling blocks in the outreach program. We all agree that science must respond to societal needs and global challenges. Nevertheless, we need to translate our noble thoughts to a reality.

The theme will become crystal clear when I cite some examples.

From the film industry point of view, we can call 2023 as the 'Oppenheimer Year'. So, the first example that comes to our mind is 'Nuclear Energy'. Way back in 1938, three chemists - Otto Hahn, Lise Meitner, and Fritz Strassman, working in a laboratory in

Berlin, discovered nuclear fission that indeed has altered the course of history: This is an ideal example of 'managing the fallout'! Nuclear energy is a clean form of energy as nuclear power plants do not emit greenhouse gases while generating electricity and we are all aware of the link between 'greenhouse gases and global warming'. Instead, this clean form of energy was channelized to produce the devastating 'Atomic Bomb' by Scientists in a Laboratory at Los Alamos, New Mexico, USA under the leadership of the physicist J. Robert Oppenheimer. After witnessing the first detonation of the nuclear weapon on July 16, 1945, Oppenheimer said "Now I am become Death, the destroyer of worlds." On 6 and 9 August 1945, United States detonated two atomic bombs over the Japanese cities of Hiroshima and Nagasaki respectively, that left a path of immense destruction of life and property. Fortunately, these remain the only use of nuclear weapons in an armed conflict so far. But we are not over yet. We are standing on the tip of the iceberg! Currently many nations possess nuclear weapons and if there is a Third World War, the human race will be wiped out from the face of the earth.

Advancement in the fields of Electronics and Communication deserves a standing ovation but they are also not devoid of fallout. Cyber crime is on the rise. Stricter Cyber Security policies need to be introduced and managed. The concept of 'human beings are social beings' is drastically affected with the introduction of electronic gadgets, of which mobile phones need a special mention. It is an emergency gadget, but see its usage today, majorly for entertainment. A person in possession of a top-of-the-line mobile does not need any social interaction. We used to blame the television one day! This reminds us of the song by Moheener Ghora Guli (a Bangla band), "Prithibita Naki Choto Hote Hote ...". Couldn't resist myself from adding a few lines from the song:

পৃথিবীটা নাকি ছোট হতে হতে
স্যাটেলাইট আর কেবলের হাতে
ড্রয়িংরুমে রাখা বোকা বাক্সতে বন্দী
আ হা...

Still very true but needs some modification.

We are also skeptical about the introduction of Artificial Intelligence (AI). It is predicting huge job cuts. With a current population of India at 140.76 crores (2021), this is the last thing we would want to happen in our country. In order to avoid this fallout, concerned organizations need to carefully identify the sectors where AI will be beneficial.

Now, I want to move to "... managing the outreach" part of our theme title. Here I am going to mention the examples of Assisted Reproductive Techniques (ART) like In Vitro Fertilization (IVF), and Immunotherapy that includes prophylactic vaccines, therapeutic monoclonal antibodies, anaphylactic cytokine-based therapy and the recent CAR-T Cell-based therapy. Since these techniques are closely associated with

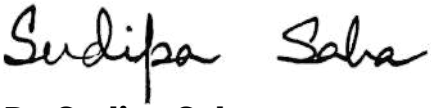
our departmental curriculum, I am leaving an explanation of the scientific basis of each of these techniques/products on the students. I will just point out the problems associated with the outreach programs.

Let us start with IVF. Almost all women want to experience motherhood. The journey from conception to parturition is an amazing experience. Unfortunately, some women fail to conceive. IVF can come to their rescue and bring a smile on their face. The technique from its inception in 1977 to till-date has been thoroughly improved and standardized. There is no dearth of IVF clinics, all over the world, even in our "City of Joy". But can it really bring joy to all the women in need of ART? The answer is a simple NO. It is a highly expensive procedure, and the financially challenged section of the society cannot afford it. Nobody, because of very selfish reasons, is trying to bring the price down for a wider outreach. The charges for IVF treatment in India is anywhere between Rs 60,000 and Rs 80,000, inclusive of medicines. However, in reality, most of the couples have to spend more than Rs 5 lakh due to the need for several rounds of IVF cycles.

Now, to Immunotherapy. Many years of extensive research in the field of Immunology have taught us that in certain diseases like cancer and viral as well as in autoimmune disorders, we are at the mercy of our immune system both naturally and artificially. This has paved the way for immunotherapy where we put to use our immune molecules like antibodies and cytokines or modified immune cells like CART in treating patients. Once again, the prices of such therapies are skyrocketing, affordable only to the privileged few. Scientists and Pharmaceutical companies must think of wider outreach programs.

Finally, time for a vote of thanks. I express my gratitude to Dr. Jhimli Dasgupta, Head of the Department, for asking me to be the editor of the 13th Edition of Chiasma. I take this opportunity to thank Principal Rev. Dr. Dominic Savio, SJ, Vice-principal Prof. Bertram Da'Silva, Dean of Science Dr. Indranath Chaudhuri and Dean of Arts Dr. Farhat Bano for their messages and constant encouragement. My gratitude also goes to all our colleagues who have been our constant inspiration, scholars and technical assistants. My heartfelt thanks to our GREAT STUDENTS. Without their active and enthusiastic participation timely launching of this edition of Chiasma would have been an impossible task.

Last but not least, I would like take this opportunity to thank Dr. Uma Siddhanta for her constant moral and academic support, and for her valuable inputs in arranging this message.



Dr. Sudipa Saha

Associate Professor and Editor,

Chiasma Volume XIII

Postgraduate & Research Department of Biotechnology

St. Xavier's College (Autonomous), Kolkata

Departmental Diaries

Dr. Jhimli Dasgupta

M.Sc., Ph.D.

RESEARCH INTERESTS AND THE PROJECTS RUNNING IN THE LAB

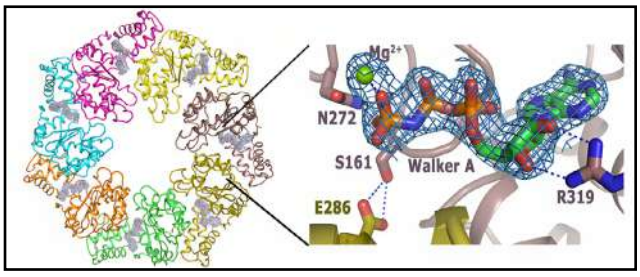
(1) Structural and functional insights of the molecular motors such as σ-54 dependent transcription activators, involved in flagellar gene transcription:

a) *Structural and functional aspects of the AAA+ ATPase FlrC that control flagellar synthesis and biofilm formation in motile bacteria.*

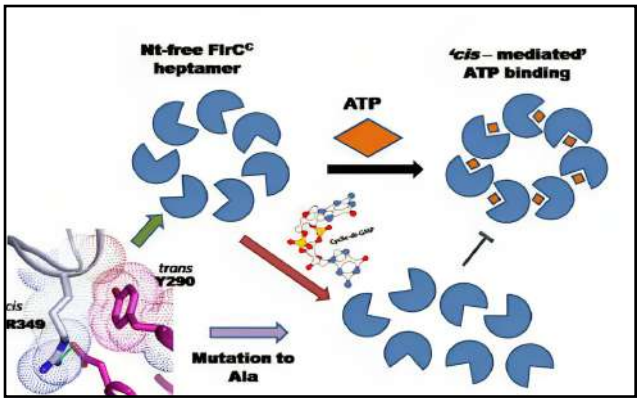
b) *FlrA, the master transcription regulator of flagellar synthesis in motile bacteria: Structural insights, oligomerisation, functional implications, and regulation by the second messenger c-di-GMP.*

(2) Revelation of the sensory signal and mechanism of FlrB, a unique cytosolic sensor Histidine kinase playing a pivotal role in flagellar synthesis and motility of *V. cholerae.*

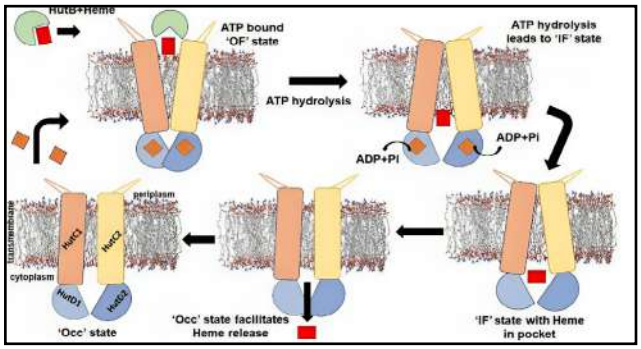
(3) Understanding the mechanism of nutrient uptake by pathogenic bacteria using ABC.



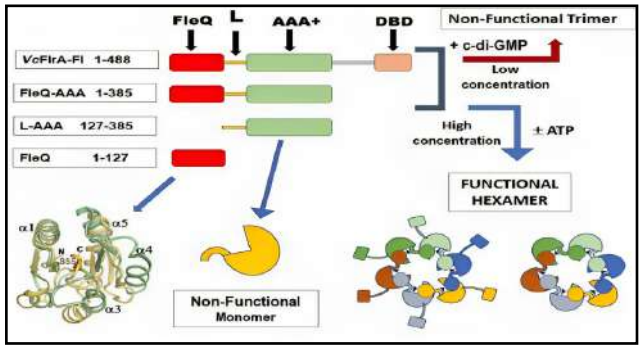
ATP binding to bEBP, FlrC



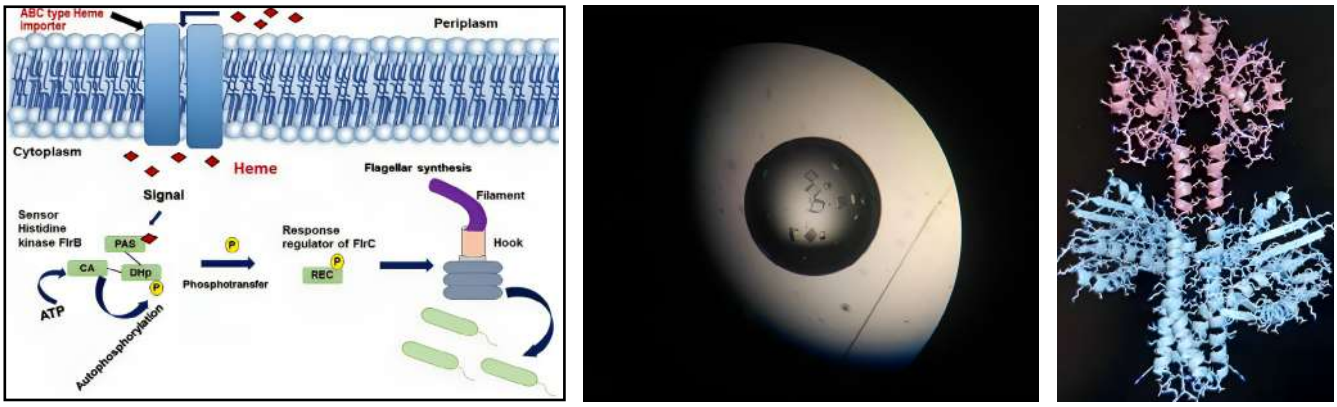
Modulation of bEBP, FlrC by ATP and c-di-GMP



Heme transportation through ABC importer HutCD



c-di-GMP mediated regulation



Crystal and the structural model of sensor histidine kinase involved in flagellar synthesis

CURRENT LAB MEMBERS

Shrestha Chakraborty
BRNS Fellow

Peeali Mukherjee
DST-INSPIRE Fellow

Indrila Saha
UGC-DAE Fellow

Ruchira Das
DST-INSPIRE Fellow

Arnab Pal
MHRD-STARS Fellow

LAB ALUMNI

Dr. Maitree Biswas
Degree awarded: 2016
Postdoc from Univ. of British Columbia, Canada
Current position: Scientist, Primary Peptides Inc., Vancouver, BC, Canada

Dr. Sanjay Dey
Degree awarded: 2016
Postdoc at IGBMC, Illkirch Cedex, France

Dr. Shubhangi Agarwal
Degree awarded: 2018
Postdoc at Department of Anesthesiology, Nimigean Laboratory, Weill Cornell Medicine, NY, USA

RECENT PUBLICATIONS

1. Peeali Mukherjee, Shubhangi Agarwal, Sritapa Basu Mallick, **Jhimli Dasgupta**. PAS domain of flagellar histidine kinase FlrB exhibits novel architecture, and binds Heme as sensory signal in unconventional fashion. **bioRxiv, 2023 doi**: https://doi.org/10.1101/2023.06.29.547052

2. Shrestha Chakraborty, Shubhangi Agarwal, Arindam Bakshi, Sanjay Dey, Maitree Biswas, Biplab Ghosh, **Jhimli Dasgupta**. The N-terminal FleQ domain of the *Vibrio cholerae* flagellar master regulator FlrA plays pivotal structural roles in stabilizing its active state. **FEBS Lett. 2023 Jul 4**. doi: 10.1002/1873-3468.14693 Epub ahead of print.

3. Saha I, Chakraborty S, Agarwal S, Mukherjee P, Ghosh B, **Dasgupta J**. Mechanistic insights of ABC importer HutCD involved in heme internalization by *Vibrio cholerae*. **Sci Rep. 2022** May 3;12(1):7152. doi:10.1038/s41598-022-11213-9.

4. Shrestha Chakraborty, Maitree Biswas, Sanjay Dey, Shubhangi Agarwal, Tulika Chakrabortty, Biplab Ghosh, **Jhimli Dasgupta**. The heptameric structure of the flagellar regulatory protein FlrC is indispensable for ATPase activity and disassembled by cyclic-di-GMP. **J Biol Chem. 2020** Dec 11;295(50):16960-16974. doi: 10.1074/jbc.RA120.014083.

BOOK PUBLICATION

Chapter 3. **Structural Insights of Cobalamin and Cobinamide Uptake by ABC Importer of *Vibrio* Species**. Arunima Bhattacharya[1#], Samriddhi Bhattacharya[1#], Shubhangi Agarwa[l1,2] and Jhimli Dasgupta[1]. [1] Post Graduate Department of Biotechnology, St. Xavier's College (Autonomous), Kolkata, West Bengal, India; [2] Weill Cornell Medicine, Department of Anaesthesiology, New York, USA. In: Advances in Health and Disease. Volume 57; Editor: Lowell T. Duncun. ISBN:979-8-88697-098-2. © **2022 Nova Science Publishers, Inc. # Equal contribution.**

Dr. Sudipa Saha

AREA OF RESEARCH

Structure function studies of proteins

SCHOLARS

Sushmita Nandy

Research Focus:

Protein Biology, Bioinformatics

Aparajita Chakraborty

Research Focus:

Protein Structure and Function, Bioinformatics

Granting Agency: West Bengal Department of Higher Education, Science and Technology and Biotechnology

PUBLICATIONS (2020-2023)

1. Aparajita Chakraborty, Priyanka De and **Sudipa Saha**. "Structure-function relationship of α-crystallin in the context of vertebrate lens evolution and its role in eye disorders" (Review). Journal of Proteins and Proteomics, 2022. https://doi.org/10.1007/s42485-022-00101-5

2. Aparajita Chakraborty, Sayak Ganguli, Priyanka De and **Sudipa Saha**. "An insight into the structural analysis of α-αcrystallin of habitat specifc fsh: a computational approach". Journal of Proteins and Proteomics, 2022. https://doi.org/10.1007/s42485-023-00107-7

3. Aparajita Chakraborty, Sushmita Nandy, **Sudipa Saha** and Priyanka De. "An Insight on α-crystallin Interactions with Various Proteins in Systemic Disorders" (Review). Journal of Stress Physiology & Biochemistry, Vol. 19, No. 3, (2023), 35-46. ISSN 1997-0838.

Dr. Aniruddha Banerji

PRIMARY AREA OF RESEARCH INTEREST

Cancer biology

ADDITIONAL AREAS OF RESEARCH INTEREST

Wildlife biology
Evolutionary biology
Environmental biology
Ecology and Epidemiology

RESEARCH SCHOLARS

Mr. Anirban Roy

Area of Research: Cancer Biology

Scholarship Granting Agency:

Swami Vivekananda Merit-cum-Means Scholarship, Government of West Bengal

Ms. Indira Chakraborty

Area of Research: Cancer Biology

Scholarship Granting Agency:

Swami Vivekananda Merit-cum-Means Scholarship, Government of West Bengal

LAB ALUMNUS

Dr. Aheli Majumder

Awarded Ph. D from University of Calcutta, Department of Zoology, 2022.

PUBLICATIONS (2020-2023)

Journals and Book Chapters

1. **A. Banerji.** Endocrine Disrupting Compounds (EDCs): The Risks for Aquatic Fauna. Current Strategies in Biotechnology and Bioresource Technology Vol. 2, pub: Book Publisher International (2020) pp.149-155; Print ISBN: 978-93-89816-88-4, eBook ISBN: 978-93-89816- 89-1.

2. **A. Banerji**, K.K. Ganguly, A. Chatterjee. All-trans Retinoic Acid (ATRA), a Potential Inhibitor of Matrix Metalloproteinase-2 (MMP-2) and Tumour Invasion in Melanomas. Current Strategies in Biotechnology and Bioresource Technology Vol. 2, pub: Book Publisher International (2020) pp.156-168; Print ISBN: 978-93-89816-88-4, eBook ISBN: 978-93-89816- 89-1.

3. **A. Banerji**, P. Ghoshal. Agricultural Production and Climate Change: The Scope for Innovation in the Post-COVID 19 Scenario. Current Strategies in Biotechnology and Bioresource Technology Vol. 2, pub: Book Publisher International (2020) pp.169-176; Print ISBN: 978-93-89816-88-4, eBook ISBN: 978-93-89816-89-1.

4. A. Majumder, S. Ray, **A. Banerji**. Phosphatidylinositol 3' Kinase (PI3K), A Crucial Regulator of Epidermal Growth Factor Receptor (EGFR) Modulated MMP-2, MMP-9 and MT1-MMP 5 Expression in Breast Cancer Cells. Recent Progress in Microbiology and Biotechnology Vol. 2, pub: Book Publisher International (2020) pp. 165-174; Print ISBN: 978-93-90206-62-9, eBook ISBN: 978-93-90206-59-9.

5. I. Chakraborty, A. Roy, **A. Banerji**. Therapeutic Potential of Phosphatidylinositol 3' Kinase (PI3K) Inhibitors in Cervical Cancer. Science and Culture (2021) vol. 87(1-2) pp. 57-61.

6. P. Ghoshal, **A. Banerji**. Studies on Some Issues Specific to Demography during COVID-19 Pandemic. Issues and Development in Health Research Vol. 3, pub: Book Publisher International (2021) pp. 1-9; Print ISBN: 978-93-91595-14-2, eBook ISBN: 978-93-91595-16-6.

7. A. Roy, I. Chakraborty, **A. Banerji.** Determination of Phytochemicals as Potential Inhibitors of Matrix Metalloproteinases (MMPs) with Special Reference to Breast Cancer. Issues and Development in Health Research Vol. 5, pub: Book Publisher International (2021) pp.72-81; Print ISBN: 978-93-91882-30-3, eBook ISBN: 978-93-91882-32-7.

8. A. Roy, I. Chakraborty, **A. Banerji**. Natural Compounds as Potential Regulators of the Phosphatidylinositol 3' Kinase (PI3K) Pathway in Breast Cancer. South Asian Journal of Experimental Biology (2021) vol. 11(5), pp. 524-538.

9. P. Ghoshal, **A. Banerji**. Agriculture in COVID-19 Pandemic: The Indian Perspective. New Innovations in Economics, Business and Management Vol. 8, pub: Book Publisher International (2022) pp. 77-86; Print ISBN: 978-93-5547-510-7, eBook ISBN: 978-93-5547-518-3.

10. P. Ghoshal, **A. Banerji**. Looking at COVID-19 Pandemic Through The Lens Of Epidemiological Transition Theory. Science and Culture (2023) vol. 89(1-2) pp. 27-32.

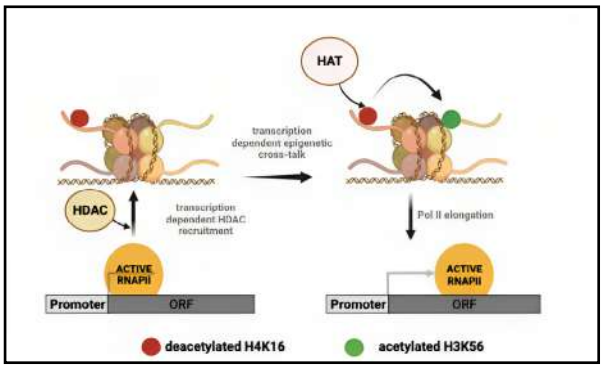
11. S. Sen, A. Biswas, **A. Banerji.** Analysis of Avian Diversity at Chintamoni Kar Bird Sanctuary: An Urban Forest Perspective. Uttar Pradesh Journal of Zoology (2023) vol. 44 (12), pp. 7-15.

12. P. Ghoshal, **A. Banerji**. Forest Cover and Its Management: A Study in Indian Perspective. Novel Perspectives of Geography, Environment and Earth Sciences Vol. 9. pub: Book Publisher International (2023) pp. 28-43. Print ISBN: 978-81-19491-52-0, eBook ISBN: 978-81-19491-53-7.

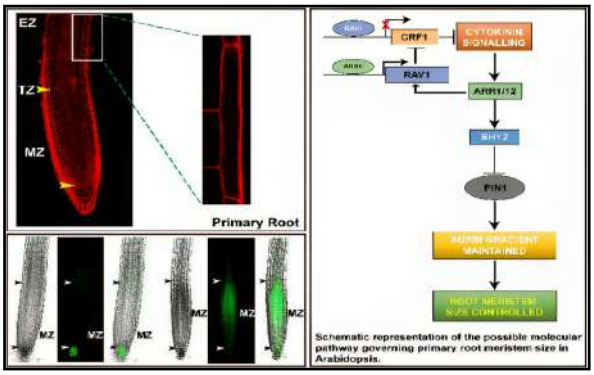
Dr. Ronita Nag Chaudhuri

RESEARCH INTEREST

- *The mechanism of chromatin regulation during Gene expression and DNA damage response*



- *Genetic and epigenetic basis of root system architecture modulation*



LAB MEMBERS (PRESENT)

Preeti Khan (CSIR-NET Fellow, SRF)
Research Focus: Role of histone acetylation in Nucleotide Excision Repair and gene expression regulation

Drishti Mandal (SERB Project Fellow, SRF)
Research Focus: Cross talk between hormone signaling pathways in modulation of root system architecture

Saptarshi Datta (CSIR-NET FELLOW, SRF)
Research Focus: Genetic and epigenetic regulation of root system architecture and its dynamism in response to abiotic stress signals.

Priyabrata Singha (DBT Project Fellow)
Research Focus: Elucidating the significance of crosstalk between histone methylation and acetylation during DNA-templated processes.

Sicon Mitra
(SERB Project Fellow)
Research Focus: Transgenic approach to improve quality traits for better adaptation to stress conditions.

Swarnavo Chakraborty
(CSIR-NET Fellow, JRF)
Research Focus: Understanding the overlapping molecular mechanism of lateral root development and nodule organogenesis mediated by B3 domain transcription factors

LAB MEMBERS (PAST)

Dr. Sonia Bedi
Genome Solution Specialist, Molsys Ltd. Bangalore

Dr. Anagh Ray
Post-Doctoral Fellow, National Cancer Institute, NIH, Bethesda, MD, USA

Dr. Sourabh Sengupta
Post-Doctoral Fellow, Levy Lab, University of Wyoming, Wyoming, USA

RECENT PUBLICATIONS

1. ***RAV1 mediates cytokinin signalling for regulating primary root growth in Arabidopsis.*** Drishti Mandal, Saptarshi Datta, Giridhar Raveendar, Pranab Kumar Mondal and Ronita Nag Chaudhuri*. ***The Plant Journal (2023) doi: 10.1111/tpj.16039.***
2. ***Acetylation of H3K56 orchestrates UV-responsive chromatin events that generate DNA accessibility during Nucleotide Excision Repair***. Preeti Khan and Ronita Nag Chaudhuri*. **DNA Repair (2022),** DOI: https://doi.org/10.1016/j.dnarep.2022.103317
3. ***DNA methylation and regulation of gene expression: Guardian of our health.*** Invited Review as a part of Special Thematic Issue. Gaurab Aditya Dhar, Shagnik Saha, Parama Mitra and Ronita Nag Chaudhuri*. **The Nucleus (2021)**, DOI: 10.1007/s13237-021-00367-y
4. ***Deacetylation of H4 lysine16 affects acetylation of lysine residues in histone H3 and H4 promotes transcription of constitutive genes.*** Anagh Ray, Preeti Khan and Ronita Nag Chaudhuri*. **Epigenetics (2020)**, DOI: 10.1080/15592294.2020.1809896
5. ***ABI3 plays a role in de-novo root regeneration from Arabidopsis thaliana callus cells***. Sourabh Sengupta and Ronita Nag Chaudhuri*. **Plant Signaling & Behavior (2020)** DOI:10.1080/15592324.2020.1794147
6. ***ABI3 mediated repression of RAV1 gene expression promotes efficient dehydrationstress response in Arabidopsis thaliana.*** Sourabh Sengupta, Anagh Ray, Dristhi Mandal and Ronita Nag Chaudhuri*. **BBA Gene Regulatory Mechanism (2020)**, 1863(9):194582. DOI: 10.1016/j.bbagrm.2020.19458

Dr. Priyanka De

RESEARCH INTEREST

Physiology (Cardiology, Neurobiology), Ethology, Environmental biology, Trans-disciplinary Research

PUBLICATIONS (2020-2023)

Scientific Journals:

1. Chakraborty, A., **De, P.**, Saha, S. (2023). Structure–function relationship of α-crystallin in the context of vertebrate lens evolution and its role in eye disorders. Journal of Proteins and Proteomics, 14, 25–41.
2. Sarangi, N. and **De, P.** (2022). Global warming and neuromarketing: An opinion-based neurocognitive analysis of associated lifestyle modifications. Journal of Environment and Sociobiology, 19(2), 257-270.
3. Chakraborty, A., Nandy,S., Saha,S., **De, P.** (2023). An Insight on α-crystallin Interactions with Various Proteins in Systemic Disorders. Journal of Stress Physiology & Biochemistry, 19(3), 35-46.
4. Chakraborty, A., Ganguli, S., **De, P.**, Saha, S. (2023). An Insight into the Structural Analysis of α-crystallin of Habitat- specific – A Computational Approach. Journal of Proteins and Proteomics, 14, 111–127.

Book Publication:

1. Book entitled *'Bigyaaner Antoraale',* a collection of scientific articles (ISBN: 978-93-84184-87-2). August 2021.

Book chapters:

1. "Diverse Facets of Physiological Ailments in the Light of Health Geography" as part of Book "Geography in the 21st Century: Emerging Issues and the Way Forward" [ISBN: 978-81-947715-9-3]. 2020.

2. "Enigma of Indian Tradition of Healing: A Phytomedicinal Perspective" as part of Book "Handbook of Agriculture & Plant Sciences" [ISBN: 978-93-91002-25-1]. 2021.
3. Enigma of consumer perception in marketing management: COVID-19 based cognitive
4. perspective, as part of book "How Covid-19 Changed the Consumer Behaviour in India" [ISBN: 978-93-92978-00-5]. 2021.
5. "Post-Pandemic Health Communication: Significance and Emerging Prospects" as part of Book "Opportunities in Media Industry Post-COVID-19" (Vol 2), [ISBN: 978-93-91537-90-6]. 2021.
6. "Enigma of emotion-cognition interactions in the contemporary COVID-19 based educational arena" as part of Book 'COVID-19 & YEAR 2020 (VolI), [ISBN:979-8885300049], 2021.
7. "Diverse facets of mental health disorders during COVID-19 pandemic", as part of Book "COVID 19 pandemic: A comprehensive understanding [USA ISBN: 9781005151577]. 2021.
8. "Role of metacognitive platform in the changing COVID-based education system" as part of book Society under seize: COVID 19 and consequences [ISBN: 978-93-91897-22-2]. 2022.
9. "Heavy Metal Perception in Plants", as part of book Heavy Metals in Plants: Physiological to Molecular Approach [ISBN 9780367627393]. 2022.
10. "Diverse impacts of air pollution on biodiversity: a different outlook" as part of book Environment conservation, challenges threats in conservation of biodiversity Volume-II (ISBN: 978-93-94766-04-4). 2022.

Dr. Souvik Roy

Ph.D. (Microbiology), M.Phil. (Microbiology), M.Sc. (Microbiology, Gold-Medalist), B.Sc. (Microbiology, Gold-Medalist)

PRESENT RESEARCH INTERESTS

1. **Different aspects of Clinical/Medical Microbiology:**

a) Although commercially-available toilet-seat sanitizers claim to be effective in killing the responsible uropathogens, their efficacies need to be checked periodically and compared, particularly keeping in mind the rapid emergence of multi-drug resistant (MDR)- and new pathogenic strains of uropathogens.

a) In recent times, there has been an increased quest for alternative novel herbal drugs to ameliorate the mammoth problem of new antimicrobial resistance (AMR) mechanisms. Antioxidant and antimicrobial activities in the leaves of Pine (*Pinus spp*.), Fir (*Abies spp*.) and Chinar (*Platanus*

a) orientalis) have not been assessed till date. The present research focus of our lab is to conduct in vitro phytochemical screening of radical-scavenging antioxidant properties and antibacterial activities of the aqueous and alcoholic extracts of the leaves of Pine, Fir and Chinar against drug-sensitive (DS), MDR- and XDR-bacterial strains ***[Recipient of Intramural Research Grant from St. Xavier's College (Autonomous), Kolkata for this Study]***.

2. **Assessment of the microbiological quality of various street-vended and shop-sold food and aromatic beverages:**

In a country like India, especially in Kolkata, consuming food and aromatic beverages from itinerant street vendors and roadside stalls is very common. As these unhygienically-sold consumables are very prone to huge microbial contaminations, a periodic assessment of their sanitary qualities, and tracing down ways to maintain their hygiene status as far as practicable, should always be in the top priority list of Food and Industrial Microbiologists for an overall societal benefit.

PUBLICATIONS [2020-2023]

A) Original Research & Review Papers in Peer-Reviewed Journals:

1. **Roy, S**., Manna, S., Chowdhury, S., & Choudhury, L. (2023). Improvement of Large-Scale Production of Lignocellulosic Bioethanol through Synthetic Biology Approaches: A Comprehensive Review. **World Journal of Biology Pharmacy and Health Sciences.** 14:316-331 [ISSN (Online): 2582-5542].
2. **Roy, S.**, Shaw, D., Sarkar, T., & Choudhury, L. (2023). Mycotoxins in fermented foods: A comprehensive review. **Novel Research in Microbiology Journal.** 7(2):1897-1917 [ISSN (Print): 2537-0286; ISSN (Online): 2537-0294].
3. **Roy, S**., Chakrabarty, S., Pal, R. and Choudhury, L. (2023) Combating SARS-CoV-2: A Comparison between mRNA Vaccines and Killed Whole Cell Vaccines. **International Journal of Biology, Pharmacy and Allied Sciences.** 12(4):1781-1798 [ISSN (Online): 2277-4998].
4. **Roy, S**., Mullick, S., Chakrabarty, S. and Choudhury, L. (2023) Pathogen-based Molecular Mimicry and Autoimmune Disorders: A Close Look. **International Journal of Biology, Pharmacy and Allied Sciences**. 12(4):1701-1716 [ISSN (Online): 2277- 4998].
5. **Roy, S.**, Banerjee, S., Bhowmick, P. and Choudhury, L. (2023) Psychobiotics: Deciphering its role in neuropsychiatry. **World Journal of Biology Pharmacy and Health Sciences.** 13(01):457–464 [ISSN (Online): 2582-5542].
6. **Roy, S**., Majumder, S., Deb, A. and Choudhury, L. (2023) Various Types and Effects of Microbial Contamination in Cosmetics and Pharmaceutical Products, and their Preservation Strategies. **Aviskaar: A Xaverian Journal of Research** [ISSN (Print): 2277-8411; ISSN (Online): 2278-1048].
7. **Roy, S**., Laha, I., Ray, D. and Choudhury, L. (2022) Influence of Climate Change & Environmental Toxicants on Epigenetic Modifications. **World Journal of Environmental Biosciences**. 11(3):21-29 [ISSN (Online): 2277-8047].
8. **Roy, S**., Bhowmick, P., Mukherjee, P., Dey, K. and Choudhury, L. (2022) Mucormycosis in COVID-19 patients: a fungal disease decoded. **International Journal of Biology, Pharmacy and Allied Sciences.** 11(11):4979-4995 [ISSN (Online): 2277-4998].
9. **Roy, S.**, Banerjee, A., Mullick, S. and Choudhury, L. (2022) Hunt for non-antibiotic antibacterial approaches: A possible game changer? I**nternational Journal of Biology, Pharmacy and Allied Sciences**. 11(8):3643-3656 [ISSN (Online): 2277-4998].
10. **Roy, S**., Nag, S., Saini, A. and Choudhury, L. (2022) Association of human gut microbiota with rare diseases: A close peep through. I**ntractable & Rare Diseases Research**. 11(2):52-62. doi:10.5582/irdr.2022.01025. [ISSN (Print): 2186-3644; ISSN (Online): 2186-361X].
11. **Roy, S.** Roy, L., Khatun, Z. and Sarangi, N. (2022) Gut Microbiome Therapy: A Future Biotechnological Wonder. **Aviskaar: A Xaverian Journal of Research** [ISSN (Print): 2277-8411; ISSN (Online): 2278-1048].

12. **Roy, S.**, Choudhury, L., and Sarangi, N. (2022) COVID-19, Long COVID and its Neurological Effects. **International Journal of Biology, Pharmacy and Allied Sciences** .11(3):1151-1165[ISSN (Online): 2277-4998].

13. Roy, L., **Roy, S**., Siddhanta, U., Siddhanta, A. (2021) Prevalence of antibiotic-resistant pathogenic bacteria from canal bank soils in and around Kolkata, India. **International Journal of Environmental Studies (Taylor & Francis)**. 9:1-15. https://doi.org/10.1080/00207233.2021.1966249. [ISSN (Print): 1735-1472; ISSN (Online): 1735-2630].

14. **Roy, S**., Bhattacharjee, A., Chaudhuri, R, Dash, J.J., Saha, M., Choudhury, L. (2021) Pre- treatment with Scopolamine naturally suppresses Japanese Encephalitis Viral Load in Embryonated Chick through regulation of multiple signaling pathways. **Applied Biochemistry and Biotechnology (Springer).**193:1654–1674. doi: 10.1007/s12010-021-03526-8 [ISSN (Print): 0273-2289; ISSN (Online): 1559-0291].

15. **Roy, S**., Ghorai, S., Choudhury, L., Das, A., Banik Ghosh, R. and Banik, S.P. (2021) Advances in cellulosic enzyme technologies for enhanced stability and catalysis. **Journal of Advanced Scientific Research.** 12(2) Suppl 1:49-65 [ISSN (Online): 0976-9595].

16. **Roy, S**. and Sarangi, N.(2021) Neurological Impact of COVID-19 and its Effect on Pediatric Population: A Comprehensive Review. **Aviskaar: A Xaverian Journal of Research** [ISSN (Print): 2277-8411; ISSN (Online): 2278-1048].

17. **Roy, S**., Datta, A., Ghosh, A., Mandal, G., Banerjee, S. and Roy, L. (2020) Studies on the susceptibility of Common Uropathogens to Toilet Seat Sanitizers and their Antibiogram. I**nternational Journal of Biology, Pharmacy and Allied Sciences.** 9(9):2212-2230. https://doi.org/10.31032/IJBPAS/2020/9.9.5178. [ISSN (Online): 2277-4998].

18. Choudhury, L., **Roy, S**. and Chakrabarti, K. (2020) Microorganisms in Khoa, the base of Indian Sweets, and their Impact on Public Health. **International Journal of Biology, Pharmacy and Allied Sciences.** 9(9):2132-2149. https://doi.org/10.31032/IJBPAS/2020/9.9.5171. [ISSN (Online): 2277-4998].

19. **Roy, S**., Bhattacharjee A., Roy, L. and Das, S. (2020) Recent Advances Towards The Development and Applications of Novel Therapeutics against Chikungunya Virus Infections. **International Journal of Pharmaceutical Sciences and Research**. 11(12): 6503-6513 [ISSN (Print): 2320-5148; ISSN (Online): 0975-8232].

B) Book Chapters:

1. **Roy, S**., Manna, S., Chowdhury, S., and Choudhury, L. (2023) Ways of Improvement: A step ahead towards improved cellulosic ethanol production. Taylor & Francis (Ed. Banik Samudra Prosad & Bagchi Debasis). *(In Press)*.

2. **Roy, S.**, Banerjee, S., Bhowmick, P., Choudhury, L. and Mukherjee, A. (2022) Psychobiotics and their Applications in Neuropsychiatry. Microbial Essentialism: An Industrial Prospective. Elsevier (Ed. Sarsan Sreedevi). *(In Press)*.

2. **Roy, S**. and Choudhury, L. (2022) Human Gut Microbiota and Rare Diseases: A Knot Tied? Recent Trends in Microbiology. Vijaygarh Jyotish Ray College and Scholar's Book Hub, Kolkata (in association with the Microbiologist's Society of India) (Ed. Debnath Sampa).Volume II. Pp 246-275 [ISBN (Print): 978-81-956878-9-3].

3. **Roy, S**. and Roy, L. (2022) The symbiotic relationship between fungi and plants. Sustainable Utilization of Fungi in Agriculture and Industry (Series - Mycology: Current and Future Developments). Bentham Science Publishers Pte. Ltd. Singapore (Ed. Shanthipriya Ajmera, B. Bhima, Krishnappa M. and Ramchander Merugu).Volume 4. Pp 52-74(23) [ISSN (Online): 2452-0780; ISSN (Print): 2452-0772; ISBN (Online): 978-981-5040-34-0; ISBN (Print): 978-981-5040-35-7; ISBN (Paperback): 978-981-5040-36- 4] DOI: 10.2174/9789815040340122020009.

Dr. Sayak Ganguli

RESEARCH INTERESTS

Plant Biology, Genomics, Bioinformatics & Computational Biology

RESEARCH SCHOLARS

Meesha Singh
Ph.D. Awarded
Antimicrobial Resistance of Urban Wastewater
Co- PI: Dr. Mahashweta Mitra Ghosh; Microbiology

Sarmishta Mukhopadhyay
CSIR -NET
Genomics guided Drug Discovery against *Shigella*

Souradip Basu
WBDST -SRF
Tribal Gut Microbiome Profiling & Bioprospecting
Co- PI: Dr. Mahashweta Mitra Ghosh; Microbiology

Rupsha Karmakar
CSIR-NET
Community genomics for wastewater monitoring
Co- PI: Dr. Mahashweta Mitra Ghosh; Microbiology

LIST OF SELECTED PUBLICATIONS (JANUARY 2020 – MAY 2023)

1. Ganguly, K., Dutta, T., **Ganguli, S.** et al. Common structural attributes of tyrosinase variants are unlikely to determine differential retentions within endoplasmic reticulum: a homology modelling study with 45 variants. *Proc.Indian Natl. Sci. Acad*. (2023). https://doi.org/10.1007/s43538-023-00196-4
2. Chakraborty, A., **Ganguli, S**., De, P. et al. An insight into the structural analysis of α-crystallin of habitat-specific fish: a computational approach. *J Proteins Proteom* 14, 111–127 (2023).
3. https://doi.org/10.1007/s42485-023-00107-7
4. Bhattacharya, A., Bhowmick, P., **Ganguli, S**., & Mitra, A. K. (2023). Evolutionary Insights into the Enzymes involved in the Biosynthesis of the Volatile Organic Compounds Isoprene and Pinene in Plants. *Plant Science Today*. https://doi.org/10.14719/pst.2115
5. Sengupta S., Singh P.K., **Ganguli S.** 2022. Insights into the core bacterial consortia of root endophytes in two cultivated varieties of rice in West Bengal. *Environmental and Experimental Biology* 20: 205–218. DOI: 10.22364/eeb.20.19
6. Sarkar, N., Chakravarty, R., **Ganguli , S.**, Singh , S. P., Narayan , J., & Banerjee, A. (2022). A pilot study on some critical immune elements in HBV infection: evidence of Alpha-1 Antitrypsin as an immunological biomarker: HBV and critical immune elements. *Gastroenterology and Hepatology from Bed to Bench*, 15(4). https://doi.org/10.22037/ghfbb.v15i4.2587
7. Gaurab Aditya Dhar, **Sayak Ganguli** & Bidisha Mallick "First insights into the rhizospheric bacterial abundance data of *Ceriops tagal* (Perr.) C.B.Rob. from Indian Sundarbans" https://doi.org/10.1016/j.dib.2022.108468
8. Sarmistha Mukhopadhyay, Santanu Chakrabarti and **Sayak Ganguli** "Exploring undeciphered shigella proteins for identifying potential drug targets" International Journal of Computational Biology and Drug Design, 2022 Vol.15 No.1, pp.60 - 75 DOI: 10.1504/IJCBDD.2022.10049591
9. Souradip Basu; Sohini Gupta; Kaustav Das; Subrata Sankar Bagchi; **Sayak Ganguli** "Tribal ethnomedicine: a rich source for future drugs" Indigenous Traditional Knowledge, ISBN: 978-81-955847-0-3; Chapter 5; Pg: 21 - 29
10. Kaustav Das, Koel Mukherjee**, Sayak Ganguli** & Subrata Sankar Bagchi (2022) Dietary Intake and Nutritional Status of the adult Kheria Sabar males of West Bengal, India, Ecology of Food and Nutrition, 61:3, 367-384, DOI: 10.1080/03670244.2021.2018310
11. **Ganguli** S et.al 2022 Metagenomics-Guided Assessment of Water Quality and Predicting Pathogenic Load in Handbook of Research on Monitoring and Evaluating the Ecological Health of Wetlands DOI: 10.4018/978-1-7998-9498-8.ch005
12. Kundu, A.**, Ganguli, S**., Pal, A. (2022). Genomic Designing Towards Biotic Stress Resistance in Mungbean and Urdbean. In: Kole, C. (eds) Genomic Designing for Biotic Stress Resistant Pulse Crops. Springer, Cham. https://doi.org/10.1007/978-3-030-91043-3_8

13. Souradip Basu, Kaustav Das, Mahashweta Mitra Ghosh, Rajat Banerjee, Subrata Sankar Bagchi, **Sayak Gangul**i, First report of gut bacterial dataset of a tribal Bhutia family from West Bengal, India, Data in Brief, Volume 41, 2022, 107859, ISSN 2352-3409, https://doi.org/10.1016/j.dib.2022.107859.

14. Souradip Basu, Rajdeep Das, Sohini Gupta, **Sayak Ganguli**; Does Air Quality Influence the Spread of the Sars -Cov2 In Metropolitan Cities? -A Case Study from Urban India; June 2021 Current World Environment DOI:10.12944/CWE.16.2.27

15. Das, K., Mukherjee, K., **Ganguli, S**. et al. The association between somatotype and nutritional status: a cross-sectional study among the adult Sabar males of Purulia, West Bengal, India. Int. j. anthropol. ethnol. 5, 5 (2021). https://doi.org/10.1186/s41257-021-00046-5

16. "Exploration of Rhizospheric Microbial Diversity of the Indian Sundarbans: A World Heritage Site" in M. Nath et al. (eds.), Microbial Metatranscriptomics Belowground, https://doi.org/10.1007/978-981-15-9758-9_23; Springer Nature 2021\

17. "A Pipeline for Assessment of Pathogenic Load in the Environment Using Microbiome Analysis" in M. Nath et al. (eds.), Microbial Metatranscriptomics Belowground, https://doi.org/10.1007/978-981-15-9758-9_23; Springer Nature 2021

18. S Mukhopadhyay, **S Ganguli,** S Chakrabarti *Shigella* pathogenesis: molecular and computational in- sights AIMS Molecular Science, 7 (2): 99–121. DOI: 10.3934/molsci. 2020007

19. **S Ganguli,** PK Singh, A Pal - Plant Small RNA, 2020 Transcriptome-based identification of small RNA in plants: The need for robust prediction algorithms Plant Small RNA. Academic Press, 2020:65-97. https://doi.org/10.1016/B978-0-12-817112-7.00004-3

20. Debmalya Sengupta, Gairika Bhattacharya, **Sayak Ganguli** and Mainak Sengupta "Structural insights and evaluation of the potential impact of missense variants on the interactions of SLIT2 with ROBO1/4 in cancer progression" 2020 Nature Scientific Reports https://doi.org/10.1038/s41598-020-78882-2

Dr. Arindam Bakshi

CORE EXPERTISE

Molecular plant virology, Biochemistry, Plant Molecular Biology, Protein engineering.

PRIMARY AREA OF RESEARCH INTEREST

- Structure-function relationship of plant viral proteins and domains in viral replication, genome encapsidation and cell to cell movement.
- Functional characterization of plant viral RNA dependent RNA polymerase (RdRp) in vitro and in vivo
- Use of proteomic approaches to identify interaction partners of viral RdRp and novel host factors in viral replication.

ADDITIONAL AREA OF RESEARCH INTEREST

- Structural studies of Plant viral RdRp and its complexes using X-ray crystallography and cryo-electron microscopy
- Engineering of plant viral coat proteins as nano particles (VNPs) or virus like particles (VLPs) for intracellular delivery of therapeutic antibodies
- Subcellular localization of antibody tagged VNPs/VLPs inside mammalian cells and elucidation of biochemical pathways involved in antibody delivery

PUBLICATIONS (2020-2023)

1. Dev, B., **A. Bakshi** and B. Paramasivan (2022). Prospects of utilizing seawater as a reaction medium for pretreatment and saccharification of rice straw. Chemosphere 293: 133528.
2. Wijeratne, S., **Bakshi, A**., Talbert, J. (2022). Comparative Analysis of NanoLuc Luciferase and Alkaline Phosphatase Luminescence Reporter Systems for Phage-Based Detection of Bacteria. Bioengineering 9, 479. https://doi.org/10.3390/bioengineering9090479.
3. Chakraborty S, Agarwal S, **Bakshi A**, Dey S, Biswas M, Ghosh B, Dasgupta J. (2023) The N-terminal FleQ domain of the Vibrio cholerae flagellar master regulator FlrA plays pivotal structural roles in stabilizing its active state. FEBS Letters. https://doi.org/10.1002/1873-3468.14693.
4. Dev, B., **Bakshi, A.**, Kar, S. et al. (2023). Evaluation of potent marine ligninolytic bacteria and its efficiency in seawater-based delignification. Biomass Conversion and Biorefinery. https://doi.org/10.1007/s13399-023-04731-7.

Dr. Ditipriya Hazra

M.Tech., Ph.D.

I have joined the Postgraduate & Research Department of Biotechnology, St. Xavier's College, Kolkata in May, 2023. I am a structural biologist by training and by passion, deciphering RNA-protein interaction by X-ray crystallography and molecular dynamics simulation.

AREAS OF RESEARCH

1. Investigating the role of epitranscriptomic modulators in methylation dependent RNA degradation using X-ray crystallography
2. Structure guided drug designing and deciphering protein-drug interaction by molecular dynamics simulation

PUBLICATIONS (2020-2023)

1. Manna, S., Samal, P., Basak, R., Mitra, A., Roy, A.K., Kundu, R., Ahir, A., Roychowdhury, A. and **Hazra, D.** (2023). Amentoflavone and methyl hesperidin, novel lead molecules targeting epitranscriptomic modulator in acute myeloid leukemia: in silico drug screening and molecular dynamics simulation approach. Journal of Molecular Modeling, 29(1), p.9.
2. Mitra, A., Manna, S., Kundu, R., **Hazra, D**. and Roychowdhury, A. (2023). Brute Force Virtual Drug Screening with Molecular Dynamics Simulation and MM/PBSA to Find Potent Inhibitors of METTL16. IEEE/ACM Transactions on Computational Biology and Bioinformatics.
3. **Hazra, D.** and Roychowdhury, A. (2022). Protein-Based Nanostructures. Nanomaterials in Clinical Therapeutics: Synthesis and Applications, pp.269-283. (Book chapter)
4. Andric, V.†, Nevers, A.†, **Hazra, D**.†, Auxilien, S., Menant, A., Graille, M., Palancade, B. and Rougemaille, M. (2021). A scaffold lncRNA shapes the mitosis to meiosis switch. Nature Communications, 12(1), pp.1-12. †: equal contribution
5. **Hazra, D**., Andrić, V., Palancade, B., Rougemaille, M. and Graille, M. (2020). Formation of S. pombe Erh1 homodimer mediates gametogenic gene silencing and meiosis progression. Scientific reports, 10(1), pp.1-11.

FIRST YEAR
(Batch of 2023 - 2028)

SECOND YEAR
(Batch of 2022 - 2027)

THIRD YEAR

(Batch of 2021 - 2026)

FOURTH YEAR

(Batch of 2020 - 2025)

FIFTH YEAR

(Batch of 2019 - 2024)

SUPPORT STAFF

CHIASMA 2023 COMMITTEE

Departmental Achievements

Wisdom is not a product of schooling but of the lifelong attempt to acquire it.
– Albert Einstein

The pandemic is over, and now we are in full force with our daily lives with lots of challenges upfront, trying to hone our knowledge and skills in various fields and aspects. As for us, the students of the Postgraduate & Research Department of Biotechnology, we often find ourselves navigating a challenging terrain, where the fusion of science and innovation demands unwavering determination.

Our biotechnology students are more than just learners; they are not only knowledge seekers with an insatiable thirst for understanding the complexities of life sciences, but also they showcase a holistic approach to personal and professional development through participation in extracurricular activities with equal rigour. Their academic excellence, coupled with their active engagement in extracurricular activities, serves as an inspiring example of tenacity and perseverance.

Listed below are the achievements of the students in the year 2022-23, which made us all, as a department, proud of them.

ACADEMICS

List of students qualified in CSIR-NET (Life Sciences), June 2022

2018-23 Batch

Name	Qualified for	Rank
Nabhonil Chatterji	JRF-Lectureship	143

2019-24 Batch (SEMESTER IX)

Name	Qualified for	Rank
Uttirno Nath	JRF-Lectureship	142

List of students qualified in CSIR-NET (Life Sciences), December 2022 - June 2023

2018-23 Batch

Name	Qualified for	Rank
Anwesha Laha	JRF-Lectureship	59
Sutrisha Kundu	JRF-Lectureship	115

2019-24 Batch (SEMESTER IX)

Name	Qualified for	Rank
Astha Mukhopadhyay	JRF-Lectureship	8
Ritam Das	JRF-Lectureship	31
Saheli Majumder	JRF-Lectureship	83
Anushree Biswas	JRF-Lectureship	120
Anushka Chowdhury	Lectureship	31
Madhura Das	Lectureship	134

List of students qualified in GATE (Biotechnology) 2023

2018-23 Batch

Name	Rank
Avirup Chakraborty	117
Abhinanda Adak	326

2019-24 Batch (SEMESTER IX)

Name	Rank
Anushree Biswas	247
Astha Mukhopadhyay	440

List of students qualified in GATE (Life Sciences) 2023

2018-23 Batch

Name	Rank
Nabhonil Chatterji	13
Abhinanda Adak	131
Avirup Chakraborty	186

2019-24 Batch (SEMESTER IX)

Name	Rank
Anushree Biswas	45
Astha Mukhopadhyay	76
Surya Sarathi Das	506

List of students qualified in 24th WB SET examination, January 2023

2019-24 Batch (SEMESTER IX)

Name	Qualification
Saheli Majumder	Qualified

List of students involved in PhD Programs

2018-23 Batch

Name	Institute
Sanjana Banerjee	University of Nebraska Medical Center, USA.
Nabarun Roy	IIT Kanpur

1. **Ankur Paul (Semester 9)** received IASc-INSA-NASI Summer Research Fellowship to work under the guidance of Dr. Dipak Dutta at CSIR Indian Institute of Microbial Technology, Chandigarh.

2. **Indrakshi Banerjee (Semester 9)** received IASc-INSA-NASI Summer Research Fellowship, 2023 and worked under the guidance of Dr. Devyani Haldar at Centre for DNA Fingerprinting and Diagnostics, Hyderabad.

3. **Oushnik Goswamy (Semester 9)** received IASc-INSA-NASI Summer Research Fellowship to work under the guidance of Prof. Saumitra Das at Indian Institute of Science, Bangalore.

4. **Shrabasti Mukherjee (Semester 9)** received IASc-INSA-NASI Summer Research Fellowship, 2023 to work under the guidance of Dr. Kavita Babu at Indian Institute of Science, Bangalore.

5. **Aniket Deb and Saheli Majumder (Semester 9)** published an article titled "Microbial contamination of cosmetics and the pharmaceutical products, and their preservation strategies: A comprehensive review" in the Novel Research in Microbiology Journal, Volume 7, Issue 5, along with Dr. Souvik Roy and Dr. Lopamudra Roy. DOI: 10.21608/nrmj.2023.317346

6. **Swayambhik Mukherjee (Semester 7)**
   a. Qualified for science related project topic: Molecular docking and molecular dynamics simulation of Insulin with monovalent, divalent, and trivalent ions at Indian Institute of Technology Guwahati.

   b. Received DST-SERB, Govt. of India funding for attending high-end workshop on Computational Fluid Dynamics and Machine Learning organized at Indian Institute of Technology Indore.

BEYOND ACADEMICS

1. **Souptik Ghosh (2018-23 Batch), Dayita Saha and Uttirno Nath (Semester 9)** secured 3rd position in College Quiz of Kolkata International Quiz Festival 2023

2. **Uttirno Nath, Shreyan Ghosh (Semester 3), Sayak Choudhury (Semester 9)** stood 1st in Inter College quiz Brainstorm of Scottish Church Comp Sci dept fest "Innovarium"

3. **Soumyajit Ganguly (Semester 9)** stood 1st in Stage Play in Xavotsav 2023.

4. **Upama Mukhopadhyay (Semester 9)** stood 2nd in 90 seconds to Dance in Xavotsav 2023

5. **Dibyanshu Shaw, Koyena Nandi, Tiyas Sarkar, Abantika Samanta (Semester 7)** won 2nd prize in Model Making Competition at SN Bose Science & Technology Fair.

6. **Tiyas Sarkar, Koyena Nandi, Abantika Samanta, Reeddhi Banerjee, Vidhi Dhanuka (Semester 7)** won 1st prize in Eureka at SIGMA 2023.

7. **Rohita Sarkar, Anushree Sadhu, Sampreet Manna, Subhayu Chowdhury (Semester 7)** won 1st prize in Treasure Hunt at SIGMA 2023.

8. **Ranit Sarkar, Nandini Jaiswal (Semester 7)** won 1st prize in Treasure Hunt at Xavotsav 2023.

9. **Dyutishmita Bhattacharjee, Debdeep Chattopadhyay, Subham Sarkar, Sruty Dey (Semester 5)** secured 2nd position in Model and Paper Presentation at SN Bose State Science & Technology Fair.

10. **Subham Sarkar, Debdeep Chattopadhyay, Dyutishmita Bhattacharjee, Sruty Dey (Semester 5)** secured 2nd position in Model Making at SIGMA 2023.

11. **Subham Sarkar, Debdeep Chattopadhyay, Dyutishmita Bhattacharjee, Sruty Dey (Semester 5)** secured 3rd position in Paper Presentation at SIGMA 2023.

12. **Tania Banerjee (Semester 5)** secured 2nd position in Paper Art at Xavotsav 2023.

13. **Tania Banerjee, Sampoorna Dey, Heeya Gupta, Souvik Ghosh (Semester 5)** secured 1st position in Radio Play at Xavotsav 2023.

14. **Rupangi Biswas (Semester 5)** secured 2nd position in Doodle Art at Xavotsav 2023.

15. **Saranya Dattaray (Semester 5)** secured 3rd position in Paper Art at Xavotsav 2023.

16. **Shweta Mallick (Semester 5)** secured 2nd position in Eastern Dance at West Bengal Commission for Women: Kolkata Book Fair'23

17. **Shweta Mallick (Semester 5)** secured 1st position in Bollywood Group Dance at Xavotsav 2023.

18. **Supreeti Poddar (Semester 5)** secured 1st position in On Campus Program at Hult Prize St. Xavier's College, 2023.

19. **Aliza Ahmad (Semester 5)** was awarded certificate by St. Xavier's College for serving as the Guard of Honour to Group Commander Commodore Sameer Chaudhary, 2023.

20. **Shreya Mukhopadhyay (Semester 1)** was awarded certificate by St. Xavier's College for serving as the Guard of Honour on Independence Day, 2023.

21. **Shreshtha Biswas (Semester 1)** secured 1st position in Mixed doubles of Table Tennis and 3rd position in Women's single of Table Tennis at XPL (Xavier's Premier League), 2023.

22. **Samadrita Shaw (Semester 1)** became Runner-up in Women's Throwball at XPL (Xavier's Premier League), 2023.

Down the Memory Lane

5 Years or Half-a-Decade?

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Certain periods in life feel long and short at the same time. It is like riding a sine curve of emotions versus time without the amplitude remaining constant and one never knows which part of the curve it is unless you are ahead of it. I guess my entire life ahead is going to have a similar trend, now that I am not complaining about attending 10:10 am classes anymore, and those days now feel like mere mock tests for the real ones mocking me now.

These five years were a paradox to me. I will not be able to describe a semester in an adjective, let alone ten of them. Every day was nothing short of an adventure, if not physically, psychologically for sure. It all began when our professors tagged us as the 'guinea pig batch'. We all know what purpose a guinea pig serves, but what we don't know is what purpose a guinea pig wants to serve. Nevertheless, the rollercoaster ride began. Traveling through exams, events and emotions, I could eventually reach the greener side. But on the contrary, what seemed like the Amazon when I was in there, seems like a beautiful garden from the other side! And just like every Instagram reel romanticized the end of life's summer vacation, monsoon arrived literally in my eyes!

Having provided a buttload of unnecessary metaphors, I will now continue the rest of my chronicle giving you glimpses of the summer I turned 'adult'.

Adulting probably began when I started attending classes 75 times out of 100 without a uniform. I should have taken the hint then about how non-uniform life is going to get now, but rollercoasters are supposed to be so, aren't they? When we know we are in for a ride, we should not complain about the ups and downs, but get the necessary gear to get ourselves through it.

Have you ever heard about clearing arrears in the same semester you have got it? I have, and the subject of the story is I, me and myself. My journey here started with getting two arrears in the first semester but not because I failed to secure the passing marks but because I failed to appear for the concerned exams. Although the story isn't as tragic as I am making it sound on purpose. There were some discrepancies in the examination records and although I appeared for the exams, the results showed that I was absent. After some formalities, the issue got resolved and since then, I take pride in telling this story that I am the only Xaverian to have cleared arrears in the same semester in which I got them. It seems very funny now but believe me, I was crest-fallen back then. Unexpected stuff like this happens all the time, but it eventually does get resolved, and all one needs to do is be patient.

My innocent and ignorant self didn't know then how brittle our hearts are, and how it is always kept on the edge by a hormone called adrenaline rushing through our veins during this phase of our lives. Hearts not breaking is thus a statistical improbability.

There's no point in protecting it, all one needs to learn is how to make the impact less painful. Newton of all has a remedy for it because the longer an object takes to come to rest, lesser is the impact. If time is something you don't have, I am pretty sure you will get some use out of the broken pieces.

The classes, which barely fit into our schedule among the carnival going around the entire college throughout the year, are the ones that are eventually going to be handy more than anything else, if you aspire to make a career out of academia. Everything taught here will prepare you for all the hiccups ahead which no YouTube video can. My seniors told this to me way back when I was too naive to the antigens outside, but now when I have developed the quintessential antibodies, I know the importance of the classes I was reluctant to attend once.

Having said that, I should add a hind word that classes should be a part of your life, not your life. These five years will be the time when you will learn how your web browser feels when you keep 105987 tabs open. Simplifying, one needs to learn how to not crash and switch between tabs as and when required. Do everything you can and want to do, just not at the cost of your mental peace. Juggling is an essential skill that you will learn here which may not appear in your curriculum vitae, but will surely help you perform your act inadvertently in this circus of life!

The one important thing that you will surely get out of here along with your degree, assuming you clear all your arrears, is friends. You may begin and end your college life with different sets of people around you, but trust me by the time you get out, you will know who are the ones worth sticking around for. Treasure them, value them because they are going to last longer than the glamour we run after.

It took a long time to realize how short the time here was. That is the comedy of life. You will never understand the value of the ID card, which we were so irritated to wear, unless it becomes invalid! The race from Park Street metro station to room number 47 at 10:05 am may have been very taxing to our lungs but I will choose that race my entire life, if given an option to, over the marathon that I am a part of now. The race did end when we saw the laughing faces of our friends greeting us in the classroom when the concerned professor was complaining about our redundancy in getting late. I don't know how long I have to run now.

Seeing and perceiving things are two sides of the same coin. Basing our lives on the outcome of that toss is not the best way to go about it. 350 runs in 50 overs at 7 runs per over seems different than 350 runs in 300 balls with a little more than a run needed per ball. The easier option varies from person to person. Similar is the case with the duration of our course even though I believe there is no easy way to look at it. The shorter you believe it is, no time will be enough for you, and the longer you think it is, falling short will be inevitable. I have no idea which option will be helpful but I am pretty sure that if you are here, you will surely get through it, not just for the sake of it but in the best possible way for you. So, don't worry about the time you have, just make sure whenever you look back at these years, you have nothing but a smile on your face, and everything will automatically fall into place.

This is your song, sing it the way you want to!

College Chronicles: Memories of A Five-Year-Long Journey

Arkopriyo Banerjee
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"Life's journey is an infinite loop of endings and beginnings. Embrace the endless possibilities that lie ahead as you embark on the next chapter of your life."

I still remember the first day of college vividly like it was only yesterday. Five years flew by, leaving behind a bag full of memories. Stepping into Room 47 and sitting amongst so many unfamiliar faces, I had clutched my ID card in anticipation of the days to come. We were told that this course had no exit, and we are in for a long five-year commitment and should decide carefully. Well, hopefully, I made the right decision. We all think that it is going to be such a long journey but believe me, it goes by in a flash and reality starts hitting you harder after it is gone. Enjoy your college life while it lasts, but don't forget to read those slides in between (do not follow my example of studying at the last moment, that adrenaline rush isn't worth it). There were several moments of despair as well where I would find myself lost as to why I am pursuing this area of study but time and again, our teachers would narrate a story about a certain scientific milestone and we would all listen with awe. We all wanted to be like that, to find and address that one little macromolecule which is the key to maybe an extremely important pathway that would make or break a system. The departmental picnics were a breath of relief after the mid-semester exams, and we had so much fun. Post-Pujo we had our hands full with arranging our departmental seminar "Frontiers in Biotechnology", and coordinating multiple things to release CHIASMA timely. I definitely miss the rooftop canteen adda sessions, the food not so much.

Unfortunately, COVID-19 unleashed its wrath upon us in 2020, and we all realised laptops are our best friends (well to be honest, not having to rush up the Stairs to Heaven every single day was kind of a relief). But still, somewhere inside, the heart longed to meet those not-so-unfamiliar-anymore faces in person, and have rolls from 6, Russel Street before catching the metro. I have to say, we kind of enjoyed both sides. Arranging Google Meet for Teacher's Day with amazing artworks, performances and write-ups from all the skilled people in the department, working overnight to publish CHIASMA online, attending classes with intense concentration so that you do not miss out on attendance roll call, and making online exams a "fun activity" kept us going through the pandemic. If I could, I would definitely want to rewind time back to those days, and probably wish COVID-19 never happened so that I could engage a little bit more. While reminiscing those college days, one line from 'What The Folks' comes to my mind –

Hum to yuhi adhure reh gaye...

Five Years of a Lifetime

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July 3rd, 2017 – a nervous start to the day as I first entered through the green back gate of St. Xavier's College, Kolkata. With loads of enthusiasm and excitement, when I took a quick look at the campus, nothing but a feeling of joy ran down my shoulders.

"Biotechnology department is on the 3rd floor, right?" was the first question I could ask in a confused voice to one of the students. "It is on the 4th floor," he replied. This is how I started my journey of 5 years in BMBT. Soon I started to fall in love with the subjects, the culture, the people. Even on the busiest of class days, we could still manage some time for a short tea-break, in the rooftop canteen.

It is very difficult to pen down all the new experiences. However, the one thing I was sure from the first day of joining was this was the course I wanted to continue with. Through the packed schedules, exam fears, I started to develop deeper understandings of the topics of my interest. I can never thank the professors enough for helping me develop scientific intuition, ability to ask relevant questions and address them carefully, and above all, for shaping me as a better person.

A journey of half of a decade can never be a bed of roses. So was the case for us. As a COVID pandemic-hit batch, half of our journey was restricted to seeing our professors through the rectangular screen of the laptop. However, I can still be nothing but grateful to the department for giving us the essence of all the topics in a lockdown phase. Due to the lockdown, we could not have our animal biology and plant biology excursions. However, professors did not fall short in giving us the actual experience through beautiful slides, videos, stories etc.

No journey is complete without friends backing you up in hardships, and I was blessed with the most amazing bunch of friends. From sharing our tiffin and having some amazing discussions, to organizing departmental seminars, picnics etc., five years went by in a flash.

Lastly, I am happy that everything has become normal again, and the juniors are able to experience the true spirit of the department. Though our "5-year journey" is over, I would still like to go back in time and ask that guy, "Biotechnology department is on the 3rd floor, right?" For now, let the rooms stand as witnesses to the memories of a lifetime and many more.

Cover Article

Tech-Tonic: Harnessing the Power and Managing the Fallout/Outreach

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In the world of science, the journey from laboratory discovery to the realization of a product or a technique is a multilayered and multifaceted process. This year, we embark on a thought-provoking journey with our theme, "Tech-tonic: Harnessing the Power & Managing the Fallout/ Outreach." At first glance, this theme may appear complex, but we are here to unravel its layers and significance.

It's the art of "harnessing the power" that nature bestows upon us, both in the living and non-living domains. However, the story does not end there. Equally crucial is the aspect of "managing the fallout." Scientific advancements must be driven by a sense of responsibility towards humanity, prioritizing their benefits over any potential harm. Furthermore, "outreach" becomes the litmus test for any scientific endeavour. The true worth of a discovery lies in its accessibility to all, regardless of economic status or standing. Unfortunately, barriers like stringent patent laws, profit-driven motives, and uneven distribution obstruct this noble objective.

With Oppenheimer releasing this year, we are given yet another reminder of the complex interplay between harnessing the power and managing the fallout. The story of nuclear energy, from its peaceful applications to its destructive potential, epitomizes this theme. The legacy of J. Robert Oppenheimer serves as a stark reminder of the consequences when science deviates from its path of responsibility.

As we delve deeper into this article, we will explore the nuances of "managing the outreach". From Assisted Reproductive Techniques (ART) to cutting-edge Immunotherapies and Vaccines, the real challenge lies in ensuring the outreach of these innovations to those in need. Stay tuned with us as we uncover the challenges and triumphs in the pursuit of responsible science and innovation.

Decades of research on radioactivity routed nuclear physicists and other scientists to decode the enigma of generating tremendous energy from tiny masses, mediating the ingrained potency of the nucleus. The discovery of nuclear fission, which involves hitting a heavy nucleus with a slow neutron to stem a controlled chain reaction releasing enormous thermal energy, culminated in two historic reports by the MAUD committee (a British scientific working group formed during the Second World War) - "Use of Uranium for a Bomb" and "Use of Uranium as a Source of Power", which were later made available to the United States that

eventually energised the Manhattan Project. Rest of the story is fresh in our mind from watching the movie, 'Oppenheimer'. The MAUD reports tell us that from its very inception constructive and destructive capabilities of nuclear power were crystal clear to the scientists. Still the catastrophic detonation of atomic bombs over Hiroshima and Nagasaki took place leaving behind a trail of unimaginable destruction of both life and property. Unfortunately, we failed to learn our lesson from this horrific testimony. Convoluted human emotion, ego and avarice for dominance, have resulted in multiple nations in possession of nuclear weapons. Very often we hear about political tensions between countries in different parts of the world, sometimes even threatening to start a nuclear war. God forbidden, if there is a Third World War then human civilisation will be wiped out from the face of this Earth. This is where we failed to 'manage the fallout' of the otherwise amazing discovery of nuclear fission, followed by nuclear fusion reactions.

Why call such a potentially dangerous phenomenon 'amazing'? The enormous heat energy generated from fuel pellets, prevalently consisting of U-235, converts water into steam, driving the turbines to foster electricity generation in the nuclear reactors. An inch-sized Uranium pellet emanates energy equivalent to one ton of coal or 120 gallons of crude oil, according to the data from U.S. Department of Energy. Alongside the impressive energy yield, nuclear power is esteemed as clean energy for its negligible carbon footprint and greenhouse gas emission-free manoeuvre. Nuclear power reactors can comfortably cater to the ever-evolving energy demand; simultaneously, suppressing the over-reliance on ephemeral fossil fuels; and hence cooperating to mitigate the alarming climate change.

For efficient 'harnessing of the nuclear power' we must be aware of the associated risks from highly mutagenic radioactive radiation that can emanate from nuclear reactors due to mal-functions or accidents. How can we forget the Chernobyl or Fukushima nuclear disasters! Each step involved in operating a nuclear reactor, to managing the nuclear waste, are high-risk operations and impart major challenges in capitalising on nuclear power. But proficient workforce, tight safety precautions, efficient waste disposal systems, and finally further progress of relatively safer technology of nuclear fusion, will make nuclear power harnessing more promising in the near future. At this juncture, it is worth mentioning that the power of radioactive materials has also been harnessed for other purposes like, in various landmark scientific discoveries, in nuclear imaging for proper diagnosis of certain diseases and even in nuclear medicines.

Thus, destruction and restoration are the two sides of a single coin of human-developed nuclear power technology. Our success oscillates between how well we 'harness the power and manage the fallout'.

Next to electronic and telecommunication and the wonder gadget 'Mobile Phones'. These are small and portable and can save life in an emergency. The internet access through the mobile phones have brought the entire world on our fingertips. We are nowadays completely dependent on mobile

phones for a source of relevant information and constant entertainment through the various social networking sites and applications available. But, on the contrary mobile phones have now become a deadly source of addiction specially amongst the adolescents and the young masses of the society. These have led to many health issues and sleeping disorders and to some extent lifestyle disorders as well. Another side effect of internet technology is the increasing cases of cybercrime all over the world. The effect of mobiles and other electronic gadgets is bringing the curtain down on the very concept of 'human, a social being'. So, the message is, a judicious usage of products of technological advancement can help mankind to reap their benefits without spoiling the social structure.

Now we shift our attention to Biotechnology-related topics – IVF and Immunotherapy. A revolutionary invention in the field of science and medicine is Artificial Reproductive Techniques (ART). These techniques like, In Vitro Fertilization (IVF), Zygote Intrafallopian Transfer Technique (ZIFT), Gamete Intrafallopian Transfer Technique (GIFT), etc. can bring a ray of hope to a woman facing problem in conceiving. IVF and other related techniques though extremely useful are still very expensive procedures, that too without the assurance of a 100% success rate. This is where the 'outreach programme' should be brought into consideration. All women, rich or poor, incapable of conceiving naturally, should be given a chance to experience motherhood by availing ART.

Decades of intense research in the field of Immunology has taught us that we can use our own Immune System, more appropriately - immune molecules and cells, for the treatment of various diseases for which, either we have no therapeutic drugs or the drugs have severe side-effects. Two key words about the Adaptive Immune System are 'specificity' and 'memory'. The memory concept has been put to use in the form of vaccine development from the time of Edward Jenner, rightfully called the Father of Immunology. Vaccines are prophylactic or preventive in nature. They train our body how to fight future infections. We are all aware of how vaccines work and how vaccines have helped in eradication of a few dreaded diseases. In the last few years, scientific advances have impacted the establishment of new vaccine platforms using sub-unit vaccines, nucleic acid-based vaccines, viral vector-based vaccines, etc. as well as improved adjuvants. These newer techniques have overcome problems associated with stability and hence transportation of vaccines to remote areas. Currently, vaccines have a better outreach with respect to distribution. More work needs to be done in the cost-effectiveness and affordability to the down-trodden of the society. Unethical hoarding of vaccines by developed countries, limiting its availability to the developing countries, as experienced in the recent SARS-CoV-2 pandemic, is just not acceptable!

Immunotherapy is relatively a new concept and stresses on the 'specificity' factor of our immune system. Taking the example of cancer, rightfully called "The Emperor of all Maladies" by Dr. Siddhartha Mukherjee, current treatments are either surgery followed

by radiation or chemotherapy and for cancers inaccessible to surgical removal, radiation-therapy or chemotherapy are the only options. We all are very aware of the facts how non-specific and painful both these therapies are. Patients may or may not survive the therapies. Immunotherapy, that uses the body's immune system to detect and specifically destroy cancer cells can come to the rescue of such patients. The various types of immunotherapies include:

- **Monoclonal Antibody Therapy –** mono-epitope-specific antibodies are immune molecules which may be created in the laboratory, further humanised and conjugated to toxin that can bind to specific targets on cancer cells and destroy them. Antibodies to infectious viral particles through prophylactic vaccines or through therapeutic monoclonal antibodies can prevent viral infections.

- **CAR T-cell Therapy** is a more recently approved immunotherapeutic approach which involves enhancing T-cell function via a chimeric antigen receptor (CAR). In this custom-based treatment, immune cells (T cells) are taken from the cancer patient. Those that are most active against the cancer are selected or changed in the lab to better attack the cancer cells, grown in large batches, and put back into the patient's body through a needle in a vein. Many first-generation CAR-T cells were anergic, i.e., failed to get activated. Subsequent modifications indicate a huge prospect in this aspect of immunotherapy.

- **Immune Modulators** are small immune molecules, pro- or anti- inflammatory cytokines and chemokines, which help in regulating as well as orchestrating immune responses to cancer, infection, or even autoimmune disorders. Today's medical practitioners frequently use such modulators in treatment of the above-mentioned diseases either to boost the patient's immune response or to suppress the hyper immune response in certain patients, especially those suffering from autoimmune or inflammatory diseases.

As immunotherapy is taking the centre stage in treatment of diseases not cured by conventional therapies, different renowned pharmaceutical companies have engaged themselves in producing immunotherapeutic agents like monoclonal antibodies and immunomodulators. Unfortunately, the prices are skyrocketing, affordable only by the rich people. The success story of immunotherapy lies in the following facts:

- It is necessary to make common people aware of such developments so that the products/procedures can be valued and used judiciously.
- More importantly, everyone involved in this prospective therapy, starting from the investigating scientists to production personnel to medical practitioners, should leave behind their selfish motives and concentrate on how to bring down the cost of immunotherapeutic agents/ procedures, to make them affordable by people from all walks of life.

Immunotherapy is an ideal example of 'harnessing' the immense power of our very own immune system but, its success lies in the appropriate 'outreach'.

Last, but not the least, a few words on the talk of the town - Artificial Intelligence (AI). Today, AI plays a very important role in each and everyone's lives. We all are under the constant supervision of

different forms of AI. Our entire day, starting from the alarm in our phones to interacting with Alexa or Siri throughout our day is a part of AI. It is very evident that within a few years the entire world

shall be controlled by AI. Without proper judgement regarding AI usage, it may become a matter of great concern. Inspite of many positive effects, AI also has several negative impacts, breach of our privacy topping the list. Another negative effect of AI is the problem of job displacement, especially in overpopulated and developing countries like India. If AI takes over the various sectors of the society a great number of individuals will end up losing their source of daily income. So, steps and decisions must be taken as to divide the work between the AI sector and the manual labour, only then a balance can be maintained in the society, and everyone can be benefitted.

So, to conclude, in recent times 'science and technology' has undoubtedly harnessed the power of nature and reached great milestones. With proper, healthy and selfless mindset, the achievements can be utilised for the benefit of mankind. It is never too late to mend the fallouts and manage the outreach!

Scientific Articles

Neuropsychiatry and Psychobiotics: a link lesser known

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1. Introduction

While neurotransmitters like gamma-amino-butyric acid (GABA) modulate the inhibitory-excitatory balance of man necessary for proper functioning of mature brains, low levels of serotonin have been found associated with mental health disorders like depression and anxiety [1, 2].

In the present era of increasing and surfacing mental illnesses, with more and more people opening up about their psychological dilemma, scientists are slowly moving closer to the possibility of treating such disorders with advanced and cost-effective approaches, targeting dietary modifications in the form of 'psychobiotic' supplements.

In this context, the very recently proposed Gut-Brain Axis (GBA) may be thought of as a bidirectional communication pathway between the central nervous system (CNS) and enteric nervous system (ENS) that connect the brain's emotional and cognitive centres with peripheral intestinal processes [3]. This gut-brain crosstalk has portrayed a rather sophisticated information exchange that not only supports adequate gastrointestinal (GI) homeostasis maintenance, but is also likely to have diverse consequences on emotion, motivation, and higher cognitive processes [3].

Adversities centering around the dysbiosis of the gut microflora, as investigated through pivotal experiments conducted on animal models, revealed exaggerated neurological responses in the germ-free ones lacking indigenous microbiome, in contrast to those raised with normal microflora [4]. These aberrant responses were mitigated using probiotic-induced bacterial re-colonisation, which in turn has shed a light on what has been termed as 'psychobiotics'.

2. Psychobiotics

2.1 The Fundamental Concepts

Psychobiotics are a relatively recent discovery, found to modulate CNS-related functions and animal behaviours via neuronal, immunological, and metabolic pathways, thus improving not only GI functions, but also suggesting strong anti-depressant and anxiolytic potential.

Psychobiotics are described as a novel group of probiotics and prebiotics. While 'probiotics' are described as 'live microorganisms that bestow health benefits on the host when supplied in suitable doses' with *Bifidobacterium* and *Lactobacillus* being among the most accepted ones, 'prebiotics' are regarded as 'non-digestible dietary elements that benefit the host by

selectively promoting the development and/or activity of one or a restricted number of bacteria already present in the colon' [5]. It is a substrate that is preferentially utilized by host bacteria to provide health benefits since dietary ones cannot be destroyed by host enzymes [5]. Oligosaccharides (OS), polyunsaturated fatty acids (PUFAs), conjugated linoleic acid, plant polyphenols, and some fermentable fibres are some prebiotic substrates [5]. However, psychobiotics distinguish themselves from traditional probiotics by their capacity to promote the production of neurotransmitters, enteroendocrine hormones, short-chain fatty acids (SCFAs), and anti-inflammatory cytokines [6]. Owing to this potential, psychobiotics provide a wide variety of biological functions, including mood and stress relief, as well as its usage as an adjuvant in the treatment of various neurodevelopmental and neurodegenerative ailments [6].

Current research reveals a robust bidirectional communication route shared by the neuroendocrine system and gut bacteria [7]. It has been established that the activity of the Hypothalamic-Pituitary-Adrenal (HPA) axis, which is the principal neuroendocrine response system in the human body to physiological and physical stress, can impact the composition of the gut normal microflora and increase GI permeability [7].

2.2 Mechanism of action of Psychobiotics

The animal gut contains a meshwork of nearly 500 million neurons, running from the esophagus to the anus [6]. This meshwork constitutes the ENS, the key player in coordinating all the events related to digestion to the brain and CNS, via the vagus nerve [6]. This vagus nerve-mediated pathway that connects the ENS to the CNS has been proven to be the possible channel for gut microbiota to regulate the brain, and *vice versa* [6].

A recent study was successful at providing evidence of germ-free mice having intestinal neural abnormalities in the jejunum and ileum, in comparison to the Control group [8]. Germ-free mice also showed reduced nerve density, fewer nerves per ganglion, and a greater number of myenteric nitrergic neurons [8]. This evidence indicates the critical role the gut microbiome plays in influencing one's neural functioning, behaviour, and response to various kinds of stress [8]. This link was further established by the study which revealed that patients exhibiting signs of depression tend to display a gut microbiota composition that evidently digresses from the normal one [6]. When the changed microbiota was transferred to germ-free rats by transplanting faecal matter (faecal microbiota transplantation, FMT) from depressed patients, the rats displayed a dysregulated microbiota, along with symptoms associated with anxiety [6].

2.2.1 Production of Neurotransmitters

Psychobiotics promote the production of neurotransmitters in the gut, allowing modulation of neurotransmission in the proximal synapses of the ENS [9, 10]. This includes neurotransmitters like acetylcholine, dopamine, GABA, noradrenalin, serotonin, and histamine [9, 10]. Table 1 provides a comprehensive account of the various families of gut bacteria that produce different neurotransmitters.

Table 1: Summary of neurotransmitters produced by different gut bacteria

Serial no.	Neurotransmitter	Gut microbiota families/ genera	Examples of Bacterial Strains
1	Acetylcholine	Lactobacilli	*Lactobacillus plantarum*
2	Dopamine	*Bacillus, Escherichia*	*Escherichia coli*, *Bacillus subtilis*
3	GABA	Bifidobacteria, Lactobacilli, Bacteroides, Parabacteroides, Alistepes	*Bifidobacterium adolescentis, Lactobacillus plantarum* (ATCC14917), *Alistipes putredinis*
4	Noradrenalin	*Bacillus, Escherichia*	*Escherichia coli* (K-12), *Bacillus mycoides*
5	Serotonin	Lactobacilli, Streptococci, *Escherichia*	*Lactobacillus plantarum* (FI8595), *Streptococcus thermophilus* (NCFB2392)
6	Histamine	Lactobacilli, *Enterobacter*	*Lactbacillus plantarum* (FI8595), *Lactococcus lactis* subsp. *cremoris* (MG 1363)

The altered levels of serotonin in the striatum and hippocampus of the brain of germ-free mice, increased levels of serotonin and dopamine in the prefrontal cortex of the brain of mice treated with *Lactobacillus plantarum*, and an increase in the levels of noradrenaline in rats supplemented with *Lactobacillus helveticus* NS8, all demonstrate the prominent role psychobiotics have on the levels of neurotransmitters [11, 12, 13].

2.2.3 Response to Stress

The HPA axis becomes dysfunctional during chronic stress, which leads to a disruption in the production and function of stress-related hormones [10]. Like, the stress hormone cortisol is often found elevated in patients with depression.

Studies have demonstrated the recruitment of corticotrophin-releasing hormone (CRF) receptors in the colon under stress conditions [6]. This further induces changes at the level of GI function, and an increase in the levels of adrenocorticotrophic hormone (ACTH) and plasma corticosterone levels [6].

Glucocorticoids are responsible for dysregulating the gut barrier function, leading to reduced integrity of the epithelium, permitting outward movement of bacteria and triggering an inflammatory immune response [8]. Pro-inflammatory cytokines released due to stress-induced by high levels of glucocorticoids are also known to reduce the integrity of the gut barrier [6]. Additionally, bacteria can regulate inflammation directly by increasing the concentration of certain cellular elements like lipopolysaccharide (LPS, pro-inflammatory), which is a process also associated with depression [14]. Psychobiotic supplements with *Lactobacillus* or *Bifidobacterium* are capable of restoring the gut barrier integrity and reducing stress-induced gut leakiness [8]. *Lactobacillus rhamnosus* GG has been found to amend gut barrier dysregulation by inhibiting pro-inflammatory signaling by the tumour

necrosis factor (TNF)-α [8].

3. Animal Model Studies to establish Psychobiotic action

Multiple animal model studies have successfully established the role played by psychobiotics on the neural responses of individuals. Synapsing of the vagus nerve on the enteric neurons enables gut-brain communication [6]. This has been established by studies wherein damaging the vagus nerve led to a lack of any physiological response to the psychobiotics [15].

Rodent models like BALB/c mice that were innately stressed, were administered *Lactobacillus rhamnus* JB-1 [10]. They exhibited reduced intensity of anxiety and depression, along with long-term changes in both their $GABA_A$ and $GABA_B$ receptor expression in the CNS [10]. Additionally, a somewhat blunt corticosterone response to stress was observed, indicating that the probiotic might have downregulated HPA-axis activity [8]. In another set, where these BALB/c mice underwent a vagotomy, they failed to show any of the above-mentioned responses and no anxiolytic effect was observed [15].

In another recent study, *Mycobacterium vaccae* was administered to rats, and a marked reduction in brain inflammation was observed. It also prevented stress caused by anxiety [16]. In BALB/c mice, administration of live *M. vaccae* before and after a maze learning task was associated with reduced anxiety and shorter maze completion duration, which demonstrated improved learning abilities in the same task [17].

Probiotics like *Lactobacillus helveticus* NS8 were shown to reduce levels of post-restraint anxiety and improved post-restraint object recognition memory in Sprague-Dawley rats that were exposed to chronic stress [8]. These rats expressed lower levels of corticosterone and ACTH [8]. They also displayed an increase in anti-inflammatory cytokine IL-10 production, brain-derived neurotrophic factor (BDNF) mRNA, noradrenaline, and serotonin in the hippocampus [8].

Prebiotics like galactooligosaccharides (GOS) have also been used to study disorders involving anxiety and neuroinflammation. In one such study, 8-week old mice were supplemented with B-GOS (Bimuno formulation of GOS) for 3 weeks [5]. They showed reduced LPS-induced anxiety and decreased elevated cortical Interleukin (IL)-1β and 5-hydroxy-tryptamine or serotonin 2A ($5\text{-}HT_{2A}$) receptor expression in the frontal cortex of the brain, induced by LPS, in the absence of altered 5-hydroxy-tryptamine (5-HT) metabolism [5]. Hence, the research group could establish that the prebiotic-induced anti-inflammatory response regulated the anxiolytic function [5].

4. Human Clinical Trials

The current evidence concerning the efficacy of psychobiotic intervention through probiotic and prebiotic-based therapies in the management of stress and anxiety, neurological abnormalities, and its impact on cognition in humans are examined, as well as recommendations for future intervention techniques and developments in this arena are made strongly via human clinical trials.

4.1 In Mental Health Ailments

To investigate the ability of psychobiotics in the prevention of mental health ailments like

depression in humans, researchers administered a multispecies probiotic formulation comprising *Bifidobacterium lactis* W, *B. bifidum* W2, *Lactobacillus brevis* W, *L. acidophilus* W37, *L. salivarius* W2, *L. casei* W5 and *Lactococcus lactis* (W19 and W58) to 20 healthy people, while the Control group received a placebo through 4 weeks [18]. By the end of four weeks, probiotic-users demonstrated a substantial overall decrease in cognitive response to depressed state [18].

A clinical trial conducted on 22 healthy subjects found that, consuming strains of *Bifidobacterium longum* 1714 ($1x10^9$ colony-forming units every stick) for four weeks enhanced cortisol production and hippocampal-dependent visuospatial memory, as well as lowered subjective anxiety and everyday stress [19]. Long-term consumption of *Lactobacillus gasseri* CP2305 tablets ($1x10^{10}$ bacterial cells per 2 tablets) enhanced psychological state and sleep quality in a cohort of 60 young students subjected to chronic stress [20].

A further manner of how probiotics may influence mood is through their capacity to control discomfort in the stomach [18]. *L. acidophilus* has been found to alleviate pain by activating opioid and cannabinoid receptors in intestinal epithelial cells [18]. The opium and cannabinoid systems regulate mood, pain, reward, and addictive behaviour [18].

4.2 In Neurodegenerative Disorders

4.2.1. In Autism Spectrum Disorder (ASD)

The significant decline in Autism Diagnostic Observation Schedule - Calibrated Severity Score (ADOS-CSS) (both Total and Social-Affect scores) in the Non-Gastrointestinal Symptoms (NGI)-group treated with probiotics compared to the placebo group is a novel and promising finding of a 2020 study [21]. Although derived through a secondary study, this result is extremely noteworthy from a clinical standpoint, particularly in the light of the aforementioned psychometric features of the utilised tool [21]. Over six months, a mean reduction of 0.81 in total ADOS-CSS and 1.14 in Social-Affect ADOS CSS demonstrated a clinically significant reduction in Autism Spectrum Disorder (ASD) symptoms [21].

4.2.2. In Alzheimer's Disease (AD)

A study published in 2020 by Den *et al.* shows probiotics that are affordable, widely available, and well-tolerated might be prospective alternatives for the treatment or prevention of Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI) [22]. They further discovered that either single-strain or multi-strain probiotics were useful for increasing cognitive performance, indicating that *Bifidobacterium* and *Lactobacillus* strains might be the best mitigation options [22].

4.2.3 In Parkinson's Disease (PD)

Lactobacillus plantarum PS128 supplementation over twelve weeks, in conjunction with continuous anti-Parkinsonian therapy, enhanced the Unified Parkinson's Disease Rating Scale (UPDRS) motor score and quality of life in Parkinson's disease (PD) patients [23]. This result indicated that PS128 may be useful as a therapeutic adjuvant in the treatment of PD [23].

4.2.4 In Schizophrenia (SCZ)

Schizophrenia (SCZ) patients were administered

the probiotic *Bifidobacterium breve* A-1 for four weeks, and their anxiety, depression, and Positive and Negative Syndrome Scale (PANSS) ratings improved. Ghaderi *et al.* in 2019 evaluated probiotic supplement treatment in SCZ patients for 12 weeks by delivering a vitamin D and probiotic mixture including *Bifidobacterium bifidum*, *Lactobacillus acidophilus*, *L. fermentum*, and *L. reuteri* [24]. There was a substantial reduction in metabolic abnormalities and circulating C-reactive protein (CRP), indicating decreased inflammation, as well as improvements in general and total PANSS scores and plasma total antioxidant capacity [24].

5. Future Prospects

Intestinal dysbiosis has repercussions that extend beyond the host's nervous system. The expanding body of studies on psychobiotics in domains as diverse as Health Sciences, Microbiology, Neurobiology, Biotechnology and Food Sciences supports the gut microbiome's influence on the GBA, nowadays rightly considered to be a "virtual organ." Combating intestinal dysbiosis in an individual is becoming increasingly important in the treatment of neuropsychiatric illnesses, especially with the introduction of new treatments like "psychobiotic therapy," which have shown promising outcomes in animal and human trials. The key players in this respect have been established as being largely from the genera *Lactobacillus* and *Bifidobacterium,* while several additional ones have just been found that may prove even more effective in this therapy in the coming years. So far there has been little translational research in this sector, and further studies on the efficacy of psychobiotics in the alleviation of neuropsychiatric disorders are required to validate the findings so far.

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The Evolution of Artificial Intelligence – from Erewhon to Xiaolce

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Breaking Dawn:

Erewhon: or, Over the Range, is a novel by English writer Samuel Butler. This satirical utopian novel was published anonymously in London in 1872. If you look carefully then EREWHON is an anagram of NOWHERE. The setting of the novel and the location of EREWHON thus is completely fictional and the fact that Erewhonians believed machines to be potentially dangerous and that their societies had undergone a revolution which destroyed most mechanical inventions was one of the striking features of this satire on aspects of Victorian society, expanding from letters published in New Zealand's "Daily Press" by Butler. Butler appears to have contemplated the possibility of machine awareness, or artificial mind, and that machines may replicate themselves in "The Book of the Machines" section of his satire. This is regarded as one of the first literary examples of recognition of artificial intelligence (AI).

Early AI Research:

The voyage of AI began in the 1950s with Alan Turing's pioneering work, which created the Turing Test to assess whether a machine could simulate human intellect. The invention of the first AI programming language, LISP (List Processing), by John McCarthy in the 1960s accelerated AI research. Early AI systems emphasized symbolic thinking and rule-based systems, leading to the creation of expert systems in the 1970s and 1980s. Generative AI is a catch-all phrase for artificial intelligence systems that employ machine learning methods (particularly, deep learning algorithms) to generate, alter, or synthesize data, which is frequently available in the form of images or human-readable text. The term "generative" refers to the fact that the AI develops something that did not previously exist. That is what distinguishes it from discriminative AI, which distinguishes between different types of data. To put it another way, discriminative AI attempts to answer questions such as "Is this image a drawing of a rabbit or a lion?" whereas generative AI reacts to prompts such as "Draw me a picture of a lion and a rabbit sitting next to each other."

How does generative AI work?

An enormous quantity of visual or textual data, much of which is scraped from the internet, is processed by generative AI using machine learning to identify the objects that are most likely to appear close to other objects. For chatbots like ChatGPT and DALL-E, for example, much of the programming work is devoted to developing algorithms that can recognise the "things" that are important to the AI's designers—words and phrases. Fundamentally, though, generative AI generates its output by analyzing a sizable corpus of data that serves as its training set, and then reacting to prompts with something that is

within the bounds of probability as specified by that corpus. A low-level type of generative AI is autocomplete, which is when your mobile phone or Gmail recommends what the rest of the phrase or sentence you are typing might be. Models like ChatGPT and DALL-E just advance the concept to new levels.

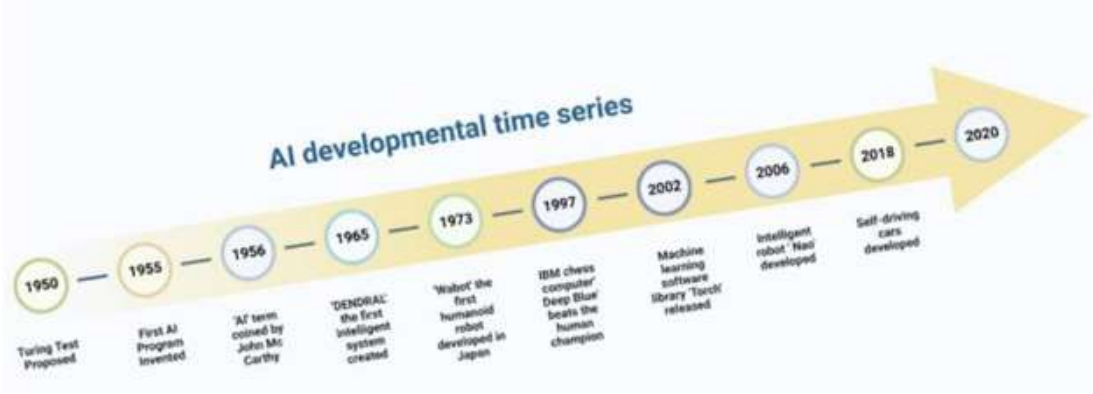

Figure 1: Evolution of AI [Source: doi: 10.3390/life12091430]

APPLICATIONS OF AI IN LIFE SCIENCES:

The application of artificial intelligence in biological science has been significant since, biology as a discipline offers the most variable of data types which can be processed and reprocessed by numerous algorithms of machine learning, deep learning and neural network based predictions. If we look closely into the different success stories of AI based methods we will come across instances where waste reduction, pathogen detection, growth rate predictions and several other applications in agriculture (Table 1), drug discovery, image processing and phenomics as well as various genome wide analyses even customized CRISPR based gene editing have been achieved utilizing artificial intelligence based methods (Table 2). Still old school morons exist who attempt to denounce the contributions of computational biology and bioinformatics in life science research, and fail miserably faced by the deluge of data that is around us which invariably makes basic understanding of artificial intelligence methods a necessary skill for a biologist interested in research.

Purpose of use	Algorithm	Results	References
Salmonella detection in agricultural runoffs	ANN, kNN, SVM	58.15–59.23% accuracy of detection	Polat et. al 2020
Growth rate modelling of Oryza sativa L.	REG, ANN, GEP	Growth Rate estimation was similar to standard methods	Liu et. al 2020
Seed Germination Efficiency	CNN	97% seed recognition accuracy	Shadrin et. al 2020
Tomato mass determination	Mask-RCNN, ResNet101-FPN, RPN	detection accuracy of 99.02% with precision of 99.7%	Lee et al 2020
"Smart Tree Crop Sprayer"	LiDAR, machine vision, GPS, CNN	84% accuracy in tree detection and 28%reduction in spray use	Partel et.al. 2021

Table 1: Important applications of AI in the agriculture sector

Diseases	Algorithm	Modality	Findings	References
AMD	ML-based predictive model	Clinical data	AMD progression prediction	Schmidt-Erfurth et. al 2018
Alzheimer's disease	RF, SHAP	Clinical and Imaging data	Alzheimer's disease progression detection with accuracy of 93.95%	El-Sappagh et.al. 2021
COVID-19	PA	Clinical data	Severity of COVID – 19 cases predicted with 70% accuracy	Jiang X et.al.2020
Ovarian cancer	ANN	Clinical data	93% accuracy in prediction of survival and 78% accuracy in prediction of surgical outcomes	Enshaei et.al. 2015
Pulmonary cancer	LCP-CNN, Brock model	Clinical data	lower false negative results than Brock model was achieved towards detection of malignant pulmonary nodules	Baldwin et al 2020
Influenza	IAT-BPNN	CDC data and Twitter dataset	influenza-like illness was predicted in a large population size with an high accuracy	Hu et.al. 2018

Table 2: Important applications of AI in health and medical sector

CONCERNS ABOUT AI:

The use of public datasets as training sets for prediction algorithms have opened up discussions on the fallouts of these practices. One of the most important points of discussion has been the misuse of available data. In a recent edited volume titled "Ethics of Artificial Intelligence", Stahl, Schroeder and Rodrigues (2023) compile various instances of misuse of AI in public practice such as:

1. Gender bias in automated shortlisting of job candidates where the model was trained according to previous ten years data which had a bias towards male candidates.
2. Denial of parole to a prisoner with a model rehabilitation record based on a risk to society predictions of an AI model which may have been provided by racially biased respondents.
3. The Saudi Human Genome Program which predicted several medical insights but informed consent was not recorded from respondents and how the data would be used was not clearly stated.
4. The Facebook and Cambridge analytica scandal where over 50 million facebook profiles were used for voter behavior analysis

The High Level Expert Group on AI (AI HLEG 2019) set up by the European Union has attempted to

create a set of guidelines based on the principles of biomedical ethics. However, beyond the geographical boundaries the practice of these guidelines is not being monitored properly. With the debut of GPT-5 predicted to be sometime in 2024, there is anticipation amongst users and developers as it is being touted to exhibit less hallucination making its output more reliable, being less computationally exhaustive. It may also support long term memory over a larger context length. The combination of reliability and long term memory has the potential to evolve GPT -5 into a system with Artificial general Intelligence (AGI) which is predicted to be a form of AI that surpasses human intelligence. Hence, there is an immediate need for enforcement of regulatory measures.

Figure 2: A: Cover page of the novel of Samuel Butler and B: Chatbot Image of Xiaoice

POINTS TO PONDER:

As the world gradually becomes increasingly nuclear, right from power, bombs to families, the emotional intelligence of a large section of the world populace is being constantly challenged. As we become more and more engrossed in our stereotypical lifestyles and digital devices, loneliness befriends us. The continuous peer pressure and competitiveness that is almost being edited into our genomes pushes us away from the natural lifestyles that nature selects for. This is exactly where Microsoft's China-based chatbot phenomenon – Xiaoice (Figure 2B) steps in and provides us with a digital embrace of love. Xiaoice since its launch in 2014 has become one of the most widely used chatbots in China. Powered by a massive and multidimensional AI framework which continuously explores deep learning techniques, large packets of data are being soaked up and her emotional intelligence is being enhanced. "Xiaoice is using her interactions with humans to acquire human social skills, behavior,

and knowhow. In other words, she is learning to be more like "us" every day" She is now designing images and patterns on fabrics for international fashion and garment producers".

How much of this artificial selection do we allow for, is a question that humankind soon needs to answer or else, we may soon be fighting a war with an invisible enemy who has been trained on our emotional intelligence and cognitive capabilities – capable of predicting our next move - that will be a difficult war to win. Remember "Judgement Day"?

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Epi-Resilience: Shaping Alzheimer's Defense with Lifestyle Choices for Vibrant Aging

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Familiar to many, DNA, or deoxyribonucleic acid, stands as the fundamental molecule entrusted with storing and transmitting genetic information across living organisms. It serves as the blueprint that guides the intricate processes of development, functioning, and reproduction across the entirety of life's diverse forms. A fascinating fact emerges when considering that the DNA within a solitary human cell, when stretched, could extend for several meters. Intriguingly, the cell's nucleus, a mere few micrometers in size and about a tenth the width of a human hair, must accommodate this immense length. To accomplish this feat, the DNA undergoes profound compaction, orchestrated by wrapping itself around minuscule foundational proteins known as histones. This intricate process forms the basis of chromatin, a highly condensed structure central to maintaining the genetic material's organization within the nucleus. Chromatin's intrigue lies in its dual role- it not only serves to compact the DNA but also orchestrates our body's control over DNA's reading and utilization. This control extends to the "central dogma," where DNA's transcription to RNA and RNA's translation to protein is governed. Wrapped DNA around histones inhibits this process, requiring spontaneous unwrapping for accessibility to factors regulating crucial cellular functions. Remarkably, distinct portions of the DNA sequence are selectively accessed or suppressed, controlling the activation or repression of specific gene expressions. This pivotal regulation, encompassing when, how, and which DNA segments are transcribed and translated, hinges on chromatin's structural alterations known as "epigenetic modifications". Epigenetic modifications predominantly encompass modifications to the DNA structure, such as methylation, and alterations to histones – proteins around which DNA coils, for instance via acetylation among others. What is truly captivating is that these modifications play a central role in regulating when genes are activated or suppressed, all without any alteration to the DNA sequence itself. Moreover, epigenetic modifications can be passed down through generations, but they retain a flexible nature across an individual's lifespan due to their heightened vulnerability to changes stemming primarily from the external environment. Intriguingly, adding to their impressive adaptability, epigenetic modifications possess the ability to be reversed. They wield a pivotal role in orchestrating normal brain development and functioning, yet their dysregulation can contribute to the onset of neurological disorders, including the devastating neurodegenerative condition, Alzheimer's disease (AD). Although age and genetics have long been recognized as significant risk factors, recent studies have illuminated the influence of

epigenetic modifications on Alzheimer's disease development and advancement. In fact, their reversibility has rendered them appealing targets for drug development and tailored treatment approaches.

Studies with animal models have revealed that aberrant histone acetylation patterns can lead to dysregulated gene expression of crucial molecules involved in synaptic plasticity, neuroinflammation and amyloid beta processing, all of which are pivotal processes in AD. Strikingly, restoring balanced histone acetylation using histone deacetylase inhibitors (HDACi) can ameliorate cognitive deficits, decrease amyloid-beta plaque burden, and attenuate neuroinflammation[1]. For instance, studies in transgenic AD mouse models demonstrated that treatment with specific HDACi led to the reactivation of genes associated with memory formation and synaptic function, thereby improving cognitive function. Although challenges such as specificity and off-target effects remain to be addressed, the encouraging outcomes from animal model studies provide a strong foundation for further investigating epigenetic modifications and their role in disease-modifying treatment strategy for AD. Interestingly, alongside pharmacological methods, there is a growing interest in non-pharmacological interventions as potential strategies to reprogram the epigenetic network. The spotlight is now on managing lifestyle factors such as physical activity, diet, and stress as non-pharmacological means to reverse or preempt Alzheimer's disease.

An expanding realm of research has unveiled the potent impact of physical activity on inducing beneficial modifications in DNA methylation patterns and histone acetylation, thereby promoting brain health, and potentially slowing AD progression. Moreover, exercise has been linked to increased levels of brain-derived neurotrophic factor (BDNF), a protein crucial for neuronal survival and synaptic plasticity, which is regulated by epigenetic mechanisms. Notably, even individuals with a genetic predisposition to AD can experience mitigated risk through exercise-related epigenetic modifications. One study found that physical activity reduced the impact of the APOE ε4 allele, a major genetic risk factor for late-onset AD, on cognitive decline[2]. These findings collectively highlight how exercise-driven epigenetic changes can bolster cognitive resilience and potentially delay the onset of AD. As the understanding of the epigenetic basis of AD grows, harnessing the potential of physical activity as a non-pharmacological intervention presents a promising avenue for combating this debilitating disease.

Besides the potential of tailored exercise regimes in mitigating AD, emerging evidence suggests that dietary patterns, such as high consumption of saturated fats and sugars, can induce epigenetic modifications associated with AD risk. A diet rich in nutrients like omega-3 fatty acids, antioxidants and polyphenols can have protective effects by modulating DNA methylation and histone acetylation of key AD-related genes. For instance, studies have demonstrated that omega-3 fatty acids found in fish oils can enhance DNA methylation patterns of genes associated with neuronal function and inflammation regulation[3]. Similarly, antioxidants such as vitamins C and E have been shown to inhibit DNA methylation changes that promote AD-related neurodegeneration. Moreover, polyphenols present in foods like green tea and berries have been linked to increased histone

acetylation levels, facilitating the expression of genes implicated in synaptic plasticity and memory formation[4]. Collectively, these findings underscore the potential of a diet rich in these nutrients to influence epigenetic processes in ways that mitigate AD risk. While more comprehensive mechanistic studies are warranted, the existing research provides compelling evidence for the role of specific dietary components in promoting favorable epigenetic modifications that could potentially restore proper gene expression patterns and contribute to the protection against AD development.

In the modern age, the confluence of demanding work, complex relationships and mounting health concerns has driven a surge in chronic stress prevalence. This stress has emerged as a potent influencer of epigenetic changes affecting Alzheimer's disease (AD) progression. Research shows chronic stress induces global DNA hypermethylation, particularly in regions linked to neuroinflammation and synaptic function. Such hypermethylation can downregulate vital genes for neuronal health, fueling cognitive decline. Stress-triggered histone modifications have also been tied to mis-regulated expression of genes linked to AD hallmarks—amyloid-beta buildup and tau hyperphosphorylation.

Therefore, stress management has emerged as a promising non-pharmacological approach for potentially reversing the progression of Alzheimer's disease (AD). By addressing stress through various strategies, such as mindfulness meditation, yoga and deep breathing exercises, individuals may be able to influence epigenetic modifications, neuroinflammation, and synaptic plasticity, all of which play pivotal roles in AD development. Research into the impact of stress management on molecular mechanisms has yielded significant insights. A study by Kaliman et al. (2014) demonstrated that meditation and mindfulness practices led to alterations in DNA methylation patterns of genes related to inflammation and cellular aging[5]. In another study, participants who underwent an 8-week mindfulness meditation program exhibited changes in gene expression profiles associated with inflammation, cellular stress, and mitochondrial function. Importantly, these changes correlated with improvements in psychological well-being[6]. A study by Dusek et al. (2008) found that individuals who practiced relaxation response techniques showed increased expression of genes related to energy metabolism, mitochondrial function, and insulin secretion[7]. These genes are also known to play a role in synaptic plasticity and neuronal survival[8]. While stress reduction techniques alone might not completely reverse AD, they have the potential to slow down its progression and enhance the effectiveness of pharmacological treatments. Moreover, stress management is accessible, cost-effective, and generally free of side effects, making it a viable option for individuals at risk of AD and those in the early stages of the disease.

Thus, by understanding and harnessing the influence of non-pharmacological interventions such as stress management, physical activity, and dietary choices we can actively shape the epigenetic landscape to potentially mitigate the impact of AD. This holistic approach offers a beacon of hope in the endeavor to combat Alzheimer's disease and pave the way for a more resilient and vibrant aging process.

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From Waste to Wonder: The Marvel of Microbial Plastic Degradation

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Plastics have become an inseparable part of our daily lives, quietly making their way into almost every aspect of modern living. While we may not have an emotional attachment to them, it is undeniable that we rely on plastics extensively in our day-to-day activities. By 2050, researchers estimate there will be more plastic in the ocean than fish. Despite our best efforts, only 9% of all plastic we use winds up being recycled. And to make matters worse, plastic is remarkably tough and durable. Researchers estimate it can take anywhere from 500 to 5,000 years to fully break down. It leaches harmful contaminants to our oceans, soil, food, water and into us.

Plastic is a long-chain synthetic polymer made of repeating monomer units. There are a variety of synthetic plastics like polyethylene (PE), polystyrene (PS), polypropylene (PP), polyvinyl chloride (PVC), polyurethane (PUR) and polyethylene terephthalate (PET).

Plastic is a versatile material with a wide range of uses in various industries and everyday applications. Some common uses are packaging, construction, automotive, medical, electronics, textiles, toys, household items and so on. It is essential to note that while plastic has numerous practical applications, its widespread use has also led to environmental concerns, particularly with plastic pollution and its impact on the ecosystem.

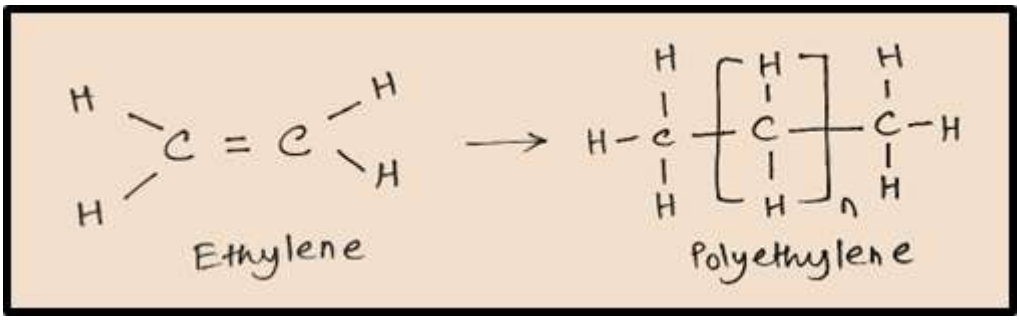


Image Reference: https://www.aiche.org/resources/publication-scep/2015/september/making-plastics-monomer-polymer)

Plastic waste accumulation has become a severe environmental and social issue. With plastic pollution reaching unprecedented levels, our environment faces a critical challenge that demands immediate attention. The urgency to develop innovative solutions for plastic waste disposal cannot be overstated. In the past few years, there has been a surge in

reports highlighting the exciting potential of biodegradation in addressing the plastic waste crisis. Microorganisms and enzymes are emerging as promising champions in the fight against plastic pollution, presenting us with a beacon of hope through the development of groundbreaking biological treatment technologies.

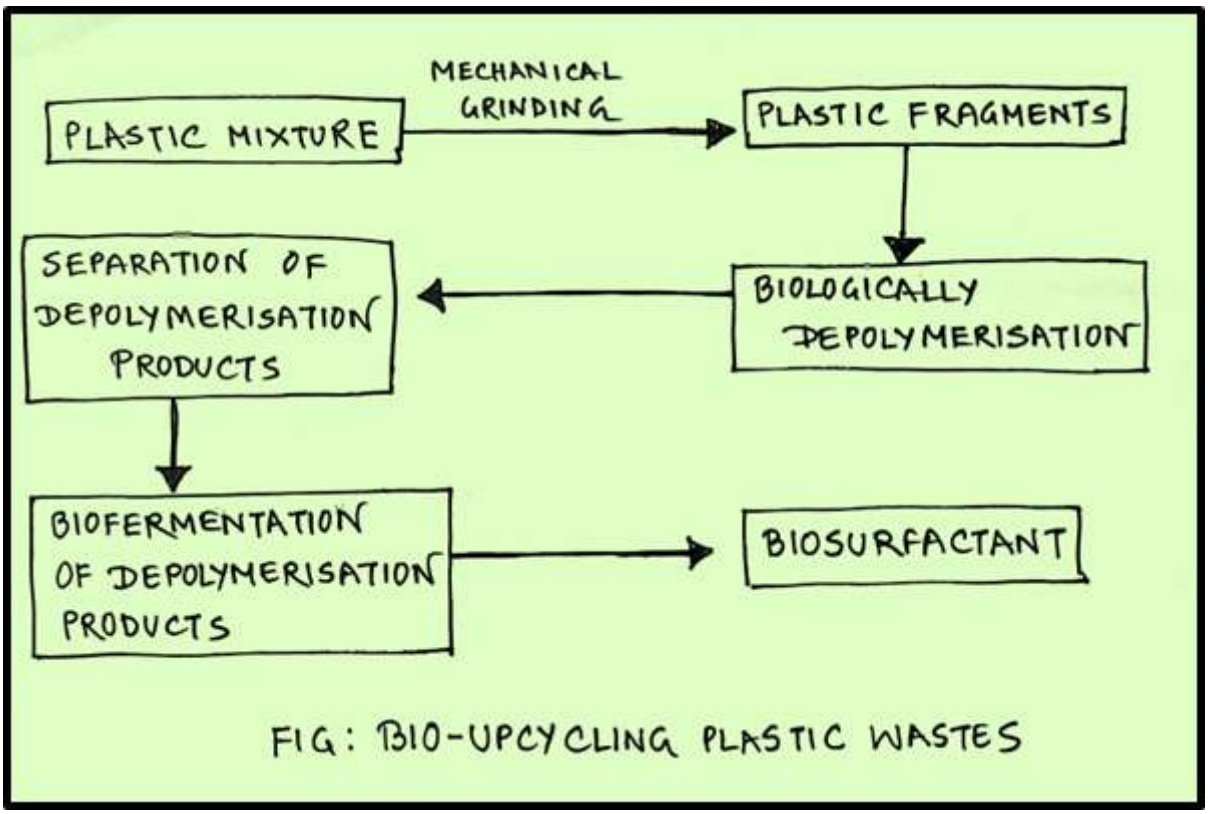


FIG: BIO-UPCYCLING PLASTIC WASTES

(Image Reference: https://www.frontiersin.org/articles/10.3389/fmicb.2020.00442/full)

Bio-upcycling plastic wastes typically involves several key steps to convert plastic waste into valuable products using biological organisms or enzymes. While the specific process may vary depending on the type of plastic and the desired end product, the general **steps** include:

1. **Collection and Sorting:** The first step is to collect and sort plastic waste. This may involve separating different types of plastics based on their chemical composition and properties, as different plastics require different approaches for bio-upcycling.

2. **Preparation and Cleaning:** The collected plastic waste needs to be cleaned and prepared for the bio-upcycling process. This may involve removing contaminants, labels and any non-plastic components.

3. **Depolymerisation:** The plastic waste is then subjected to depolymerisation, where it is broken down into its basic building blocks or monomers. This process can be achieved through various methods including enzymatic degradation, microbial fermentation or chemical depolymerisation.

4. **Microbial Treatment or Enzymatic Conversion:** In this step, microbial organisms or specific enzymes are introduced to the depolymerized plastic waste. These

microorganisms or enzymes are selected based on their ability to efficiently degrade the plastic and convert it into desired products.

5. **Biochemical Reactions**: The microbial organisms or enzymes work on the depolymerised plastic, catalyzing biochemical reactions that transform the monomers into more valuable compounds. These compounds can be used as precursors for the production of biodegradable plastics, bio-based chemicals or the high-value materials.

6. **Product Refinement:** The resulting products from the bio-upcycling process may undergo further refinement and purification to ensure they meet the required specifications for their intended applications.

7. **Application and Commercialization:** Once the bio-upcycled products have been refined, they can be used as feedstocks for microbial fermentation, producing high value chemicals like polyhydroxyalkanoate (PHA), succinic acid and biosurfactant from plastic waste.

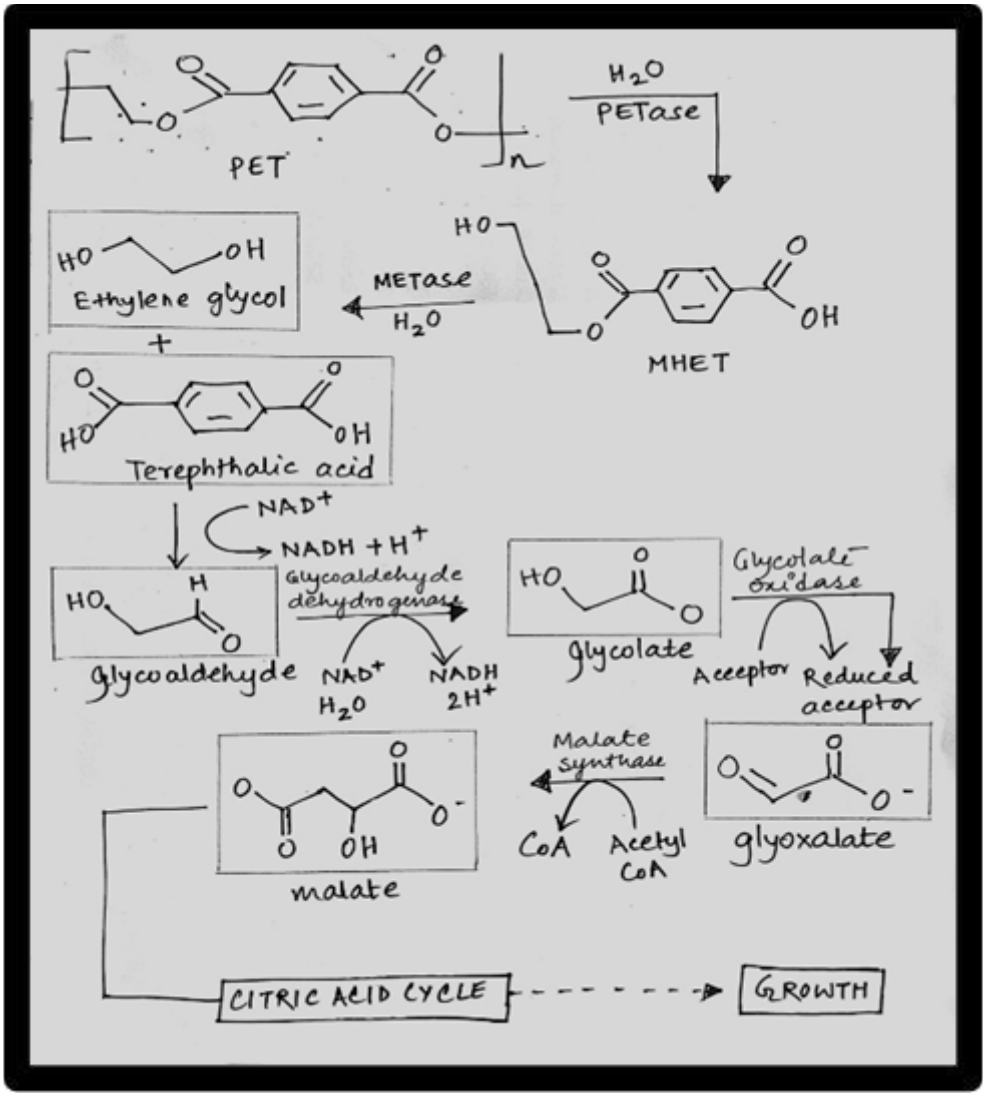
Biodegradation of plastics involves **microorganisms** like bacteria, fungi and algae breaking down polymer materials through their metabolic activity. This process can occur aerobically or anaerobically, resulting in the production of CO_2, H_2O and sometimes methane. Plastic-degrading enzymes secreted by microorganisms adsorb to the plastic surface and initiate hydroperoxidation/hydrolysis of bonds, leading to the release of short degradation intermediates. Eventually, the tricyclic acid (TCA) cycle produces the final byproducts of biodegradation. The complexity of this process depends on substrate availability, surface characteristics, morphology and molecular weight of the polymers.

Biodegradation of synthetic plastics can be divided into two groups: carbon-carbon backbone plastics (PE, PP, PS, PVC) and heteroatoms-containing plastics (PET, PU).

The biodegradation of synthetic plastics depends on factors like plastic type, chemical structure, environmental conditions and the presence of specific microorganisms. Polyethylene (**PE**) with high molecular weight can be pretreated using UV irradiation, chemical oxidizing agents, or thermo-oxidation to improve microbial degradation. Polystyrene (**PS**) is biodegraded by various strains like *Xanthomonas* sp., *Sphingobacterium* sp., and *Rhodococcus ruber* C208. Polypropylene (**PP**) degradation is aided by *Pseudomonas stutzeri*, *Bacillus subtilis*, and other strains. Plastics with heteroatoms like **polyethylene terephthalate** (**PET**) have slow degradation but can be aided by enzymes from microorganisms such as *Thermobifida fusca, Humicola insolens, Pseudomonas mendocina, Fusarium solani, Saccharomonospora viridis,* and *Ideonella sakaiensis.*

PET is a **widely used plastic** known for its strength and transparency, found in beverage bottles, food containers and polyester fabrics.

In the **PET degradation pathway** illustrated in the above-mentioned figure, PET hydrolases such as cutinase, lipase, carboxylesterase, PETase, MHETase, glycolaldehyde reductase, glycolaldehyde dehydrogenase, glycolate oxidase and malate synthase and esterase are capable of breaking down PET into simpler monomers, enabling microorganisms to use them as major carbon sources and metabolize them into CO_2, H_2O, CH_4, and N_2 for environmental adaptation.



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The process begins with PETase, which acts on PET, breaking it down into two monomeric units: ethylene glycol and terephthalic acid. Ethylene glycol is then subjected to reduction by glycolaldehyde reductase, converting it into glycolaldehyde, which serves as an intermediate in the degradation process. Glycolaldehyde, in turn, undergoes dehydrogenation by glycolaldehyde dehydrogenase, leading to the formation of glycolate.

Further in the pathway, glycolate is oxidized by glycolate oxidase, resulting in the formation of glyoxalate. Finally, malate synthase comes into play, converting glyoxalate into malate. This malate can be readily utilized by microorganisms as a nutrient source for their growth and metabolic processes.

Microbes facilitate plastic biodegradation, offering an eco-friendly solution to tackle plastic pollution and environmental challenges effectively.

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Breaking Free: Pioneering the Path to an HIV Functional Cure

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HIV-1 has affected over 70 million people. **Antiretroviral treatment (ART)** has reduced new infections and saved lives, turning HIV into a manageable condition. Yet, challenges like treatment cost, stigma and toxicity persist. Addressing these issues is vital in the ongoing fight against HIV-1.

To address this, the scientific community seeks to develop strategies for an "HIV cure" to eliminate the need for lifelong ART, prevent transmission and eliminate the virus from the body. Two ambitious goals are pursued: a "functional cure," maintaining low virus levels without ART, and a "sterilizing cure," eradicating the virus entirely from latent reservoirs. Although no effective and scalable strategies exist yet, evidence suggests these goals are possible. The cases of the **"Berlin patient"** and **"London patient,"** both treated for blood cancers, achieved HIV cures via complex stem cell transplants from donors with HIV-resistant genes (CCR5-Δ32). However, such procedures are risky and limited to specific cases, making them unsuitable for broader use. Repeating the success of the Berlin patient and expanding trials to include more individuals is crucial. Less invasive and scalable methods are being explored, including in vivo genetic modification and 'suppression and protection strategies', tested in animal models. These efforts aim to make HIV cure strategies accessible to a wider population.

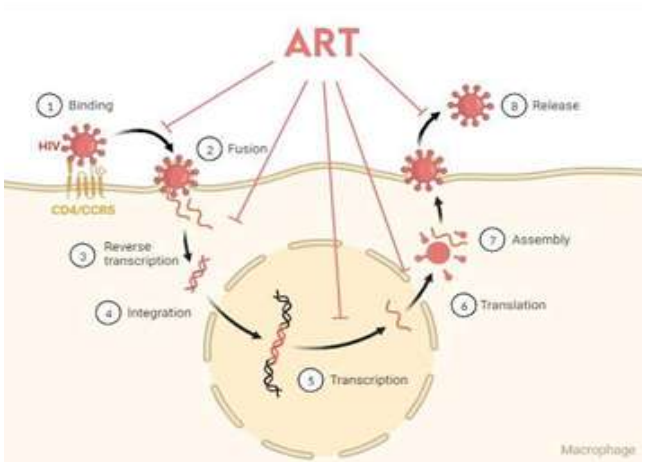

Fig 1. Antiretroviral Treatment Therapy sites of action. Self-created.

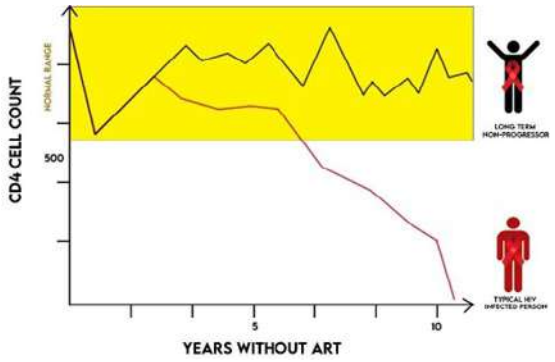

Fig 2. Berlin patient: Timothy Ray Brown. First person to be cured of HIV. Source link: https://www.bbc.com/news/health

Advancing Functional Cure Models

The term "HIV cure" can refer to either a "sterilizing cure," which eliminates the virus from the individual, or a "functional cure," where the virus is controlled without antiretroviral treatment (ART). In a functional cure, proviral HIV DNA may still be present in blood cells, but plasma viral load remains undetectable or low. Achieving viral control without eradication is associated with immune-based mechanisms and may involve therapeutic vaccines. Therapeutic vaccination aims to reactivate and enhance the immune response against the virus. However, HIV infection can cause immune dysfunction, including inflammation and exhaustion, which affect immune effectiveness. Long-term non-progressors (LTNP) exemplify cases where the immune system effectively controls HIV. Therapeutic vaccination seeks to mimic these responses. Post-treatment controllers (PTC) are individuals who maintain suppressed viremia after stopping ART without prior immune therapy. PTC rates vary, and their profiles differ, with some controlling viral replication spontaneously (post-rebound controllers) and others maintaining a low viral load (non-rebounders)

Analytical treatment interruption (ATI) is a method to measure the effectiveness of functional cure strategies, as there are no reliable predictors of viral rebound without ART. However, ATI presents ethical and medical challenges, including the risk of opportunistic infections, complications and the potential for HIV transmission or superinfection. Managing these potential dangers and unknown factors demands cautious re-evaluation. ART does not eliminate HIV due to latent reservoirs and anatomical hiding places.

Strategies like intensified ART have been explored but showed limited impact. Early treatment initiation, especially within the first six months of infection, might preserve immune function and limit viral evolution, making individuals more suitable for functional cure studies. Prolonged ART before treatment interruption also influences the size of the reservoir and post-treatment control. In summary, achieving an HIV cure involves tackling challenges related to reservoirs, immune dysfunction and viral rebound dynamics. Functional cure strategies, including therapeutic vaccination and early treatment initiation, hold promise but require thocrough investigation and careful consideration of risks. **"Kick and kill"** and **"block and lock"** are strategies aimed at achieving an HIV cure.

The **"kick and kill"** strategy involves re-activating latent HIV-infected cells using **latency-reversing agents (LRAs)** and then eliminating these cells using immunotherapeutic interventions, such as T-cell vaccines. The goal is to activate the virus from its latent state and then clear the reactivated cells. Combination approaches are often necessary, as neither component alone may be effective. However, many LRAs have safety risks and modest effectiveness in vivo. Given that latency is upheld through diverse mechanisms and the viral reservoir involves different cellular compartments, relying on a single LRA might not prove satisfactory. Multiple categories of LRAs are presently in the process of development and clinical evaluation. These encompass epigenetic modifiers, protein kinase C agonists, NF-κB agonists, activators of the Pi3K/Akt pathway, toll-like receptor (TLR) agonists and inhibitors of immune checkpoint mechanisms.

Histone Deacetylase Inhibitors (HDACi) are a widely explored class, which can re-activate HIV

by inhibiting histone deacetylation, promoting viral gene expression. HDACis like vorinostat, panobinostat, and romidepsin have shown reactivation in vitro and in vivo. However, while they have increased viral gene transcription, they have not significantly reduced the viral reservoir size. Moreover, some HDACi's might hinder host immunity and their use in HIV cure strategies is limited. Conversely, "block and lock" strategies seek to trap HIV in an irreversible latent state, reducing the chance of reactivation and replication. This involves inhibiting transcriptional factors like NF-κB, NFAT, P-TEFb complex, mTOR complex and Transcription Factor II H (TFIIH), as well as other drugs. These strategies aim to prevent the virus from re-activating and spreading. However, while promising, these approaches are still in the initial stages of research and need further investigation.

In conclusion, progress has been made in testing strategies for an operational HIV cure. Yet, no treatment ensures lasting viral suppression without antiretroviral therapy. Various methods like vaccines, antibody infusion, latency-reversing agents and immune modifiers have been tried alone or together in trials. However, success likely requires combining elements in the right way, posing a significant challenge for clinical development.

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12. Images and graphs have been digitized from the original link sources

Revolutionizing Allergic Asthma Treatment: An Updated Overview of Modern Therapeutic Modalities

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Introduction

Allergic asthma, a prevalent chronic respiratory disorder, is triggered by exposure to allergens, causing airway inflammation and hyper-responsiveness. Genetic and environmental factors contribute to disease development, with a strong familial predisposition observed. It affects millions worldwide, impacting the quality of life and straining healthcare systems. Current therapies offer symptom control but have limitations in efficacy and side effects.

Advancements are essential to improve outcomes. Understanding immunological mechanisms, identifying new therapeutic targets and personalized approaches hold promise. This article reviews modern trends in allergic asthma management, emphasizing the need for innovative strategies to reduce its global burden (Scott et.al 2023).

Potent Allergens Causing Asthma

A variety of potent allergens can trigger allergic asthma, and the following table highlights the most influential ones among them (Linnemann et.al 2008)-:

Sino.	Allergen Classification	Description
1	Pollen	Pollen from trees, grasses, and weeds is a common outdoor allergen that can trigger asthma symptoms, especially during specific seasons.
2	Dust Mites	Dust mites are microscopic organisms found in household dust, bedding, and upholstered furniture. Their fecal matter and body parts are potent allergens
3	Pet Dander	Proteins found in the skin, saliva, and urine of pets, such as cats and dogs, are known allergens that can trigger asthma symptoms.
4	Mould Spores	Mold can grow indoors in damp and humid environments, releasing airborne spores that can induce allergic reactions and asthma exacerbations
5	Cockroaches	Cockroach droppings and saliva contain allergenic proteins that can be inhaled and trigger asthma symptoms, especially in urban environments.
6	Rodent Allergens	Proteins present in the urine, saliva, and dander of rodents (e.g., mice and rats) can act as potent asthma triggers, particularly in areas with infestations.
7	Fungi and Yeasts	Apart from mold, other fungi and yeasts found in indoor environments can also serve as allergens for some individuals with asthma.
8	Air Pollution	Various air pollutants, such as ozone, nitrogen dioxide, and particulate matter, can worsen asthma symptoms and exacerbate allergic responses in susceptible individuals.
9	Tobaco Smoke	Both active smoking and exposure to secondhand smoke are linked to increased asthma severity and a higher risk of developing asthma.
10	Occupational Allergens	Specific allergens encountered in certain occupational settings, such as allergenic proteins in animal handling, agriculture, or healthcare, can trigger work-related asthma.

Table-1-: List Of Most Potent Allergens

Rise In Morbidity and Mortality-: A study done by Suissa et.al 2001 takes in account 10 years of data and depicts the major factors that lead to the rise in the death rate caused by allergic asthma. Hospitalizations have increased in Canada and the United States, contributing significantly to asthma-related expenditures. In the US, hospitalizations accounted for 29.5% of direct medical spending, costing approximately $1.8 billion in 1997. Canada's direct asthma-related expenditures were $85 million, comprising 28% of total asthma costs in 1990. Asthma mortality rates vary globally, with the US reporting an average of 34 deaths per year among 5 to 17-year-olds. Disparities in mortality exist among different age groups and socioeconomic backgrounds, with inner-city African-Americans facing higher rates. Despite fluctuations, the US has seen a progressive increase in asthma mortality over the past two decades.

Modern Techniques and Research on The Treatment of Allergy Asthma

A. Natural Treatment Options-: Research is going on rapidly in the search for appropriate treatment from natural origin. These are mainly because of inexpensive and reduced side effects. Some Modern Natural Treatment is as follows-:

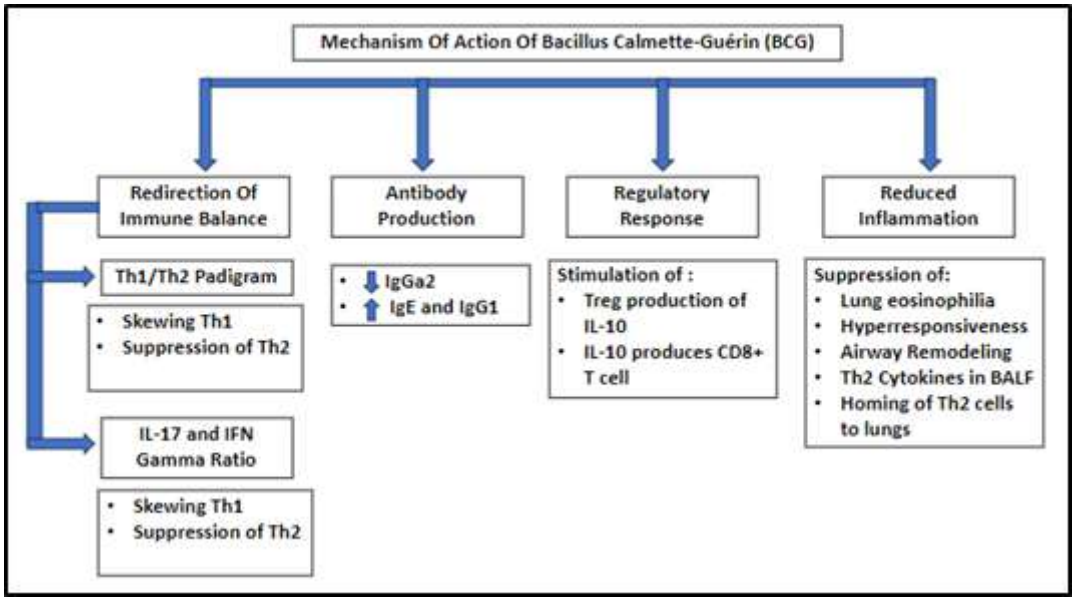
Slno.	Natural Source	Mode of Inhibition
1	Glycyrrhizic Acid	Inhibition of the expression levels of pro-inflammatory cytokines (TNF-α, IL-1β and IL-6) in the livers of t-BHP-treated mice models, Regulation of Th1/Th2 balance through suppression of OX40-OX40L signaling and p38 MAPK activity (Fouladi et. al 2017)
2	Cucurmin	Reduction of Total Differential Leukocyte Count and Significant Reduction of Proinflamatory Cytokines IL-4 and IL-5 TNF-α, TGF-β (pro-fibrotic cytokines), eotaxin (chemokine), and heat shock protein 70 (marker of airway obstruction) (Shahaid et. al 2019)
3	Gerberae Piloselloidis Herba	Targets PI3K/Akt and IL-17 pathways. Inaddition, GPH improved the OVA-induced asthma symptoms, the alveolar septa thickening and theinfiltration of inflammatory cell around bronchi and bronchioles as well as reduced the levels of IgE, IL-8and TNF-α in serum or BALF. (Zhou et. al 2022)
4	Withania somnifera Extract	Reduction in the levels of mmunoglobulin E (IgE), interleukin 4 (IL-4), and tumor necrosis factor-alpha (TNF-α) levels, as well as eosinophil count, in blood and BALF (Ali et. al 2023)
5	Kaempferol	Reduction in the levels of IL-25 and IL-33, and the NOX4- mediated autophagy. improved airway inflammation and remodeling through suppressing NOX4-mediated autophagy. (Xu et. al 2023)

Table-2-: List of Novel Anti-Allergen from Natural Sources

B. Nano Drug Treatment-: This is a novel Nano-technological approach to more efficient drug delivery. One such technique is the use of Vasoactive Intestinal Peptides i.e. conjugated with alpha alumina nanoparticles to prevent proteolysis in the Lung epithelial cells. The antiallergic effects of this technique are as follows (Athari et.al 2016)-:

- Increase in airway responsiveness.
- Significantly lowering the eosinophil level in blood.
- Reduction of Lung Mucus Secretion.
- Significant Reduction of IL-2 and IL-5 levels.
- Reduced mRNA of Cytokines and Mucin genes.

C. *Mycobacterium bovis* Bacillus Calmette-Guérin-: This compound is generally used as a vaccine for Tuberculosis but recent research has found the potential of BCG in



Flow Chart (1)-: Mode of Action of BCG

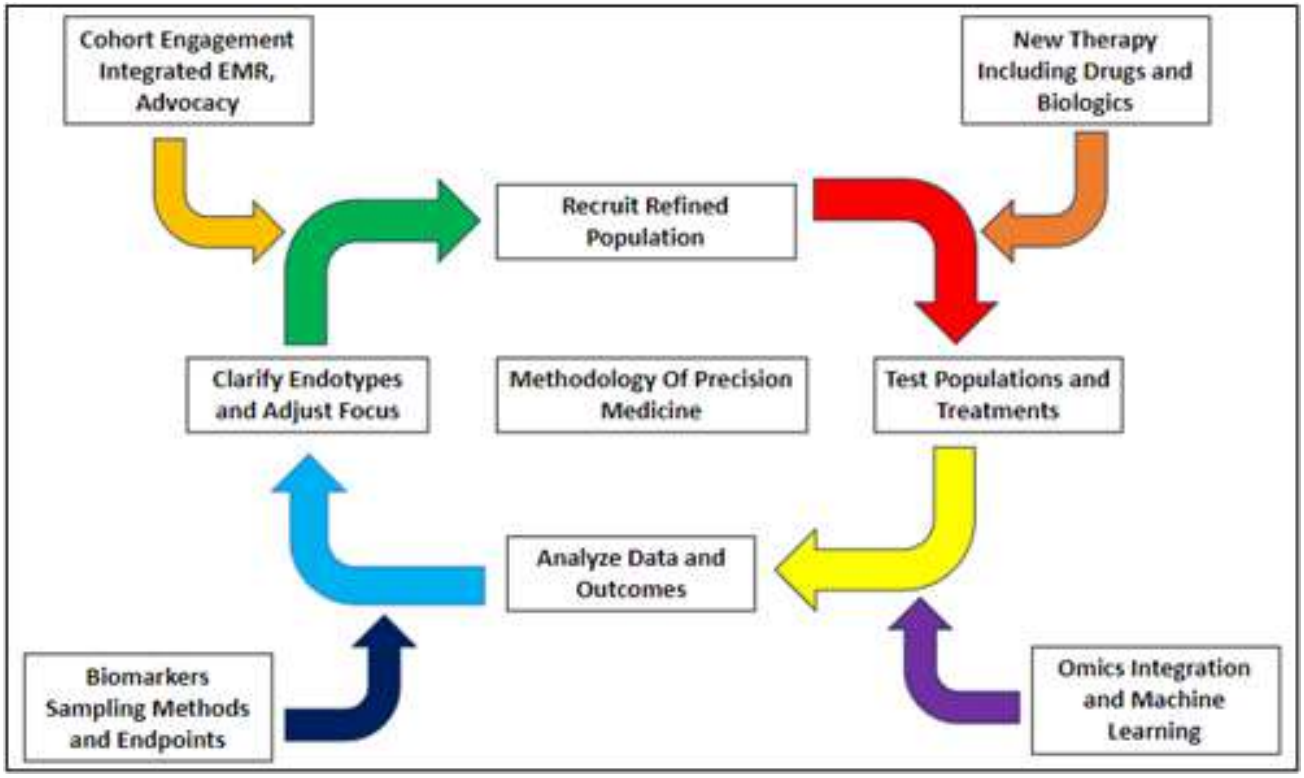
anti-allergy therapy that targets the lungs. The mechanism of action of BCG is as follows (Kulbat et.al 2021)-:

D. *Schistosoma japonicum*-: A helminth whose extract has proven to have a significant effect on allergic asthma and also on allergic rhinitis, which has been proved in mice. The effect of helminth peptides on allergic asthma are as follows (Gao et.al 2023) -:

- Reduced the number of sneezes and rubbing movement of mice.
- Prevented the entry of inflammatory cells in the lungs.
- Reduce the concentration of IL-4 and IL-13.
- Increased concentration of Breg cells.

E. GliSODin-: Asthma, a chronic inflammatory airway illness, is characterized by type 2 inflammation, airway hyper-responsiveness and mucus hypersecretion. Reactive oxygen species (ROS) play a significant role in asthma pathogenesis. GliSODin, a dietary supplement with antioxidant properties, acts as a defence against ROS. GliSODin reduced airway hyper-responsiveness, lung immune response and HDM-specific IgE production. It also decreased the polarization of CD4+ T cells into Th2 and Th17 cells when cocultured with HDM-sensitized dendritic cells. In adoptively transplanted CD4+ T cells from asthmatic mice, GliSODin reduced the reactivation of Th2 and Th17 cells after stimulation with HDM (Klein et.al 2023).

F. Precision Medicine-: It is the notion of using several layers of patient-specific data to customize diagnoses and treatments for the person; ideally, a patient receives the correct intervention at the right time to maximise efficacy and reduce mortality, morbidity, and expense. Despite the fact that allergy precision medicine is still in its infancy, the recent success of biologics, the development of technologies focused on the integration of huge data sets and improved sampling techniques are encouraging and show the value of improving our knowledge



Fig(2) Flow Diagram of the Mechanism of Precision Medicine

of allergic endotypes to enhance therapy. The mechanism of Precision Medicine in the treatment of Allergic asthma is as follows (Proper et.al 2021)-:

G. Gene Therapy-: The technique of RNA-based silencing can be used to silence a variety of disease pathways. This technique can also be used to silence genes that are responsible for the expression of the symptoms of allergic asthma. Blocking a biological function by targeting mRNA is more efficient than targeting a protein because multiple copies of a specific protein are translated from each mRNA molecule. Post-transcriptional

Target Gene	Species	Intervention
Gene-silencing Stratagies For Treating Allergic Airway Diseases-:		
IL-5	Mouse	Intratracheal siRNA lentivirus
IL-4	Rat	Intravenous antisense RNA recombinant AAV
IL-4 Alpha	Mouse	Inhalation antisense oligonucleotide
IL-3 GM-CSF	Human	Inhalation TPI ASM8
STAT6	Human	siRNA + cationic liposomes
GATA-3	Mouse	Intratracheal short hairpin RNA, lentivirus
STAT 1 and STAT 3	Rat	Intratracheal decoy oligonucleotide
miR-126	Mouse	Intranasal antagomir: cholesterol-linked, single stranded RNA
CD86	Mouse	Inhalation antisense oligonucleotide
CD40	Mouse	Intravenous hairpin siRNA–expressing vector
AMCase	Mouse	Intratracheal recombinant AAV with hairpin siRNA
Gene Overexpression Stratagies for Treating Allergic Airway Diseases-:		
IL-4RA	Mouse	Intratracheal mouse IL-4RA on plasmid
IL-12	Mouse	Intramuscular mouse IL-12 on plasmid
IL-10 and IL-12	Mouse	Intratracheal recombinant adenovirus
IFN-Gamma	Mouse	Intranasal chitosan IFN-γ nanogene particles
T-bet	Mouse	Intranasal recombinant AAV vector

Table(3)-: Recent Advancements of Gene Therapy For Treating Airway

inhibition of gene expression at the mRNA level can occur by antisense oligonucleotides, DNAzymes, and RNA interference. The strategies are as follows (Maes et.al 2011)-

H. Prebiotic and Probiotic-: Probiotics and prebiotics have immunomodulatory effects, regulating immune responses and potentially attenuating allergic reactions. IL-17, GTP, and other factors decrease mucus secretion, goblet cell hyperplasia, peribronchial and perivascular inflammation, along with EPO activity. TLR4 and CCL11 gene expression may decrease, while IL-38 gene expression is boosted by probiotic and prebiotic therapy. These treatments may also regulate the expression of genes related to IL-4, 5, 13, 25, 33, leukotrienes, AKT, NLR3, NF-B, MyD88, and MUC5a. Prebiotics could potentially regulate PI3K gene expression and peribronchial inflammation. Probiotics may also enhance cellular and humoral immune responses, providing protection against allergic diseases while maintaining tolerance to allergic inflammatory reactions (Wu et.al 2022).

Conclusion

This initiative puts light on the fascinating developments in the management of allergic asthma that have transformed this chronic illness. The described contemporary treatment methods, including probiotics and prebiotics, have shown promising immunomodulatory effects that successfully control immune responses and may even lessen allergic reactions. These medicines' capacity to target certain genes and pathways linked to allergic inflammation opens new possibilities for individualised and focused therapy. As we continue to understand the complex mechanisms causing allergic asthma, it is clear that these cutting-edge methods have a lot of potential to provide patients with safer and more efficient treatment options. Accepting these developments and encouraging more study and cooperation will help usher in a new age of allergic asthma therapy that will provide patients with a higher quality of life.

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Sculpting a New Paradigm: Scorpion Venom's Promise in Cancer Therapy

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Introduction

In the pursuit of innovative cancer treatments, scientists are now turning their attention to an unlikely source: scorpion venom. Scorpions, abundant in various global ecosystems, have venom containing an array of bioactive compounds. This venom has recently shown a remarkable ability to selectively target cancer cells, while sparing healthy ones, presenting a tantalizing avenue for cancer therapy. Traditional treatments like chemotherapy can damage healthy cells alongside cancerous ones, leading to severe side effects. Scorpion venom's components, however, seem to zero in on cancer cells with greater accuracy, potentially minimizing collateral damage and adverse reactions. Recent studies also highlight scorpion venom's potential to disrupt crucial cancer-promoting pathways. By impeding tumor growth, inducing programmed cell death (apoptosis) and inhibiting the formation of new blood vessels that feed tumours (angiogenesis), these venom-derived molecules exhibit a multifaceted approach to tackle cancer. While research is still in its infancy, scorpion venom's abundance and unique properties make it an exciting frontier in cancer therapy. As investigations progress, scorpion venom could pave the way for targeted, effective and less toxic treatments, offering renewed hope for patients and revolutionizing the fight against cancer.

Anticancer Components of Scorpion Venom

Recent studies have been able to discover avenues that have possibilities for treatment against a variety of cancers. The anticancer peptides in the scorpion venom is as follows-: (Poku et.al 2016) (Rave et.al 2019)

Slno.	Anti Cancer Component	Scorpion Species	Anticancer Activity
1	BmKKx2	*Mesobuthus martensii*	Induction of Apoptosis
2	LMWSVP	*Mesobuthus martensii*	Growth Inhibition
3	Bengalin	*Heterometrus bengalensis*	Increase production of Caspase-3
4	Chlorotoxin (CTX)	*Leiurus quinquestriatus*	DNA Synthesis Inhibition and Apoptosis
5	Iberiotoxin	*Leiurus quinquestriatus*	Enhances FasL production
6	Toxin Gamma	*Tityus Serrulatus*	Reduces Glutathione levels
7	Toxin-5	*Tityus Serrulatus*	Induces Apoptosis
8	Neopladine 1	*Tityus discrepans*	Growth Inhibition
9	Neopladine 2	*Tityus discrepans*	High Selectivity for SKBR3
10	Mauroporin	*Androctonus mauritanicus*	Increased Nitric Oxide production
11	SAaCtx	*Androctonus australis*	DNA Synthesis Inhibition and Apoptosis
12	BmKCT	*Mesobuthus martensii*	Growth Inhibition
13	CA4	*Mesobuthus martensii*	Degrades Hyaluroan
14	CTX-23	*Mesobuthus martensii*	Increases Nitric Oxide Production
15	rAGAP	*Mesobuthus martensii*	Growth Inhibition and Apoptosis
16	AcrAP1	*Androctonus crassicauda*	Enhances FasL production

Table(1) The Potential Anti-Cancer Components of Scorpion Venom

Anti-Cancer Activity of Snake Venom

a. **Breast Cancer-**: A recent study conducted by Teleb et.al in 2022 showed the potency of scorpion venom peptide Smp43 in the treatment of breast cancer. This peptide was isolated from Scorpio maurus palmatus. DNA fragmentation and Annexin V/PI analyses revealed that Smp43 treatment caused cell death rather than cell growth, migration or metastasis. Additional molecular mechanism analyses revealed that the expression levels of bax, p53, caspase 7 and caspase 9 were upregulated in both treated cell lines. On the other hand, both treated cell lines had considerably lower levels of bcl-2, ki67, PCNA, laminin-5 and upA expression. Additionally, an ELISA test for cytochrome C, MMP9, and VEGF confirmed these findings. (Teleb et.al 2022)

b. **Cervical Cancer-**: A study conducted by Olivera et.al in 2019 proved the anti-cancer activity of venom from Tityus serrulatus on cervical cancer cell lines. Upon treatment with venom the HeLa cells showed reduced number of tumour cells and abrogated monolayer formation. Cytometry analysis of the HeLa cells revealed the cytotoxic effect of TsV which includes caspase mediated apoptosis and inhibition of proliferation. (Olivera et.al 2019).

c. **Lung Cancer-**: The venom from Egyptian scorpion Scorpio maurus palmatus has a Smp4 peptide that has proven its anti-tumour activity in a study conducted by Guo et. al in 2022. It was found that Smp24 can interact with the cell membrane, enter cancer cells through endocytosis, target mitochondria and affect its function. This significantly increases the production of ROS, changes the potential of the mitochondrial membrane and affects the expression of proteins related to cell cycle distribution, the mitochondrial apoptotic pathway and cell proliferating signalling pathways thereby inhibiting Lung cancer cells. (Guo et. al 2022).

d. **Colorectal Cancer-**: A study of 2018 demonstrated the efficacy of Hemiscorpius lepturus venom in the inhibition of colorectal cancer cell lines. MTT assay shows that the venom of this species can inhibit the cellular proliferation rate and without hampering the cellular proliferation of the normal cells. Real time PCR showed that the expression of the apoptotic genes like caspase 3, Bcl and Bax were heightened upon incubation with the venom leading to cell death via apoptosis and thereby preventing metastasis and proliferation. (Moradi et.al 2019)

e. **Oral Cancer-**: The scorpion venom anticancer peptide BmKn-2 has been successfully studied against oral cancer cells. It was found that this peptide was very effective against human oral squamous epithelial cell lines. Phase contrast microscopy and RT-PCR assay confirmed the venom mediated apoptosis in the cancer cell lines through the increase in expression of the apoptotic genes. Shrinkage and rounding of the cells were also observed due to venom application without altering the normal cells. (Tong et.al 2015).

f. **Leukemia-**: A scorpion venom peptide called SCVIII was tested against hematopoietic malignancies for its antagonistic effect on NF-Kappa B. It was found that SCVIII inhibited cell proliferation by arresting it in G1 phase and inhibition of Cyclin D1 protein. SVCIII

prevented IkB alpha phosphorylation caused its degradation, it inhibited the constitutive activation of NF-B. (Song et.al 2012)

Nano-technological Delivery Approaches

Nano liposomal delivery approaches are fairly new in the field of biosciences but have shown significant fidelity and precision when it comes to drug delivery to specific tissues. The steps of formulation of nanoliposome are as follows-: (Asmari et. al 2017)

1. **Liposome Formation:**
   - Mix phospholipid 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC) and cholesterol in tert-butyl alcohol (TBA)/ water co-solvent system.
   - Form isotropic monophasic liposome solution.
   - Freeze-dry the solution in a sterile vial, resulting in dehydrated liposomal powder.
   - Empty lipid vesicles are retained after TBA and water removal.
2. **Venom Encapsulation:**
   - Employ dehydration-rehydration method to encapsulate venom.
   - Rehydrate dehydrated liposomes with venom AB in PBS at 37°C.
   - Incubate the mixture at 37°C for 2 hours.
3. **Cryopreservative Addition:**
   - Introduce 0.5% (w/v) Mannitol as a cryopreservative.
4. **Freezing and Lyophilization:**
   - Freeze the mixture using a liquid nitrogen bath.
   - Lyophilize the frozen mixture at -40°C and 5 mbar pressure overnight.
5. **Resuspension and Unincorporated Venom Removal:**
   - Resuspend lyophilized cake in normal saline.
   - Centrifuge the mixture at 10,000 rpm for 30 min at 4°C.
   - Resuspend precipitates in normal saline post washing.

Conclusion

The investigation into the potential utilization of scorpion venom in cancer therapy presents a captivating realm of study with promising prospects. The assortment of bioactive elements within scorpion venom offers a distinctive and multifaceted strategy for addressing cancer, characterized by its exceptional precision in targeting cancerous cells while safeguarding healthy ones. This selectivity holds the potential to alleviate the adverse effects often linked with traditional treatments, ushering in a new era of more bearable and efficacious therapeutic approaches. Furthermore, scorpion venom's capacity to disrupt pivotal pathways promoting cancer, inhibit tumor progression, trigger apoptosis and hinder angiogenesis highlights its significance as a formidable contender in the fight against cancer. As scientific comprehension and technological advancements advance, scorpion venom could emerge as a transformative element, reinstating renewed optimism in patients and reshaping the landscape of cancer treatment.

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From Hive to Hope: Bee Venom and Melittin Opening the Door to Revolutionary Cancer Treatment

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Cancer remains the predominant global cause of mortality, characterized by multifaceted neoplastic progression. The past decades have witnessed a notable surge in cancer cases and associated fatalities. Enhancing the efficacy of conventional chemotherapies necessitates innovative agents and approaches. Natural products, encompassing biotoxins, have garnered increasing attention for cancer treatment. Among these, bee venom (BV) and its core constituent, melittin (MEL), have emerged as promising candidates. MEL, a 26-amino acid peptide, constitutes 40-60% of BV. Its hydrophilic carboxyl-terminal segment drives lytic activity, while the amino-terminal hydrophobic portion lacks such action. MEL's amphipathic nature enables solubility in water and integration into membranes, disrupting the phospholipid bilayer. MEL disrupts membranes by forming pores, inducing non-selective lysis of prokaryotic and eukaryotic cells. MEL's hemolytic, antifungal, antibacterial, and anticancer actions are mediated by this pore formation. Collectively, these findings highlight MEL's potential as an alternative for cancer management.

Mechanisms of action of melittin

Different in vivo and in vitro studies have shown that MEL exerts various effects on cell functions such as apoptosis, metastasis, proliferation, angiogenesis and the turnover of cancer cells. Depending on the type of cancer, different pathways, genes and molecules are activated or altered to control this process, as shown in **Figure 1.**

1. Induction of apoptosis

Numerous studies have demonstrated that melittin prompts apoptosis by elevating intracellular Ca^{2+} levels, upregulating death receptors (DRs), activating the mitochondria-mediated apoptosis pathway and the inositol-requiring protein α (IRE-α)-mediated unfolded protein response (UPR) pathway. This occurs alongside the deactivation of the NF- κB pathway and Akt signal pathway. Calcium serves as a pivotal apoptosis regulator, capable of initiating the process through mitochondrial-dependent or -independent routes. MEL treatment induces heightened $[Ca^{2+}]_i$ and phospholipase A2 (PLA2) activation in various tumor cell types, ultimately leading to cytosolic free Ca^{2+} alterations that trigger cell apoptosis or necrosis.

2. Inhibition of tumor metastasis and invasion

Tumor metastasis contributes significantly to poor patient survival rates due to challenges in controlling recurrence and metastasis post-cancer resection. Liu et al. have elucidated the molecular anti-metastatic mechanisms of melittin in liver cancer cells. This involves the down-regulation of ras-related C3 botulinum toxin

substrate 1 (Rac1), a pivotal player in invasion and migration of tumor cell, accompanied by the extracellular-signal-regulated kinase (ERK) and c-Jun N-terminal kinase (JNK) down-regulation. Central to cancer cell migration is matrix metalloproteinase-9 (MMP-9), responsible for extracellular matrix degradation. Its activity is influenced by transcription factors such as NF-κB and AP-1. Notably, MEL inhibits MMP-9, curbing aortic migration by suppressing ERK/p38 MAP kinase phosphorylation and the NF-κB pathway, as shown in a study. In breast cancer cells, MEL suppresses EGF-induced invasion and migration by targeting the phosphatidylinositol 3-kinase/ protein kinase B (PI3K/Akt)/mammalian target of rapamycin (mTOR) pathway, thereby inhibiting focal adhesion kinase (FAK) phosphorylation and MMP-9 expression.

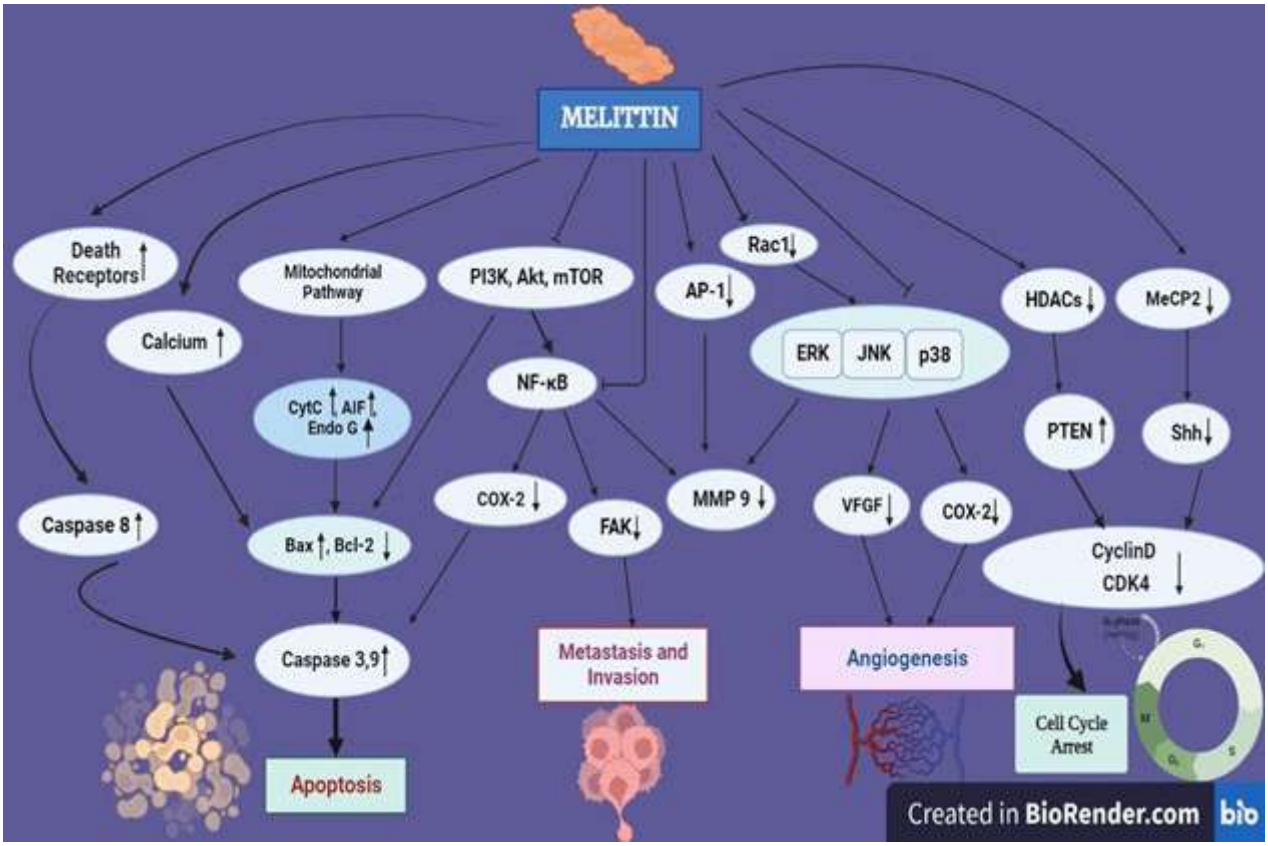

Figure-1: Schematic diagram of the mechanisms of action of Melittin created by BioRender.com

3. Angiogenesis

The primary role of angiogenesis in cancers is to provide the tumor cells with the nutrition and oxygen they need to grow and spread aggressive malignancies. Focusing on angiogenesis rises as a key anti-tumor approach by preventing this pivotal supply. In cancer, the up-regulated Vascular Endothelial Development Calculate (VEGF) plays an essential part in angiogenesis, supervising endothelial cell multiplication, movement and tube arrangement. MEL suppresses VEGF-A-induced expansion and tube arrangement by means of the VEGFR-2 and COX-2 pathways. In human cervical carcinoma cells, MEL down-regulated VEGF mRNA and secreted protein levels, concurrently deactivating the ERK and mTOR/p70S6K pathway.

4. Cell cycle arrest

Cell cycle dysregulation is a hallmark of malignancy. MEL impedes cancer cell growth by modulating cell cycle progression. In SMMC-7721 cells, MEL restricts growth by suppressing methyl-CpG binding protein 2 (MeCP2) via the Sonic hedgehog (Shh) pathway, inducing G0/G1 cell cycle arrest without affecting apoptosis. Additionally, MEL reduces histone deacetylase (HDAC) levels, elevating phosphatase and tensin homolog (PTEN), leading to diminished CyclinD1 and cyclin-dependent kinase 4 (CDK4) expressions.

Synergistic effect of melittin

MEL was found to be having synergistic effects with some chemotherapy agents and the combination of these agents with MEL may be effective in treatment of drug-resistant human cancers. According to Wang et al. 's research, MEL can sensitize Hepatocellular carcinoma (HCC) cells to TNF-related apoptosis-inducing ligand (TRAIL)-induced apoptosis. This suggests that using MEL in conjunction with TRAIL treatments may be helpful in treating TRAIL-resistant human cancer.

Optimizing efficacy of Melittin: Future Perspectives

Even though melittin shows potential as an anticancer drug, its high doses induce hemolysis, impeding intravenous use. Strategies to optimize MEL focus on mitigating toxicity and improving targeting. For instance, MEL conjugation to tumor-specific antibodies or polymers has been explored to enable precise tumor cell targeting for intravenous delivery. Additionally, MEL's short half-life and rapid action restrict its potential. Enhanced delivery methods such as virus vectors, ligands and polymers have limitations in human translation. Non-viral gene transfer vehicles offer low toxicity and cost-effectiveness, yet they suffer from lower transfection rates and unstable gene expression compared to viral methods. Viral vectors are common in cancer gene therapy, though they evoke immune responses necessitating combination therapy. An alternate avenue for practical MEL therapeutic applications involves targeted delivery vehicles like nanoparticles.

In conclusion, the clinical utilization of MEL demands further exploration. Addressing concerns related to administration route and dosage is imperative for clinical application. Nevertheless, extensive research and gene engineering hold the potential to enhance MEL's efficacy in eradicating tumor cells.

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Exploring the Intricate Role of Viral Oncogenes in Carcinogenesis

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What are oncogenes?

An oncogene is a gene that has the capability to beget cancer. Before an oncogene is mutated, it is called a proto-oncogene, and it plays a part in regulating normal cell cycle. When a proto-oncogene is mutated, changing it into an oncogene, it causes the cell to divide and multiply uncontrollably, which may lead to cancer. In tumour cells, these proto-oncogenes are frequently mutated or expressed at high levels. Most normal cells will undergo apoptosis when important cellular functions are altered. The products of most proto-oncogenes are components of signal transduction cascades, like hormone receptors, growth factors, protein kinases, G proteins or transcription factors regulating fundamental cellular processes such as growth, proliferation, differentiation, metabolism and apoptosis.

What are viral oncogenes?

Viral oncogenes take part in the process of carcinogenesis by the RNA of the viral genome which gets integrated into the DNA genome of the host after being reverse-transcribed by reverse transcriptase enzyme. The viral oncogenes transcribe DNA sequences which are nearly identical to sequences in the cellular DNA of most animal species and can be assumed to have the same potential for affecting malignant growth as cellular oncogenes. 12% of all the cancers now are caused by oncoviruses. Oncoviruses are classified as direct or indirect carcinogens, although some similarity exists between the distinctions. Direct carcinogenic viruses contain viral oncogenes that directly contribute to neoplastic cellular transformation, whereas indirect carcinogens cause chronic inflammation, which can further lead to oncogenic transformation. Oncogenic DNA viruses include EBV, human papillomavirus (HPV), hepatitis B virus (HBV) and human herpesvirus-8 (HHV-8). RNA viruses which may be oncogenic include human T-cell lymphotropic virus-1 (HTLV-1) and hepatitis C virus (HCV).

Common pathways of viral oncogenesis

Tumour suppressor pathways, such as retinoblastoma and p53, are often inhibited. Other targets include tumour necrosis-associated factors (TRAFs), cytoplasmic PI3K-AKT-mTOR, nuclear factor-κB (NF-κB), β-catenin, telomerase reverse transcriptase (TERT), interferon signalling pathways, major histocompatibility class-1 (MHC-1) and Janus kinase/signal transducer and activator of transcription (JAK/STAT). The host DNA damage response pathway (DDR) can also get affected, mostly by DNA viruses. Cell cycle may be delayed by the DDR until DNA repair is completed or foreign viral DNA is no longer detected. To promote oncogenesis, viral proteins activate the various aspects of the DDR that are beneficial to viral replication such as repair factor recruitment and inactivate DDR activities that are detrimental to viral DNA survival like apoptotic

pathways. The oncogenicity of some viruses has been established, and viruses are thus becoming targets for cancer treatment and prevention. Successful vaccines are already available for HPV and HBV infection prevention. Antiviral malignancy treatments and therapeutic vaccines have not yet been developed, but are under study.

P13K-AKT-mTOR signalling

The phosphatidylinositol 3-kinase–AKT–mechanistic target of rapamycin (PI3K–AKT–mTOR) pathway is an important eukaryotic nutrient-sensing pathway that coordinates between macromolecule synthesis and metabolism in response to nutrient abundance. Some oncogenic viruses, including HPV, HTLV-1, KSHV, EBV and MCPyV have evolved mechanisms to engage this pathway in the absence of necessary growth factors and when nutrient levels are low. Activation of PI3K–AKT–mTOR signalling may benefit viral infection by promoting cell proliferation and inhibiting autophagy.

MAPK signalling

Mitogen-activated protein kinase (MAPK) pathways regulate the transcription of genes that control the antiviral immune response and cell proliferation. They are involved in the life cycle and propagation of several oncogenic viruses, such as HPV, MCPyV and HCV by promoting viral assembly, production and release. For example, the activity of MAPK-regulated cytosolic phospholipase A2 contributes to the assembly of infectious HCV particles. MAPK signalling also enhances the production of non-enveloped viruses.

NOTCH signalling

Depending on the tissue context and cellular environment, perturbations in the Notch signalling pathway can either promote or suppress tumorigenesis. A role for Notch signalling was found in the development of B cell malignancies, chronic lymphocytic leukaemia, and in breast cancer. On the contrary, Notch signalling has a tumour suppressor function in skin epithelia and pancreatic cells.

WNT signalling

The WNT/β-catenin signalling pathway regulates various physiological processes, such as stem cell renewal, embryonic development, growth control and tissue differentiation. When the downstream transcription targets of WNT/β-catenin signalling get hyperactivated, it can contribute to cancer. Viral oncoproteins control the WNT/β-catenin pathway and contribute to carcinogenesis.

NF-κB signalling

Activation of the nuclear factor-κB (NF-κB) pathway by inflammatory cytokines and pathogens calls for the genes involved in diverse cellular processes, particularly the innate immune and inflammatory responses. Activation of NF-κB and downstream target genes in inflammation and chronic infection also promotes cancer formation by stimulating cell proliferation, enhancing invasiveness and inhibiting apoptosis. Activation of NF-κB is a part of an appropriate response to severe viral infection, but viruses that establish infections in adaptive immune cells can utilise constitutive NF-κB activation to expand their host environment.

Exploiting the host DNA Damage Response Pathway

The host DNA damage response (DDR) system is a complex network of signalling pathways that monitor and repair DNA damage that results from DNA replication, cellular metabolism and external factors such as radiation and viral infection. Stimulation of the major components of the DDR

signalling network, such as ataxia telangiectasia mutated (ATM) and ataxia telangiectasia and Rad3-related protein (ATR) kinases, can induce a series of phosphorylation events that activates downstream effectors like p53 to stall cell cycle progression at checkpoints. Cell cycle checkpoints allow time to repair damaged DNA or lead to cell death. Cells with improper DNA damage recognition and repair systems can gather genetic mutations that enhance cell survival and proliferation. Failure to control these populations of cells ultimately leads to cancer. The engagement of DNA Damage Response factors and enforcement of a replicative state by oncogenic viruses results in genomic instability. Nucleotide deficiency, replication stress and the production of reactive oxygen species (ROS) during viral infection can lead to genomic instability and oncogenesis.

Conclusion

Viruses have evolved many ways to exploit and control the host cellular machinery for propagation. On the other hand, their hosts evolved mechanisms to maintain the integrity of the cellular environment and perform life-sustaining functions for the organism. The fate of both pathogen and host is decided by the extent to which either one controls growth signalling pathways, immune surveillance and genome maintenance machinery. Oncogenic viruses have been helpful in divulging key features of normal cellular function and pathology. Recent oncogenic virus research has also shown that double-stranded DNA introduced by viral infection and DNA damage generated during viral proliferation can stimulate innate immune DNA sensing pathways, leading to the formation of cytokines that have both antitumor and antiviral function**.** Keeping all these observations in mind, many new drug designs have been instrumented which may help to cure the viral oncogenesis in near future or reduce its effect on the host life to a greater extent.

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Artificial Intelligence and The Future

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"Simply put, jobs that robots can replace are not good jobs in the first place. As humans, we climb up the rungs of drudgery — physically tasking or mind-numbing jobs — to jobs that use what got us to the top of the food chain, our brains."
–The Wall Street Journal, The Robots Are Coming. Welcome Them.

Artificial Intelligence (AI), the technology that has proven that the human mind has no boundaries. It is the concept that has taken the whole world by storm. Since its arrival, AI has revolutionized our lives in every aspect, wstarting from the health care sector to industries. The idea of automation and AI has surely changed our way of living but it comes with a lot of drawbacks and ethical issues. The alarming rate of unemployment has made people fearful about AI taking up their jobs in the near future.

When compared to the ability of humans, AI can increase productivity and efficiency in the work culture but every technology should be used mindfully and should not be an addiction to the future generation.

The increased use of machines and technology can harm the job market and our youth. It can significantly affect human intelligence and self-esteem as now every other individual is dependent on AI for their routine life. The frequent use of chatbots and robots in our daily lives have made people lazy and unskilled.

Since the last few years, the world has seen companies laying off thousands of their employees either due to recession or automation and this raises a question among people whether artificial intelligence and machines are going to replace humans in the years to come. A report from the World Economic Forum says that by 2025, AI can cut up to 85 million jobs worldwide. AI has been identified as one of the many reasons for approximately 4,000 job losses in May this year, according to a monthly report released by the multinational HR company, Challenger, Gray & Christmas. This accounts for around 4.9 per cent of the total job cuts reported for the month. A recent survey by software company Krista found most people believe that AI will incur significant impact on their jobs at one point or the other. Only 11 per cent of employees at managerial levels said that the technology will negatively affect their work but the number nearly doubled when it came to the rank-and-file workers. At the same time there are people who are hopeful that AI can create opportunities and jobs who are more skilled with technology and machines.

It is true that AI can take up jobs very easily when it comes to repetitive and tedious tasks but it can never compete with the human mind when it comes to creativity, innovation and empathy. Moreover, there will always be a need for people who understand this technology and will definitely give rise to more skilled employees in

the job market.

Every new technology or machine has its pros and cons and if we humans get blindfolded only by the pros and not consider the latter, we will be the ones to suffer in the future years. Therefore, we should always keep in mind that any technology can be a boon in many ways but it can be a curse as well as its use goes out of control.

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DNA Origami: Unfolding the Nanoscale Future

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Introduction

Structural DNA nanotechnology has emerged as a ground-breaking field, unlocking the potential of DNA as a building material rather than solely serving as a genetic information repository. Leveraging the robust base-pairing properties of DNA, researchers have made significant strides in designing and constructing nanoscale objects with ever-increasing complexity. At the heart of this fascinating field was the concept of "DNA origami", an idea that would transform the way we perceive and manipulate the tiniest of building blocks. Guiding these researchers was the trailblazing mind of Ned Seeman, who saw DNA not as a mere thread of genetic code but as a canvas for crafting nanoscale masterpieces. Inspired by nature's precision, DNA origami allows scientists to create intricate and functional nanorobots and molecular devices that hold immense promise for diverse applications in nanoscience and beyond.

The Concept of DNA Origami

Metaphors such as 'DNA origami,' 'DNA Lego,' and 'DNA carpentry' aptly describe the different methodologies employed in this field. DNA origami was pioneered by Ned Seeman at New York University, initially intending to construct DNA cages for holding proteins in crystallography experiments. The choice of DNA for designing nanostructures is critical, and certain viruses with single-stranded genomes, such as the M13 virus, are suitable for this purpose. The process of folding DNA involves the addition of short strands called 'Staple-strand' that bind to specific positions on a long DNA strand called 'Scaffold-strand', bringing distant locations together and creating creases and folds. This results in a parallel array of helices forming the desired DNA origami structure.

Enter the Holliday Junctions

To maintain the stability of DNA structures, periodic 'Holliday junction' crossovers are strategically introduced. Holliday junctions naturally emerge during genetic recombination. It comprises four DNA strands that intertwine to form a cross-shaped structure, wherein two duplexes are connected by branch migration points. Holliday junctions have different conformational isomers that differ in the patterns of coaxial stacking between the four double-helical arms. These flexible joints enable complex folding geometries by altering the relative orientations of DNA strands. To achieve these breathtaking structures, they set the distance between neighbouring crossovers along each helix at 1.5 helical turns, equivalent to 16 base pairs. This spontaneous folding process however, demanded precise temperature control to avoid tangling. The result was an elegant arrangement of DNA origami structures, resembling the regular DNA we all know, with parallel double helices interconnected by crossovers. Structural motifs incorporating multiple Holliday junctions are employed to construct rigid "tiles" that can subsequently assemble into larger "arrays."

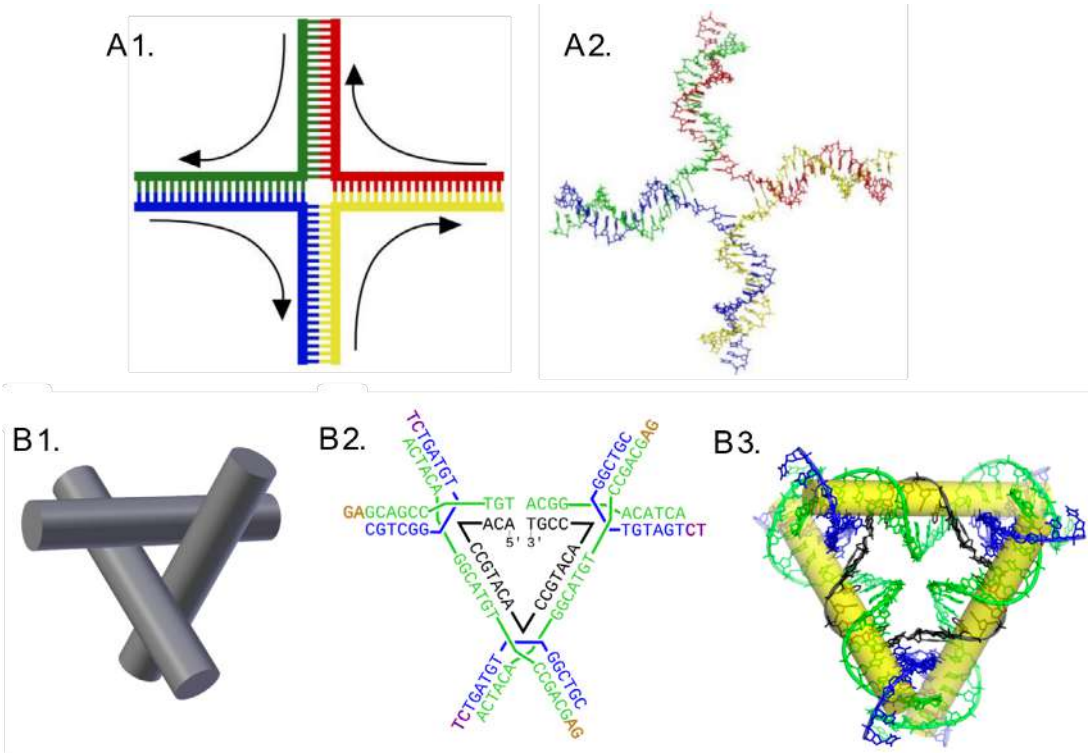

Figure 1: Holliday Junctions; A1 & A2 illustrate a schematic representation of a DNA origami structure featuring a duplex Holliday junction. The duplex Holliday junction is a key motif in DNA origami design, allowing for controlled branching and folding of DNA strands. B. Figures B1, B2 & B3 depict a DNA origami construct with a triplex Holliday junction. Unlike the duplex Holliday junction, the triplex junction involves six DNA strands forming three parallel DNA helices, which are connected by six crossover points.

Reference (A1, A2): Working group of Prof. Tim Liedl. (n.d.). *Biophysics advanced internship - experiment L2B*. Retrieved 2020, from https://www.softmatter.physik.uni-muenchen.de/teaching/fortgeschrittenenpraktikum/dnaorigami/l2b_dna_origami_2020_english-2.pdf

Reference (B1, B2, B3): Paukstelis, P. J., & Seeman, N. C. (2016, August 18). *3D DNA Crystals and Nanotechnology*. MDPI. https://doi.org/10.3390/cryst6080097

Nanostructure assembly

Instead of using a chemically synthesized strand for the scaffold strand, it was more cost-effective and convenient to utilize a single-stranded DNA strand sourced from a viral genome. These viral genomes, as mentioned in the M13mp18 virus, already possess thousands of nucleotides with known sequences. Therefore they serve as excellent scaffolds for assembling DNA origami structures. The specific sequences of the staple strands were determined based on the routing pathway of the scaffold, the positions of the crossovers that maintained the overall structure and the locations of the nick points. To assemble

the DNA origami structure, the scaffold and staple strands were mixed in a salted buffer. The mixture was then slowly annealed from a high temperature of 90 °C down to room temperature. This controlled cooling process allowed each short staple to find its specific position on the scaffold strand, leading to the formation of the desired DNA origami structure.

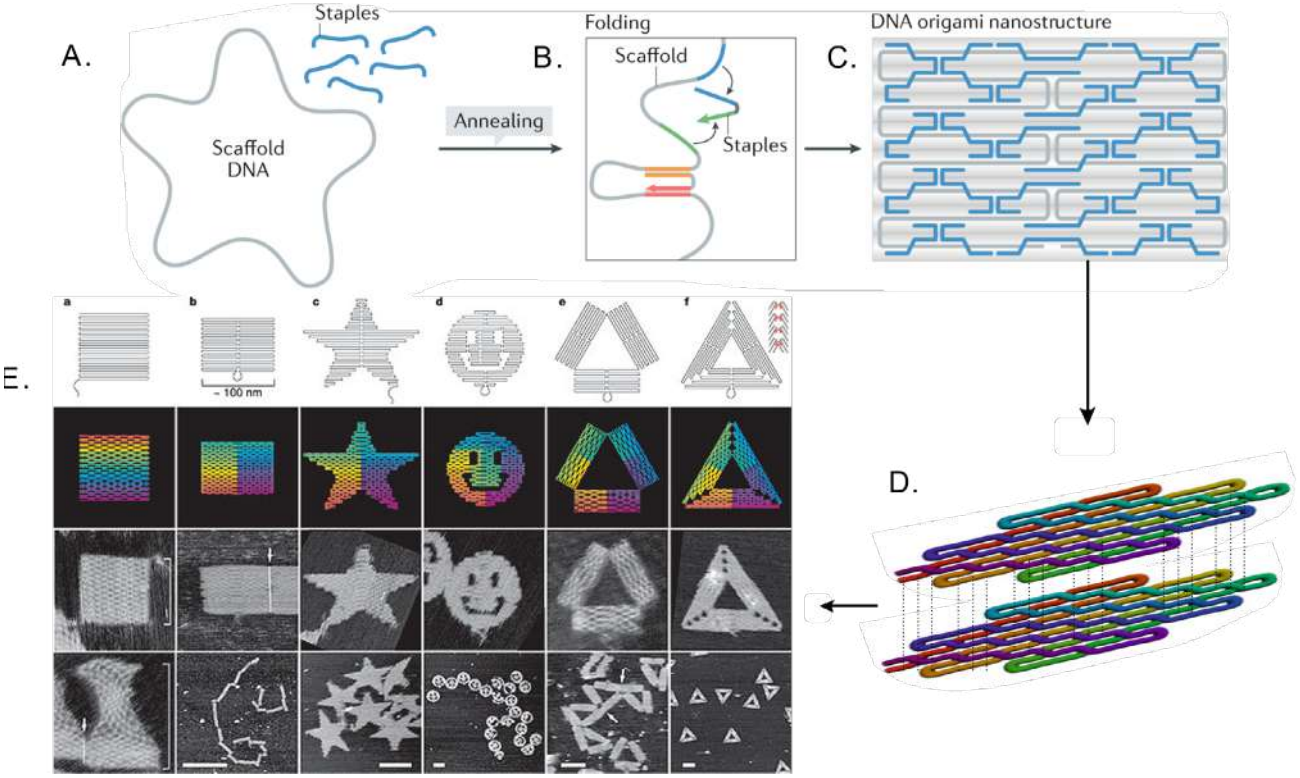

Figure 2: A. The figure highlights the specific and predictable interactions between the DNA strands during assembly. Complementary base pairing allows the strands to self-assemble into the desired structure, driven by hydrogen bonding between the bases. B. The individual DNA strands are mixed in a controlled buffer solution, where they encounter their complementary partners. C & D. As the complementary DNA strands continue to pair, the DNA origami structure begins to fold into its predetermined shape. The process is akin to the folding of a sheet of paper into a specific origami pattern. E. The final part of the figure showcases the fully assembled experimental photographs of DNA origami structure.

Reference (A, B, C, D): Dey, S., Fan, C., Gothelf, K. V., Li, J., Lin, C., Liu, L., Liu, N., Nijenhuis, M. A. D., Saccà, B., Simmel, F. C., Yan, H., & Zhan, P. (2021, January 28). DNA origami. Nature Reviews Methods Primers, 1(1). https://doi.org/10.1038/s43586-020-00009-8

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Advancing from 2D to 3D DNA Origami Structures

DNA origami has evolved from two-dimensional (2D) to three-dimensional (3D) structures inspired by paper origami's intricate transformations. Various strategies, including helix curling and immobile Holliday junctions have been employed to achieve solid 3D DNA origami structures. Two main approaches for constructing 3D structures involve controlled positioning of crossovers to create tubular and multi-layered architectures with adjustable rotational angles, yielding pleated surfaces and six-helix bundled tubular structures. Additional stabilization by connecting adjacent layers forms honeycomb lattices. More complex structures, like wireframe icosahedrons are achieved by perpendicularly joining these 3D units.

Design Software for DNA Origami Nanostructures

Rothemund's scaffold method in 2006 paved the way for 2D and 3D DNA structures. To simplify 3D scaffolded design, Douglas and team introduced CaDNAno in 2009, an open-source software package. It arranges cylindrical double-helices on honeycomb or square lattice layers, held together by crossovers and staple strands. However, CaDNAno has limitations in certain designs. In response, Adenita, introduced in 2020, enables diverse 3D structures, including tiles and wireframes using the Daedalus algorithm for sequence conversion. These tools democratize DNA origami design, making it accessible and user-friendly.

Bridging the Gap between Nanoscale Complexity and Real-World Applications

In the realm of nanoscience, achieving precise manipulation of objects at the nanometer scale presents a critical challenge. DNA origami initially attracted interest for producing distinctive shapes and objects through bottom-up self-assembly. However, it has subsequently developed far beyond being merely an interest or creative endeavour. DNA's built-in programmability enables the creation of adaptable nanoscale structures with real-world uses. These DNA origami structures have enormous potential in a variety of industries, including nanofabrication, medicine, and nano-computation in the next few years.

DNA Origami: Past, Present, and Future

Since its inception in the 1980s, DNA origami, led by Nadrian Seeman and colleagues, has undergone remarkable progress. Breakthroughs in immobile Holliday junctions and crossovers formed basic structural units. Advancements in single-stranded DNA scaffolds, tile-based methods and hybrid approaches followed suit. Software design packages like CaDNAno and Adenita further accelerated research accessibility. The field's future lies in refining techniques for higher replicability and commercial applications in medicine, optics and computing. Challenges remain in achieving higher yields for complex designs and understanding the folding process better. Nonetheless, DNA origami holds immense promise in advancing nanoscience and practical applications across diverse disciplines. Its profound impact on nanotechnology and scientific discovery is destined to shape the future.

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Application	Principle	Explanation
1. Molecular Robotics	DNA walkers can move along a linear track with the help of DNA fuel strands that provide energy for walking.	Machines perform motions like rotating and shuttling and various driving forces, strand displacement reactions, enzyme-catalyzed reactions, and base stacking.
2. DNA Origami Templated Architectures	Using simple DNA structures such as DNA duplexes or tiles, metal nanoparticles can be organized with precision.	The DNA origami structures are modified with nucleic acids, enabling them to hybridize with specific docking strands protruding from the DNA origami.
3. Biophysical Studies with DNA Origami	Attaching motor proteins to DNA nanotube cargos minimizes directional velocity when polarity is the same.	DNA origami-based single-molecule force spectroscopy allows researchers to probe the mechanical properties of individual biomolecules.
4. Drug Delivery	Targeted drug delivery enhances disease therapeutics by eliminating abnormal cells.	Nanostructures can deliver therapeutic agents like anticancer drugs, with DNA origami exhibiting innate resistance, proving stability and suitability for drug delivery applications.
5. Bioanalysis with DNA Origami	Combining DNA origami's addressability, shape customization, and ease of modification with advanced imaging techniques.	Biomolecular components are precisely arranged for distance-dependent interactions, aiding biosensing and diagnostic applications, revealing molecular interactions and structural dynamics.
6. Programming the Structure of Non-DNA Materials	DNA origami synthesizes shape-controlled inorganic materials like gold clusters and nanoparticles.	Programmable scaffolds guide non-DNA material assembly, enabling precise placement of various materials, resulting in multifunctional nanomaterials with tailored properties.
7. Top-down and Bottom-up Fabrications	Utilizes DNA origami to bridge different fabrication techniques like molecular lithography.	Top-down approaches involve lithographic techniques to create nanoscale structures, while bottom-up approaches rely on self-assembly of nanomaterials.
8. Self-Assembled Nanoreactors	Improve enzymatic coupling efficiency and maintain robust metabolic networks.	Enzymatic nanoreactors mimic the organization and functions of natural cellular compartments, enabling high efficiency and selectivity in catalytic reactions.
9. Self-Assembled Light Harvesting Systems	Efficient systems capture and transfer solar energy to a reaction center for chemical conversion.	Chromophores in DNA origami scaffolds optimize absorption and emission properties, making them promising for light-harvesting and energy conversion applications.

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Sailing the Nile of Medical Discovery: Reviving Egypt's Biotechnological Secrets

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A review unravelling the medical biotechnology of Ancient Egypt for modern times.

In the shadows of Egypt's grand pyramids and enigmatic sphinxes lies a profound secret: an advanced medical legacy woven into history's fabric. Amidst pharaohs and gods, the Nile's ancient civilization possessed a deep understanding of medical biotechnology – an intricate blend of natural compounds, rituals and empirical wisdom that shaped life and legacy. Today, standing at science's crossroads, these echoes of ancient mastery resonate anew, with relevance for our present and future. The Egyptians' medical biotechnology surpassed boundaries, embracing the physical, metaphysical, and divine realms.

Unveiling these ancient mysteries, we draw parallels with modern medical quests. In our age of gene editing, regenerative medicine and tailored treatments, ancient practices resonate. Might Egypt's revered compounds and techniques unlock novel healing paths? Could their instinctual biology guide us to unimagined breakthroughs?

This journey bridges eras, envisioning a future where Egypt's medical biotechnology finds renewed purpose. **Insights from Medical Papyri**

Numerous facts regarding ancient Egyptian medical practice are recorded in the medical papyri. The papyri go into great detail on the illnesses, how to detect them, and various treatments that were employed. Herbal cures, occasionally surgery, and even spells were among these treatments. A rich collection of over 40 papyri, originating from the Middle Kingdom spanning approximately 1800 to 300 BCE, provides vivid insights into the therapeutic practices of the time. The lion's share of our comprehension regarding traditional medical customs in ancient Egypt is derived from these venerable medical papyri. Among them are the illustrious Ebers, Edwin Smith, Kahun, Ramesseum, Brugsch, Hearst, Carlsberg, Leiden papyri, etc. each contributing to our understanding of this ancient healing art.

Diseases

Medical papyri contain numerous prescriptions for treating various urinary issues, such as hematuria, urine retention, infection and dropsy. Egyptian physicians were knowledgeable about cardiac ailments, encompassing arrhythmias, aneurysms, congestive heart failure, and venous insufficiency. The Edwin Smith and Ebers Papyri reveal insights into ancient Egyptian dental practices. Dental problems like caries, ulcers, extraction, pyorrhea, abscesses, inflammation, jawbone issues and dislocations were addressed. Remarkably, a 4th dynasty mummy displayed dental surgery evidence, featuring a golden wire joining two molars. A mummy's fused teeth indicated pre-mortem dental work, confirmed by

Professor Euler.

Early References to Diabetes and Cancer:

The Ebers Papyrus contains the earliest known mention of diabetes mellitus, describing " to eliminate urine which is too plentiful." This likely alluded to polyuria, associated with diabetes. Breast cancer received the first documented mention in the Edwin Smith Papyrus and was deemed untreatable. The Ebers Papyrus highlights various tumors like that of thyroid, pharynx, skin, stomach, rectum and uterus, often treated with cautery, knives or chemical pastes.

Therapeutics in traditional ancient Egyptian medicine

The ancient Egyptian medicinal repertoire encompassed a rich array of treatments, drawing upon a diverse spectrum of resources including minerals, metals, animals and plants. The realm of botanical remedies was notably extensive, with utilization extending to the entire plant or specific parts like fruits, leaves, juices, and roots. These botanical interventions spanned a wide spectrum of species, encompassing acacia, anise, barley, cassia, castor bean, coriander, cucumber, cumin, date, fennel, fig, mulberry, garlic, gourd, juniper, leek, lettuce, lotus, peas, poppy seeds, saffron, sunflower, styrax, terebinth, wheat, willow buds, white thistle and wormwood. These plants harboured a myriad of bioactive secondary compounds, representative of a diverse chemical repertoire, including saponins, diterpenes, sesquiterpenes, pyrones, isochromenes, flavonoids, isoflavonoids and alkaloids.

These botanical sources were harnessed for various therapeutic purposes. For instance, Acacia offered antimicrobial and anti-inflammatory properties, while anise was utilized for digestive ailments. Barley was valued for its diuretic and anti-inflammatory effects. Coriander served as a digestive aid and fig was employed as a laxative. Garlic exhibited antibacterial and antifungal attributes, while juniper was used for its diuretic and antiseptic qualities. Lettuce was applied as a sedative and poppy seeds were known for their analgesic properties. Saffron was prized for its antidepressant and antioxidant effects. Such diverse plant resources, with their rich chemical composition, contributed to the multifaceted healing practices of ancient Egyptian medicine.

Animal-Derived Drugs in Ancient Egyptian Medicine

Ancient medical papyri recommend diverse animal-sourced drugs, often employing fats and greases from various animals for both internal and external treatments, including ointment bases. Goose-fat, for instance, was utilized orally for pain relief and topically for relaxation. Various animal products were used, such as urine, eggs, faeces and milk, alongside structural components like blood, bone, meat, marrow, bile, liver, spleen and skin. Liver, particularly rich in vitamin A, was employed to counteract grey hair and treat night blindness. A broad spectrum of animals, from cows and geese to insects and crocodiles, contributed to these remedies. Different substances acted as carriers, notably bee's wax and honey. Bee's wax, frequently recommended, served as a binding material in ointments, while honey featured in numerous prescriptions for its curative properties. In the Hearst document, honey played a central role, functioning as an antitussive, anti-diarrhoeal, wound healer, antiseptic, tooth stabilizer and remedy for toothache. Additional vehicles encompassed beer, wine, milk and water,

further diversifying the therapeutic approaches of ancient Egyptian medicine.

Past, present and future

Fascinatingly, many ingredients utilized in ancient Egyptian remedies retain their medicinal relevance today, their bioactivities now verified through modern scientific methodologies. An illustrative case is Ammi majus fruit, endemic to Egypt, traditionally used for vitiligo treatment. The compound 8-methoxypsoralen, extracted from Ammi majus, has found contemporary application in treating psoriasis and vitiligo. Ziziphus spina, termed "nebes", appeared in 33 ancient Egyptian prescriptions predominantly for managing inflammation. Recent research identified gallocatechin and epigallocatechin as key compounds within Ziziphus spina, notably influencing the expression of 79 inflammation-related genes.

Furthermore, analytical techniques have unveiled the components of ancient Egyptian pharmaceuticals and cosmetics, encompassing lead chloride, cerussite, beeswax, mastic resin, pine resin, frankincense resin, castor oil, animal fat and starches. Contemporary revelations underscore honey's remarkable antimicrobial prowess, accompanied by its multifaceted wound-healing capacities involving six distinct mechanisms.

As we peer into the horizon of medicine's future, an extensive avenue of research emerges. Reevaluating documented remedies, authenticating their constituents and corroborating their biological effects stands as a compelling imperative. This journey holds promise for bridging ancient wisdom with contemporary science, fostering a deeper understanding of the enduring therapeutic potential embedded in historical medicinal practices.

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TO BEE OR NOT TO BEE: Are we saving the Right Bees?

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"To be successful, one has to be one of three bees - the queen bee, the hardest working bee, or the bee that does not fit in." - Suzy Kassem

In the realm of success, Suzy Kassem's analogy of the queen bee, the tireless worker and the misfit bee resonates deeply. Yet, just as the bee that does not conform often escapes immediate notice, wild and native bees might not claim the spotlight, but their vital role in nurturing the ecosystem hums with significance beyond the obvious buzz. Almost anyone who has heard of the phrase "Save the Bees" automatically relates this to saving honeybees. While honeybee conservation efforts are commendable, it is vital not to overlook the critical role of native bees, whose populations are experiencing a concerning decline. Native bees possess a unique and fascinating co-evolutionary relationship with specific plants, making them highly efficient and better pollinators than honeybees. This article aims to elucidate the invaluable contributions of native bees, emphasising the urgency of their conservation.

The unique relationship between native bees and

European Honey Bee (*Apis mellifera)*
[From: https://upload.wikimedia.org/wikipedia/commons/1/1d/European_honey_bee_extracts_nectar.jpg]

particular plant species lies in their finely tuned interactions, resulting from millions of years of co-evolution. Unlike honeybees, which are generalist pollinators, native bees exhibit a specialised and intimate connection with specific flowers.

For instance, the crucial pollination of apples relies on the native bee species, *Osmia cornuta,* rather than honeybees. Surprisingly, a mere 100 of these native bees can accomplish what tens of thousands of honeybees would be required to achieve.

It Is also interesting to note that in pollination trials, wild bees outperformed honeybees at pollinating cherry and rapeseed trees.

European Orchard Bee (*Osmia cornuta)*
[From: https://www.flickr.com/photos/54563451@N08/49750839513]

Other prime examples are the bumblebee and the blue banded bee (native to Australia), which are unique bees that play a pivotal role in pollinating tomatoes, potatoes and eggplants through a unique technique known as 'buzz pollination' or 'sonication'.

Left: *Blue banded bee (Amegilla cingulate)*
[From: https://photoku-photokita.blogspot.com/2011/10/blue-banded-bee-amegilla-cingulata.html]
Right: Bumblebee (*Bombus sp.*)
[From: https://www.pexels.com/photo/bumblebee-insect-macro-771558/]

In some plants, the anthers hold the pollen so tightly that it requires a little extra assistance to break free. This is where solitary bees like the blue-banded bee and the bumblebee come in handy. These bees will grab hold of the blossom and shake their entire bodies rapidly, causing the flower and its anthers to vibrate. The pollen is knocked out of the anther by this shaking motion, which the bee then collects.

Squash Bee (*Peponapis sp.*)
[From: https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/8605/files/2019/04/Squash-bee_Peponapis-sp._Susan-Ellis-Bugwood.org-1nz5em4.jpg]

This specialised vibration-based approach ensures efficient pollen dispersal, which honeybees cannot replicate. Another fascinating example is the squash bee, exclusive to squash plants and takes charge of pollination during the early hours when honeybees are still inactive. This is interesting to note since squash plants also open early in the morning.

Furthermore, wild bees continue to actively forage under conditions of low solar radiation and cold temperatures, which allows them to pollinate a variety of fruits even during extended cold and wet weather spells. Native bees, thus, emerge as the unsung heroes driving the pollination of 80% of the world's flowering plants and contributing to the success of 35% of

food crops.

Moreover, extensive use of honeybees can inadvertently cast a shadow over our lesser-known heroes - the native or wild pollinators.

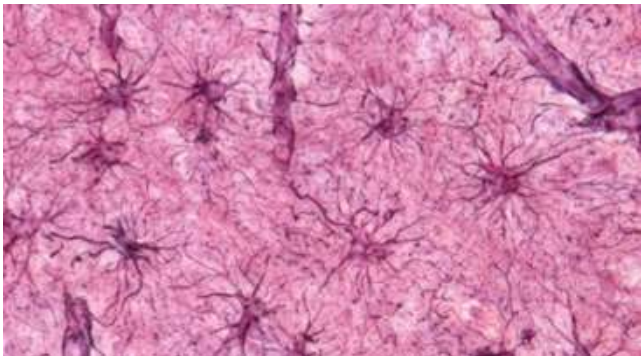
While honeybees are excellent at pollination, their intensive use in large-scale agriculture can create competition for resources with native pollinators. This can lead to a decline in native pollinator populations, affecting the delicate balance of ecosystems. Additionally, the foraging habits of honeybees might outcompete wild pollinators for nectar and pollen, leaving them with fewer food sources.

In addition, honeybees can transmit diseases to their native counterparts. The movement of managed honeybee colonies globally can spread pathogens that might negatively impact the health of native pollinators. This unintended consequence emphasises the intricate web of interactions within nature.

In our pursuit of agricultural productivity, it is crucial to recognise that a harmonious ecosystem relies on the diversity of its participants. While honeybees play a crucial role, a holistic approach that accommodates native pollinators is essential for the long-term health and sustainability of our environment.

The decline of native bees also carries dire consequences for global biodiversity and food security. With approximately 75-95% of flowering plants relying on pollination, native bees' dwindling populations threaten the delicate balance of ecosystems. Loss of plant diversity can disrupt the food chain, potentially leading to global food scarcity. Preserving native bee populations emerges as an urgent priority to safeguard the Earth's ecological equilibrium. Saving native bees can indirectly lead to increased ecosystem services in relation to food, medicine and pollination.

Given the solitary nature of most native bee species, traditional honeybee conservation approaches are often proven ineffective. Native bees construct small nests, cared for by single mothers, making mass conservation practices unfeasible. However, adopting specialised methods tailored to their needs offers hope for their preservation.



Left: Mason Bee *(Osmia lignaria)*
[From: https://www.deviantart.com/dalantech/art/Red-Mason-Bee-I-734822202]
Right: Leafcutter Bees (*Megachile sp.*)
[From: https://www.flickr.com/photos/jrxpo/5700094466/]

Mason and leafcutter bees and bumblebees showcase distinct nesting preferences, utilising hollow plant stems, beetle holes and underground burrows. Creating artificial nest boxes can attract native bees, providing them with suitable habitats. Additionally, strategically planting flowers in proximity to crops reduces the time native bees spend foraging, enabling them to rear more offspring and enhance pollination efficiency.

Furthermore, mitigating the impact of pesticides and insecticides becomes imperative in supporting native bee populations. Ecological restoration of agricultural lands can counteract habitat loss, fostering an environment conducive to the flourishing of wild bees.

The importance of native bees in maintaining the delicate balance of ecosystems cannot be overstated. As these exceptional pollinators face an alarming decline, concerted conservation efforts are the need of the hour. By understanding their unique co-evolutionary relationships and adopting tailored conservation strategies, we can ensure that these unsung heroes continue to thrive, preserving biodiversity and securing our global food supply for generations to come. Embracing the mission to safeguard native bees is, in essence, a promise to safeguard our planet's future. So, let us not just celebrate the honeybee but also ensure that our quest for sweetness does not disrupt the wild pollinator symphony.

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Revealing the Third Eye

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In our ancient Indian mythology, *Ajna* chakra is referred as the Third Eye. "Ajna" (literally means a command), the sixth chakra of our body, is present at the junction of our eyebrows. It is mentioned in *Shatchakranirupanam,* that the person who can properly understand the creation, destruction and preservation of the universe, who can realise his unity with the unique universal power, can control his *Ajna* chakra.

What are the chakras and their functions? Do they exist at all or is it an imaginary concept? Let us understand. Chakras are the energy junctions in our body. Our body energy gathers at those junctions and is circulated across the body through different pathways (which are mentioned as 'Nadis'). There are 114 chakras present in our body. Among them 7 are primary; Muladhara (root chakra), Svadhisthana (sacral chakra), Manipura (solar-plexus chakra), Anahata (heart chakra), Visuddha (throat chakra), Ajna (third eye chakra) and Sahasrara (crown chakra).

Every chakra has a certain number of petals and is assigned by different colours, eg. Ajna chakra has two petals (Ham and Ksham) and it is symbolized by deep indigo. Every Chakra has different spells to concentrate energy into it, eg. Enchanting "*Lam*" with proper meditational practice, the energy at muladhara is said to get activated (awakening of muladhara chakra). In *Shatchakranirupanam,* Chakra system has been discussed quite nicely. (*Ajna* chakra is elaborated in verse 32 to 38). Adi Sankaracharya in his book *Soundarya Lahiri,* described that these nadis are the energy channels of our body. Our life energy ('prana') flows through them. Three main nadis are known- Ida, Pingla, and Sushmna. He mentioned that, the 'prana' accumulates at the chakras and is redistributed among them through 360 pathways.

If we notice very carefully about the positions of the 7 chakras, almost all of them are in our hormonal glands. In fact, the pineal gland's location is the same as Ajna. This coincidence is quite a surprising fact. As per records, the first person to coin the term 'hormone' in 1905 was Ernest Starling. But the theory of the chakra system was stated centuries ago in *Vedas* (1500-1000 BC). This is indicative of the diversity of the vast knowledge which our ancestors possessed. It is unfortunate that a large portion of that knowledge is lost by different attacks (eg. repeated Turkish attacks), plunder of libraries (eg. Nalanda) and destruction of manuscript collections.

Context of the third eye is also mentioned in the Bible. ["The light of the body is the eye; if therefore thine eye be single, thy whole body shall be full of light" Matthew 6:22 (10)]. The Eye of Horus (sign of prosperity and protection) is mentioned in ancient Egyptian culture.

Let us see different historical prospects and opinions of different philosophers about the Third eye. According to Aristotle, the heart is

the centre of control, the soul is present outside the body and connects with the materialistic body. Later Hippocrates justified that the soul resides in the brain as the brain is the focal point of feeling and reasoning. Herophilus first gave the specific reference of pineal gland wherein he mentioned that the soul is present in '*kalamos*'. Galen described the pineal gland in his work '*De anatomicis administrationibus*'. He believed that the soul flows from the lungs to the heart and then to the brain in the form of air. The flow of air in the brain is controlled by the pineal gland. Later, Andreas Vesalius (1514—1564 AD), the father of modern anatomy and Descartes also proposed that the brain was the centre of the soul. Rene Descartes in his book *The Passion of Sole* described the pineal gland as the meeting place of the physical and spiritual worlds and mentioned that "*The body and spirit not only meet there, but each affects the other and the repercussion extends in both directions*."

After a lot of history and philosophy, let us talk about science, anatomy and functions of the pineal gland. Pineal gland is made of the pinealocyte which is derived from photoreceptive neurons. Other cell types present in pineal gland are the diverse groups of cells which include neuroglia, endothelial cells, and in some species, B lymphocytes. These pinealocytes retain several photopigments, but there is no evidence of photoreception in the pineal gland. So, the significance of these photopigments present in pinealocytes are still questionable.

The main function of pineal gland is to receive and convey information about the current day-night cycle from the environment and secrete melatonin (at dark period) according to that. When the environment is lightened, the SCN secretes gamma-amino butyric acid, which is responsible for the inhibition of the neurons that synapse in the paraventricular nucleus (PVN) of the hypothalamus, results signal to the pineal gland is interrupted and melatonin is not synthesized. On the other hand, when there is no light in the environment (darkness), the SCN secretes glutamate, responsible for the PVN transmission of the signal along the pathway to the pineal gland. Serotonin is first acetylated and then methylated to produce melatonin. Thus, the circadian cycle is maintained.

Pineal gland regulates our physicochemical rhythmicity. The pineal gland can control the activity of other glands, metabolism, sleep and locomotor activity. Pineal gland participates in CSF production and recycling. Reproductive system is also affected by pineal gland secretion, melatonin. Across most vertebrates', melatonin influences sexual development, hibernation, and seasonal breeding. Melatonin is anti-gonadotrophic (inhibits the secretion of gonadotropic hormone, luteinizing hormone, follicle stimulating hormone from anterior pituitary). High level of melatonin in children associated with late sexual development.

The size of pineal gland changes as with behavioural changes, habitats and environmental factors. It is seen that if the cold habitat is harsher, the pineal gland's size increases accordingly. Why moving the same species to a different environment causes a change in the size of their pineal gland is still unknown.

An intact and functional pineal gland is necessary for preserving physicochemical rhythmicity and optimal health. But this gland shows the highest calcification rate, with increasing age, among all organs and tissues in the human body. Blood

filtration rate in pineal gland is comparable to kidney, which is very much in excess of its metabolic requirement. It may help to produce CSF, although we do not have evidence for the same.

If we try to understand the evolutionary scenario of the pineal gland, we can see the vertebrate retina is composed of at least two types of evolutionary distant neuronal classes, the ciliary and rhabdomeric cells. These two types of cells are present in common ancestor deuterostomes and protostomes. A more detailed comparison of the cell-type homologies between the pineal and retinal neurons can be done after molecular level research of pineal-specific gene expression, developmental process and physiological functions.

At the end, let us see the most fascinating part of the pineal gland - the secretion of N,N-dimethyltryptamine. It is basically a hallucinating drug generally found in plants. Ongoing research shows that a high level of DMT leads to the near death of mice. Many researchers claimed that a 'near death experience' can be experienced by DMT. There is a high chance that this very phenomenon has been stated as *"Samadhi"* (near death state achieved by meditation) by ancient spiritual practitioners. Study about the evolution of pineal gland, mystery behind highest calcification rate and the function of DMT might help us to connect the scientific aspect of this subject considering the other philosophical, cultural and psychological perspectives.

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Kombucha: A Boon to the Future!

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Introduction

Have you ever heard of something which is like a health potion and at the same time flabbergasts mankind with its exceptional properties? If not, then prepare to delve into the captivating realm of kombucha, a magic through the microbial symphony, where science and fascination entwine in each effervescent sip! This fermented tea elixir owes its distinctive taste and potential health benefits to an enthralling interaction among microorganisms. At its core lies the **Symbiotic Culture of Bacteria and Yeast (SCOBY)**, a dynamic consortium of beneficial bacteria and yeast strains. During fermentation, the SCOBY orchestrates a sequence of metabolic events. The yeast initiates anaerobic respiration, converting sugars into ethanol, the acetic acid bacteria diligently convert ethanol into acetic acid, yielding kombucha's tangy-fizzy flavour, and the probiotic-rich content enhances gut health. Kombucha has its historical roots and origin in Japan. GT's Living Foods popularized commercial kombucha in 1995, offering original and flavor-added variations. Kombucha is scientifically recognized for its antioxidant, antimicrobial, anti-inflammatory and anti-aging properties, benefiting the immune system and possibly preventing diseases like diabetes and

cardiovascular issues as well as neurodegenerative diseases.

Shotgun metagenomics has been utilized to assess the prevalence of **acetic acid bacteria (AAB)** and **lactic acid bacteria (LAB)** in nine

Figure 1: The production process of kombucha beverages (modified from Jayabalan et al.; Kaewkod et al.; Jakubczyk et al).

kombucha products. AAB-dominant kombucha showed a high prevalence of ***Komagataeibacter*** species, while LAB-dominant kombucha was primarily represented by ***Bacillus coagulans*** and ***Lactobacillus nagelii.*** Notably, LAB- dominant kombucha exclusively harbors specific fatty acid and beta-oxidation pathways. Both acetic acid bacteria (AAB) and lactic acid bacteria (LAB) actively contribute to the synthesis of beneficial substances and bioactive compounds that promote digestion, protect against infections and possess immunomodulatory properties. With the dominant presence of ***Komagataeibacter*** species and ***Zygosaccharomyces bailii*** throughout all phases, these microorganisms exhibited fascinating functional properties, such as vitamin production, tolerance to acidic pH and antimicrobials production. Additionally, the ***Zygosaccharomyces bailii*** genome contained the ZbHAA1 gene, providing high tolerance to acetic acid and copper stress. The energetic interactions within the Kombucha microbial community hints at potential metabolic cross-talks between the dominant species that shape its unique health-enhancing properties. **Kombucha bacterial cellulose (KBC)** holds promise as a valuable resource for safeguarding ***Lactobacillus plantarum*** TISTR 541 cells in simulated gastrointestinal conditions, improving their viability and facilitating their effective delivery as probiotics. In addition, Kombucha-derived bacterial cellulose (KBC) sourced from black tea, waste and cane sugar underwent modification by incorporating different silanes, including **dimethyldichlorosilane, hexadecyltrimethoxysilane, vinyltriethoxysilane** and **3-aminopropyltriethoxysilane**, to enhance its hydrophobic properties. These treated KBC samples were then combined with **polyurethane (PU)** and **polylactic acid (PLA)**. The optimized bio composites, comprising 13.74% w/w KBC, 73.89% w/w PU, and 12.50% w/w PLA exhibited excellent elasticity, hydrophobic surface and moderate biodegradability.

It shows great potential as a sustainable substitute for leather in various industries, including fashion, textiles and automotive interior coverings. These

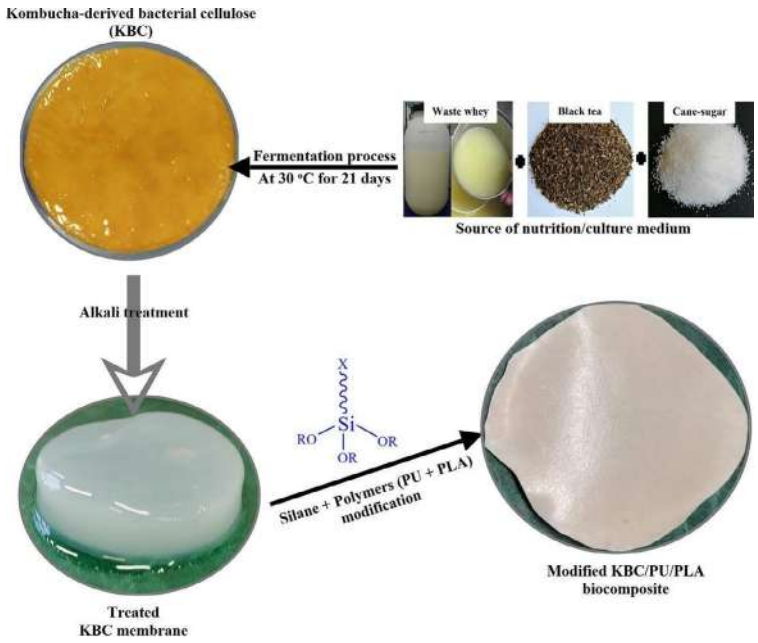

Figure 2: Modification of KBC with silane and polymers. (H.T. Nguyen et al.)

cellulose-based mats also boast of sustainability, biocompatibility and breathability, ideal for athletic wearables. Seamless integration of sensors and electronics further enhances their appeal for wearable technology. Despite resilience to tearing and water immersion, kombucha mats are vulnerable to open flames. Embracing the science behind kombucha mats opens the door to sustainable and biocompatible wearable materials, revolutionizing the future of industrial technology.

On a greener side, research demonstrates that the spraying treatment of liquid organic fertilizer containing kombucha fermentation waste of butterfly pea flowers significantly affects the growth parameters of mustard plants. The findings reveal that a concentration of 5 mL/L of the liquid organic fertilizer effectively increases plant height, number of leaves as well as wet and dry weights of the mustard plants highlighting the potential of biotechnological fermentation waste **Kombucha Bunga Telang (Butterfly Pea Flower Kombucha)** as a valuable liquid fertilizer for enhancing plant growth.

In the domain of medicine, research delves into the hangover-relieving capabilities of **Ginseng Berry Kombucha (GBK).** It is really fascinating to see how a tea can reach heights in various fields of technology through its bewildering prospects and applications. GBK is fermented using ***Saccharomyces cerevisiae*** and ***Gluconobacter oxydans***. Both in vitro and in vivo models are utilized to investigate its effects. Using human liver HepG2 cells treated with ethanol, the study evaluated the antioxidant activity of GBK and its impact on oxidative stress. Additionally, ethanol-treated male ICR mice underwent biochemical and behavioural analyses to confirm the anti-hangover effects of GBK. In HepG2 cells exposed to ethanol-induced oxidative stress, GBK significantly boosted antioxidant enzyme expression via the Nrf2/Keap1 pathway. It also reduced blood ethanol and acetaldehyde concentrations in ethanol-treated mice and increased alcohol-metabolizing enzymes. The use of natural extracts like GBK holds promise in developing functional hangover-relieving drinks. The bioconversion of major ginsenosides to minor ones adds to its potential in combating alcohol-induced liver damage.

Kombucha has extensive historical and anecdotal evidence of health benefits, but controlled human trials are lacking. However, study showed kombucha normalized blood glucose in non–insulin-dependent diabetes mellitus subjects. Animal trials indicate kombucha reduces blood glucose, improves lipid profiles, and supports pancreatic, renal, and liver function. Research findings indicate that when a practical and standard portion of kombucha is consumed alongside a high glycaemic index rice-based meal, it substantially reduces post-meal blood sugar levels and insulin response in healthy adults. Another research aims to develop an effective Turmeric Kombucha Facial Toner that can inhibit ***Propionibacterium acnes*** bacteria.

Still, the major challenge lies in optimal purification of the fermented elixir to devour the ripped benefits - characterization of microfiltration and ultrafiltration membranes has potential application in kombucha filtration. The hydraulic permeability and kombucha permeate flux of the membranes were evaluated. Ultrafiltration membranes showed more stable and coherent characteristics compared to microfiltration. Membrane filtration offers a promising method for

clarifying and stabilizing kombucha, eliminating the need for energy- intensive centrifugation and filtration processes, making it cost-effective and sustainable.

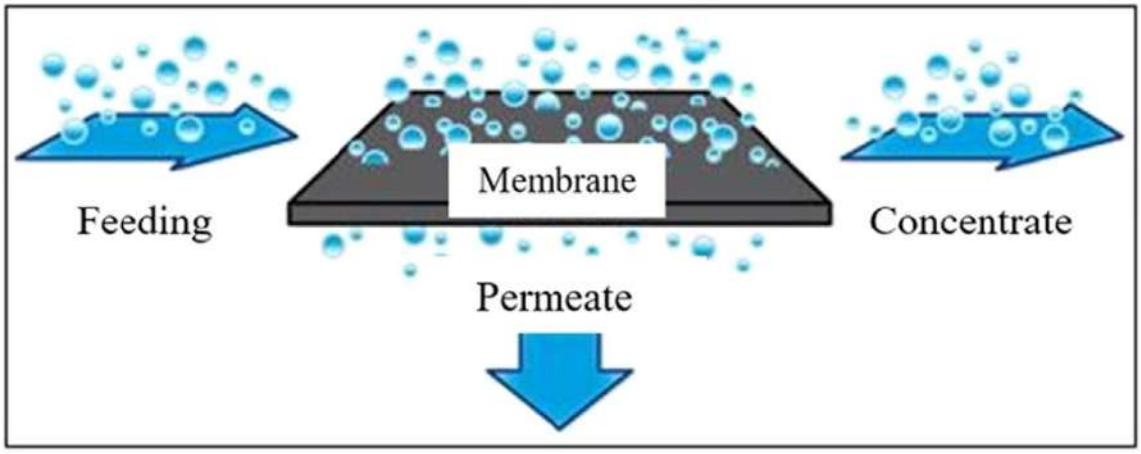

Figure 3: Illustrative demonstration of an MSP. (Júlia Daneluz, G. Ferreira da Silva, J. Duarte et al.)

Conclusion

It is really fascinating to see how a tea can reach heights in various fields of technology through its bewildering prospects and applications. However, further research is needed and is currently undergoing to explore kombucha's mechanisms and potential therapeutic benefits. With proper experimentation Kombucha can soon become a boon to the world.

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Nanotechnology: Breaking Barriers in Cancer Therapy

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Nanotechnology has emerged as a promising area of research in drug delivery and cancer therapy. Researchers have developed innovative approaches for targeted drug delivery and enhanced therapeutic efficacy by utilizing nanoparticles and nanoscale materials. This article explores the applications of nanotechnology, highlighting the potential benefits and challenges associated with this rapidly evolving field.

Nanoparticles

Nanoparticles (NPs) are defined as small objects that act as a whole unit in terms of their transport and activities. They are further classified according to their size and girth. Fine granules range from 100-2500 nm and ultrafine ones are of sizes between 1-100 nm. NPs like lipids or polymers can be designed to ameliorate the pharmacological and therapeutic properties of medicines. Cells take up these NPs because of their size and the capability of the drug to enter the cell cytoplasm through the cell membrane. NPs have a veritably high surface area to volume proportion, allowing numerous functional groups to be attached to them, which can bind to specific tumour cells. The smaller size of the NPs facilitates them to accumulate in an excrescence medium, easing newer remedial strategies that may replace radiation and chemotherapy.

Coating the surface of nanoparticles is essential for their stability and for improving the circulation time of their delivery system. For illustration, a sodium citrate-stabilized gold granule accumulates in phosphate-buffered saline (PBS) within several minutes, but once overlaid with thiol-terminated polyethylene glycol (PEG) polymer, it provides stability in PBS under different pH conditions. Neutral-charged NPs display longer circulation time and reduce the chance of being captured by the immune system.

Nanoparticles for targeted drug delivery

The critical technological advantages of NPs used as medicine carriers are high stability, high carrying capacity, the feasibility of objectification of hydrophilic and hydrophobic substances and the feasibility of variable routes of administration, including oral operation and inhalation. NPs can also be designed to allow controlled, sustained medicine release from the matrix. These characteristics will enhance the medicament bioavailability, reduce dosing frequency and prevent nonadherence to specified remedies.

Different nanoparticles used in drug delivery:

Liposomes:

- Liposomes are spherical vesicles composed of lipid bilayers that can encapsulate drugs.
- They can be modified to target specific cells or tissues, improving drug delivery efficiency.

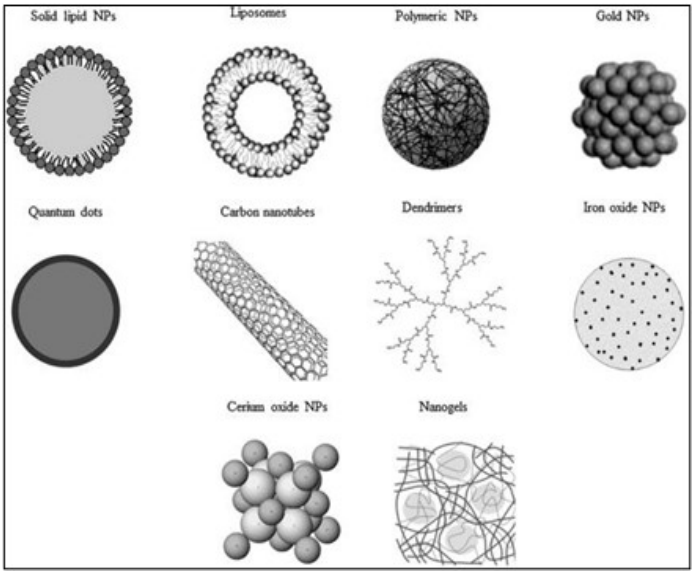

Fig: Different types of Nanoparticles
Reference: https://www.sciencedirect.com/book/9780128228913/nanomaterials-for-soil-remediation

- Liposomes can protect drugs from degradation and enhance their bioavailability.

Polymeric nanoparticles:

- Polymeric nanoparticles are made from biocompatible polymers and can encapsulate a wide range of drugs.
- They can be engineered to release drugs in a controlled manner, improving therapeutic outcomes.
- Polymeric nanoparticles can also be functionalized to target specific cells or tissues.

Dendrimers:

- Dendrimers are highly branched macromolecules that can encapsulate drugs within their interior.
- They have a well-defined structure and can be modified to enhance drug loading and release.

Dendrimers can also be functionalized by targeting ligands for specific cell recognition

Nanotechnology-based cancer therapy

Radio-labeled NPs tagged with radionuclides and fluorescent NPs like organic dye-doped NPs, Quantum dots and multi-function NPs can be combined with several functional particles, which are new diagnostic tools in cancer therapy. Nanoparticle-grounded drug delivery systems reduce the inherent distribution and associated after-effects typically seen with conventional chemotherapeutic molecules. Various molecules like organic dye, doped polymer, liposomes, and quantum dots find use in cancer diagnosis and treatment.

Photothermal therapy:

- Photothermal therapy utilizes nanoparticles that can convert light energy into heat.
- These nanoparticles can be selectively accumulated in tumour tissues and then irradiated with laser light.
- The heat the nanoparticles generate can destroy cancer cells while sparing the healthy ones.

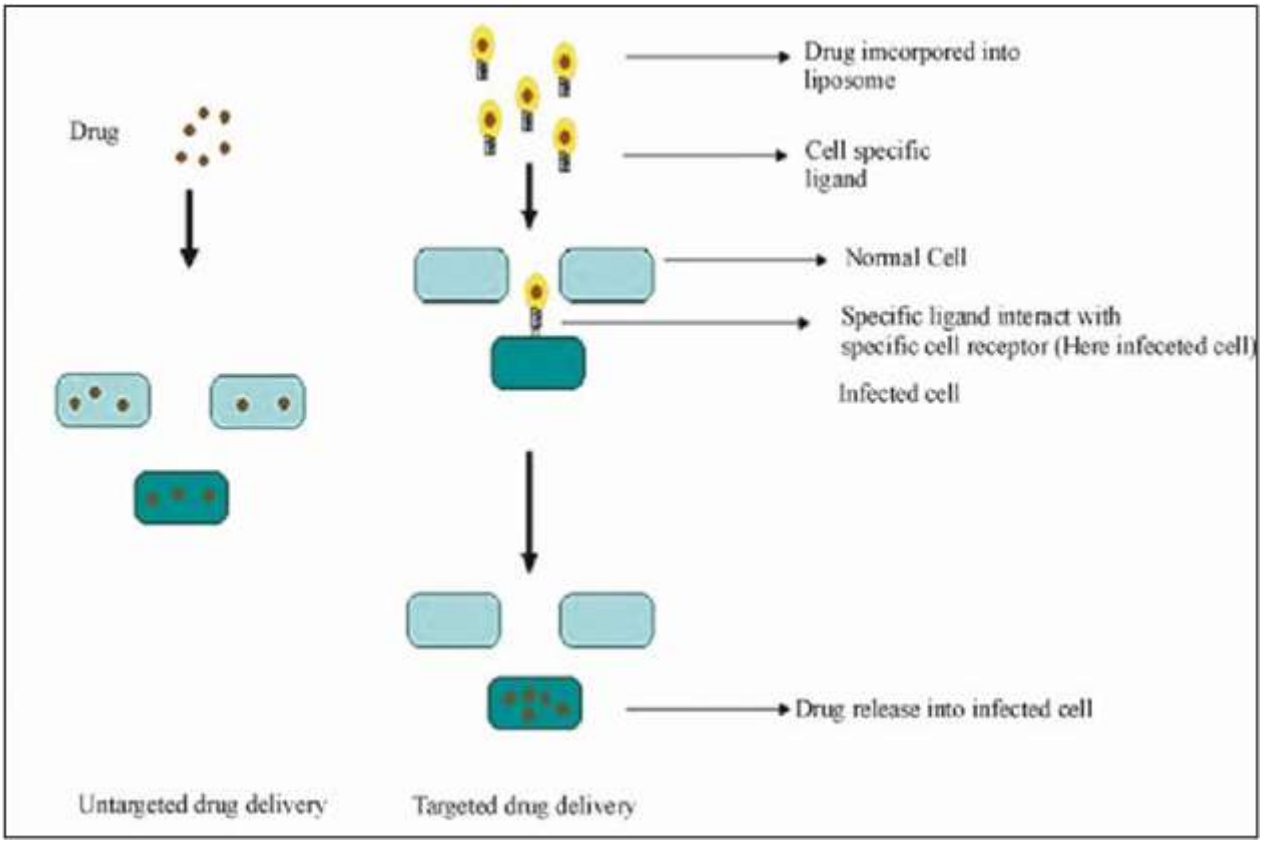

Fig: Drug delivery using Nanotechnology
Reference: Prabhu, Vinod & Siddikuzzaman, Dr & Grace, Berlin & Guruvayoorappan, Chandrasekharan. (2011). Nanoparticles in Drug Delivery and Cancer Therapy: The Giant Rats Tail. Journal of Cancer Therapy, 2011, 2, 325-334. 2. 325-334. 10.4236/jct.2011.23045.

Drug-loaded nanoparticles:

- Nanoparticles can be loaded with chemotherapeutic drugs to improve their efficacy and reduce side effects.
- These drug-loaded nanoparticles can selectively accumulate in tumour tissues, enhancing drug delivery to cancer cells.
- Controlled release of drugs from nanoparticles can also prolong their therapeutic effects.

Gene therapy:

- Therapeutic genes can be delivered to cancer cells using nanoparticles.
- These genes can inhibit tumour growth, induce apoptosis, or enhance the immune response against cancer.
- Nanoparticles protect therapeutic genes from degradation and facilitate their uptake by cancer cells.

Challenges and future perspectives

Despite the promising applications of nanotechnology in drug delivery and cancer therapy, there are several challenges that researchers have yet to address. The safety and toxicity of nanoparticles need a thorough evaluation. The scalability and cost-effectiveness of nanotechnology-based therapies need to be improved. Further research is needed to optimize the design and functionality of nanoparticles for specific applications.

Conclusion

Nanotechnology holds great potential in revolutionizing drug delivery and cancer therapy. Using nanoparticles, researchers can enhance drug efficacy, improve targeted delivery, and reduce side effects. However, further research and development are required to overcome the challenges associated with this field and translate nanotechnology-based therapies into clinical practice.

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Biomimicry: Nature's Blueprint Guiding Tissue Engineering Advances

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Tissue engineering is a multidisciplinary approach aimed at restoring lost or damaged segments of tissues. This innovative field integrates insights and methodologies from diverse areas such as biology and engineering, with the ultimate goal of fabricating fully operational tissue structures and even organs. These bioengineered organs hold the potential to address the critical shortage of donor organs available for transplantation, offering new avenues to improve the quality of life for many individuals in need. Some of the common areas where tissue engineering can be applied are injury to tendons and in cases of degenerative bone conditions.

Tissues such as tendons exhibit limited natural healing abilities when compared to other types of tissue. This is primarily due to their relatively lower blood supply, which hinders the effective delivery of essential nutrients to these areas. Consequently the healing process for tendons tends to be slower and less efficient. Scar tissue formation can occur, but the resulting tissue lacks the same level of strength and elasticity as the original tendon. The disorganized growth of tissue often occurs due to inadequate peritendinous adhesion. However, the promising field of tissue engineering holds the potential to significantly enhance the healing prospects for these types of tissues.

Bones, in general, possess a remarkable ability to naturally heal themselves. However, certain degenerative conditions linked to aging or severe traumatic incidents may necessitate grafts to restore a person's normal functionality. Among the different types of grafts, autografts are the most common, involving the replacement of the affected area with a bone sourced from the patient's own body. There are also other types like allografts entailing utilizing tissue of a donor and xenografts involving tissue from an entirely distinct species.

Biomimicry as a technique when applied on tissue engineering processes can go a long way towards addressing healthcare problems like these. Biomimicry in tissue engineering refers to the practice of emulating and adapting nature's design principles, processes and structures to create innovative biomaterials, scaffolds, and constructs for the regeneration and repair of damaged or diseased tissues. Biomimetic materials stand as the vanguard of the future in tissue engineering. These innovative substances are meticulously crafted to form structures called scaffolds to emulate the intricate 3-D structure of the extracellular matrix (ECM) present in various tissues, thereby replicating their essential characteristics.

At the forefront of biomimicry lies the crucial process of creating a well-constructed biomimetic scaffold. A Scaffold acts as the structural and physical framework which mimics the properties

of ECM (extracellular matrix). These scaffolds can be fashioned from either natural or synthetic polymers, offering versatility in their design. The scaffolds themselves may take the form of monolayered or bilayered configurations, providing options to suit specific tissue engineering needs.

For a scaffold to be deemed suitable for application in tissue engineering, it must possess certain pivotal properties. These in general include attributes that foster cell attachment, growth and proliferation, while at the same time offering appropriate mechanical support. Additionally, the scaffold should be biocompatible and biodegradable, enabling it to gradually integrate into the newly forming tissue as it heals and regenerates.

A scaffold must show the following features:

(i) These intricately designed cutting-edge substances should replicate the complex architecture and composition of the extracellular matrix (ECM) found in various tissues, effectively mirroring their fundamental properties.

(ii) Biomimetic scaffolds are customized for specific tissue types, such as bone, cartilage, skin, nerves and more considering physical and chemical properties like porosity, density etc. of the tissues to be engineered.

(iii) It should provide structural support, providing an environment for cell adherence, proliferation and differentiation thereby enhancing tissue regeneration. Cell adherence creates the initial foundation for tissue regeneration within an engineered construct.

(iv) It should be resistant to any type of infection. It must not cause any adverse inflammatory reactions in the body of the recipient.

(v) Scaffolds must be able to withstand any kind of mechanical damage. It should fit into tissue space properly without changing its shape. Breaking during or after the procedure should not take place.

(vi) Guided degradation in sync with the commencement of tissue regeneration stands as a cornerstone of biomimetic scaffold functionality. PEG (Polyethylene Glycol) based biomaterial engineered to degrade in response to matrix metalloprotease is a sophisticated strategy for designing biomaterials. These scaffolds naturally undergo controlled degradation over time. This process closely mirrors the body's inherent healing mechanisms, aligning with tissue vascularization and the gradual deposition of new extracellular matrix (ECM) components. The breakdown of the scaffold yields shorter fragments (monomers), which are subsequently excreted from the body. This eliminates the need for any supplementary removal surgery, making the entire procedure not only effective but also economically viable. This aspect contributes significantly to its cost-effectiveness, enhancing the overall appeal of this advanced tissue engineering approach.

(vii) Scaffolds play a crucial role in tissue engineering by acting as carriers for growth factors, cytokines, peptides and other signaling molecules. This strategic incorporation of bioactive elements serves to orchestrate and finely regulate essential processes such as cell-cell and cell-matrix interactions. These interactions are pivotal in governing the migration of cells, ensuring their proper alignment and ultimately facilitating the optimal formation of functional tissue structures.

The evolution of tissue engineering has paved the way for transformative medical solutions, ranging from personalized organ constructs to targeted drug delivery systems. By harnessing the power of tissue engineering through biomimicry we

embark on a journey towards a future where the restoration of health and vitality becomes not only a possibility but a tangible reality for patients worldwide.

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Immunotherapy– a comprehensive discussion

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Immunotherapy does not use a scalpel, a radiation beam or a drug- external forces on the body. Rather, it attempts to modify a person's own immune system to fight the cancer
– Dr. Steven Rosenberg.

Immunotherapy

Immunotherapy, also known as biological therapy, refers to the treatment of disease either by stimulating or suppressing the host's immune system, both to vanquish the causative agents of the disease. Meticulous and scrupulous research and thorough experimentation over the past few years have led to exponential advancement in immunotherapy. One of the principal goals of immunotherapy is to significantly minimise the scope for exacerbation or aggravation of the disease and prevent the rampancy and pervasiveness of causative agents of the disease (Conforti, 2012; Wang et al., 2019). Immunotherapies can be classified into two categories- activation immunotherapies and suppression immunotherapies. Activation immunotherapies engender or augment an immune response, while suppression immunotherapies repress an immune response. Rigorous investigations have explored prospective immunotherapy applications in the treatment of various forms of cancer. Studies have shown the effectiveness of cell-based immunotherapies in treating some cancers.

The atypical antigens expressed on the surface of tumour cells are aimed by a repertoire of immune effector cells like lymphocytes, macrophages, dendritic cells, natural killer cells, and cytotoxic T lymphocytes and collaboration between these effector cells helps our body to defend against cancer. Vaccines that induce immunity to COVID-19 generally develop immunomodulatory T lymphocyte response (Geers et al., 2021). Numerous immunologically important molecules like granulocyte colony-stimulating factor (G-CSF), interferons, imiquimod and components fractionated from bacterial cellular membranes are entitled to therapeutic and pharmaceutical administration. Research, substantiated by computational knowledge, has also demonstrated the involvement of interleukins (IL-2, IL-7, IL-12), various chemokines, synthetic cytosine phosphate-guanosine (CpG) oligo-deoxynucleotides and glucans in medical uses. Autologous immune enhancement therapy employs and manipulates an individual's intrinsic peripheral blood-derived natural killer cells, cytotoxic T lymphocytes, epithelial cells and other significant immune cells

to treat diseases like Hepatitis C, Chronic fatigue syndrome and Human Herpesvirus 6 infection. This therapy encompasses in vitro expansion followed by re-infusion of the immune cells to the person's body to combat diseases. Among the advantages of immune suppression, one of the most prominent is that it diminishes an unusual immune response, especially in autoimmune diseases or curtails an anticipated normal immune response to avert forbiddance of transplantation of organs or agglomeration of cells. It is possible to suppress the immune responses to manage organ transplantation or autoimmune diseases using several immunosuppressive drugs. The immune responses in our body rely on the systematic multiplication and burgeoning of lymphocytes. There are a multitude of immunosuppressive drugs like glucocorticoids, inhibitors, cytostatic drugs and immunosuppressive antibodies which influence the immune system. Preclinical examinations elucidate the extraordinary competence of minuscule immunosuppressive molecules like Dexamethasone, Calciferol and Curcumin in obviating chronic inflammation upon subcutaneous administration in low doses (Ospina-Quintero et al., 2020; Tabares-Guevara et al., 2021). Immunotherapy is also very propitious in allergy treatments. Conventional allergy treatments, like corticosteroids or antihistamines, remediate allergic manifestations, whereas immunotherapy can lower the susceptibility and responsiveness of our immune system towards allergens, moderating and minimising the intensity. Immunotherapy may give rise to long-term advantages and can benefit people who are immensely allergic. It can also be advantageous for people who are sensitive to specific allergens and cannot avoid them.

Various kinds of prominent immunotherapies

An optimistic technique in the remediation of food allergies is oral immunotherapy (OIT). OIT prepares people for fortuitous exposure to a certain allergen and prevents the elicitation of immune reactions. This is accomplished by exposing the person cautiously to progressively increasing amounts of the allergen in tolerable doses, eventually leading to desensitisation. This approach has been trialled on babies to prevent peanut allergies. Our immune system does not attack or affect our body tissues. Studies emphasise that CD4+ T cells are associated with autoimmune response. B lymphocytes and other immune cells are synchronously released to harmoniously act upon the problematic tissue once the T lymphocyte tolerance is lost. Therefore, the quintessential tolerogenic therapy targets clones of specific T lymphocytes responsible for organising autoimmune attacks. Immune tolerance therapies help the immune system to discriminate foreign substances from the own organs and tissues of the body in autoimmune disorders (Rotrosen et al., 2002). Such therapies also ensure that our body accepts foreign tissue during transplantation, drastically minimising immune response. Among the recent advancements in immunotherapy, a prominent approach is the infusion of regulatory immune cells into patients with organ transplant(s). These regulatory immune cells can hinder the effector cells' activity. Numerous studies have suggested that immune tolerance therapies

either considerably decrease or end the need for immunosuppressive drugs throughout one's life and also eliminate the health risks and side effects of immunosuppression. Such therapies are examined and approved for organ transplantation, type 1 diabetes and autoimmune diseases.

Cancer immunotherapy

Cancer immunotherapy, also known as immuno-oncology, is the regulation of the immune system for cancer treatment- enhancing and strengthening the inherent spontaneous ability of the immune system to fight the disease. This field of research is gaining importance as instances of cancer continue to become more common. Cancer immunotherapy is based on the fact that cancer cells can be characterised and differentiated from normal cells by their abnormal properties. The tumour antigens present on the surface of the cancer cells are identified by specific antibodies which bind to them and eventually kill them or restrict them from rampant proliferation. Such antibodies are distinguishable from normal antibodies as they are modified using immunotherapy and are more efficacious in annihilating cancer cells. Although cancer immunotherapy is effective in obliterating cells with tumorigenic tendencies, there are several examples where it was successful only for specific subtypes of gastric cancer and not for others. Hence, to increase the efficiency of cancer treatment, a combination of immunotherapy and traditional cancer treatment methods like chemotherapy, radiation therapy or surgery is used (Syn et al., 2017). There are numerous ways to treat cancer using immunotherapy, like applications of vaccines, monoclonal antibodies and a multitude of immune cells. Other immunotherapy classes- topical and injection- are also emerging as splendid approaches for treating warts. Adoptive cell transfer has been tested on lung cancer and other cancers, with the best success in melanoma (Kang et al., 2009). Cancer immunotherapy research continues searching for the best solution to alleviate the disease that has traumatised humankind for years.

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Algal Biofuel – A Sustainable And Carbon Neutral Alternative To Fossil Fuels

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As the world continues to face the challenges of depleting fossil fuel reserves and increasing greenhouse gas emissions, the search for sustainable and green energy sources has become imperative. Most of the fuels come from non-renewable sources; once used they are gone forever. The expected rise in the world population to approximately 10 billion by 2050 will result in substantial rise in energy consumption. This increasing demand of fossil fuels is the root cause for the rise in greenhouse gases in the atmosphere, leading to climate change. Under such circumstances it is crucial to adopt the concept of "biofuel"- to combat climate change, to respond to the growing demand and to make our future secure.

Defined broadly, biofuels are fuels derived from biomass – any matter derived from organic remains of plants and animals. Algae are a promising renewable feedstock for biofuel production with the potential to serve as an alternative to petroleum based transportation fuel. Microalgae harboring genetically engineered lipid biosynthesis genes are more suitable to be used as a biodiesel feedstock. Microalgae, which are photosynthetic, can convert sunlight, carbon dioxide and other nutrients into lipids which can then be converted into lipid transportation fuels. 25-75% of dry body weights of microalgae like *Botryococcus braunii* or *Schizochytrium* sp. are made of these long chain hydrocarbon oils called triterpenes. This hydrocarbon can chemically be converted into fuels. *B. braunii* is a colonial algae that creates a bio-film of hydrocarbon oils which holds the individual bodies of the organism together. *B. braunii* stores these hydrocarbons in the extracellular space in contrast to other oleaginous microalgae which accumulate lipids in the cytoplasm. The fact that microalgae have more than 50% lipid content is one of the key reasons why they have been such a topic of interest for people who want to develop biofuels in recent years!

Compared with conventional biofuels, biofuels produced from microalgae have several advantages which include high productivity, the ability to use non-arable land for microalgal cultivation and the possibility to use waste water as a source of nutrients to promote growth. It is interesting that microalgae are most efficient in performing photosynthesis other than terrestrial plants. They have a high biomass conversion rate and can produce 30 times more oil per unit space on average. Consequently, microalgal biomass can be harvested more than once a year. Irrespective of having so many bright sides, the commercialization of biofuel from microalgae is still in its early gestation and has to face a lot of

challenges to achieve cost competitive fuels.

The large-scale production of biofuel from microalgae biomass is generally performed with solar energy in open ponds or in photo-bioreactors or fermentors. The microalgae biomass can then be harvested by centrifugation, filtration or by electrophoresis techniques. Now in order to produce biodiesel from microalgae, it is crucial to extract the lipid component properly. There are a few ways to extract the lipid from microalgae, like the Oil Press Method which can extract up to 75% lipid from the algal biomass and the Hexane Solvent Method which extracts up to 95% lipid from microalgae. First, the lipid is squeezed out by pressing the algal biomass and then the remnants of the algal biomass is mixed with hexane - filtered and cleaned so that there is no chemical left in the lipid. There is another effective method of extraction of oil from microalgae, called the Supercritical Fluids Method. It is advantageous in the way that it is not toxic, easy to recover, usable at low temperatures and extracts almost 100% lipid from microalgae. However, this method is expensive and demands a lot of energy to reach high pressures. Using optimum temperature of $60^{o}C$ and pressure of 30 MPa, it was observed that *Chlorococcum* sp microalgae yield more lipids with supercritical CO_2 than hexane solvent method.

Once the oil is extracted, it is refined in a process called Trans-esterification. A catalyst and an alcohol are added to a blend of micro algal lipids. Several factors like alcohol - lipid ratio, catalyst types, temperature, time etc. determine the yield of trans-esterification reaction. Finally, microalgal biodiesel and its byproducts must be separated to increase its production. This can be done using hot water or any organic solvents like hexane. The main byproducts can be glycerol, untreated lipids, alcohol etc. Advancements in conversion technologies, including lipid trans-esterification and hydrothermal liquefaction have enabled the production of biodiesel.

Despite the promising potential of algal biofuel, certain barriers hinder its large-scale implementation. Problems related to land use, water availability, nutrient supply and waste management need to be addressed. Furthermore economic constraints such as high production costs and competition with fossil fuel industries pose significant obstacles. Further research and technological advancements are required for its wide scale implementation. Collaboration with academic institutions, industries and government is essential to overcome the aforesaid obstacles and exploit the full potential of algal biofuel as a renewable energy source.

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The Fault in our Stars: Astrocytes and neural diseases

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Neurons make up only a part of what we consider the neuronal circuitry of the body. A large volume (as much as 50% or more) is made up of glial cells, which do not conduct the nerve impulses. Rudolf Virchow observed glial cells and called them "nervenkitt" or nerve glue, implying a homogenous population of support cells with a mostly passive role. However, modern research seems to indicate that these glial cells are involved in a variety of functions, homeostasis, phagocytosis, myelin formation, neurotransmitter uptake and formation of the

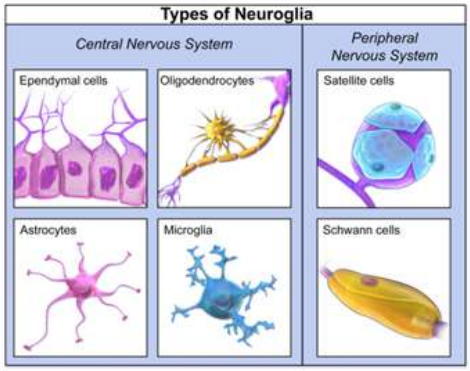

Figure 1: *WikiJournal of Medicine* (2023b). https://doi.org/10.15347/wjm

In the central nervous system, glial cells include oligodendrocytes, astrocytes, ependymal cells and microglia, and in the peripheral nervous system they include the Schwann cells and satellite cells, as shown in Figure 1.

Astrocytes, which literally mean 'star shaped cells' are the most abundant type of glial cell in the CNS. Astrocytes are electrically linked, with gap junctions between cells which allow messenger molecule IP3 to diffuse from one cell to the next - creating a syncytium which allows distant astrocytes to communicate. Modern day research indicates that these astrocytes seem to be vitally linked to the neuron. Dysfunction of astrocytes seems to be correlated with depression and many neurological disorders.

At the chemical synapse, the presynaptic membrane, postsynaptic membrane and the surrounding glial cells are in close proximity - this gives rise to functional integration . The term 'Tripartite synapse' was first introduced in the 1990s to account for a growing body of evidence that glial cells are not only involved in passive transport but they also have a functional relation with the neuron. The neuron, glial cell

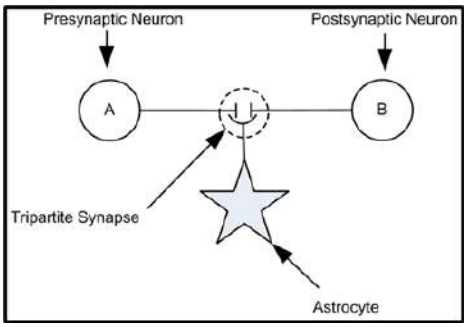

Figure 2: A cartoon depicting tripartite relationship between a neuron and astrocyte
Reference: Wade, J., McDaid, L., Harkin, J., Crunelli, V., & Kelso, J. a. S. (2011b). Bidirectional Coupling between Astrocytes and Neurons Mediates Learning and Dynamic Coordination in the Brain: A Multiple Modeling Approach. *PLOS ONE*, *6*(12), e29445. https://doi.org/10.1371/journal.pone.0029445

and the synapse communicate through both neurotransmitters and gliotransmitters.

Glutamate is an excitatory neurotransmitter in the synaptic cleft. Astrocytes seem to be involved in its reuptake after signal transmission across the neuron. Excitatory amino acid transporters (EAATs), especially EAAT-1 and EAAT-2 (GLT 1) are involved in the process. These transporters use sodium and potassium ions to actively transport glutamate across an electrochemical gradient. Small amounts of glutamate are also released by the astrocytes when needed, to synchronize the firing between adjacent neurons.

According to the monoamine hypothesis of depression, a depletion in the levels of serotonin, norepinephrine, dopamine or other neurotransmitters in the central nervous system is the physiological basis of depression. Astrocytes express transporters for both norepinephrine (NET) and serotonin (SERT); these are cellular targets for many classical neurotransmitters. Thus it is possible that different drugs may act by blocking the uptake of serotonin and norepinephrine into the astrocytes and thus increasing their concentration in the cleft. These receptors have been shown to be affected by Ca^{2+} concentrations and presence of secondary messenger cyclic Adenosine monophosphate (cAMP). Antidepressants as well as monoamine neurotransmitters differently influence gene expression in astrocytes. It is now known that the astrocytes are directly involved in their action, and active research to determine astrocyte specific drug action is ongoing. Additionally, gene expression of some astrocyte function-related proteins including glutamine synthetase, glutamate transporters and even gap junction proteins are down regulated in patients with depression, indicating their crucial role.

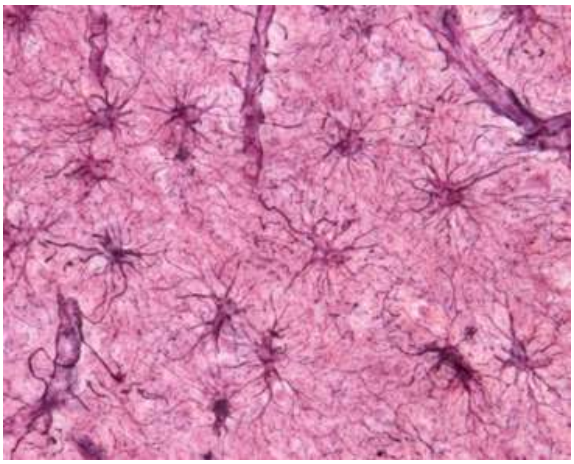

Figure 3: Astrocytes under the light microscope stained with Cajal's Gold sublimate technique.
Reference: JOSE CALVO / Science Photo Library (SPL) / www sciencephoto. com. Science Photo Library , 327-329 Harrow Road,London W9 3RB, United Kingdom

Gliotransmission is the release of neurotransmitters like glutamate (excitatory) and ATP (inhibitory) from the astrocytes to regulate neuronal coordination. The exact mechanism of gliotransmission is not known, but the pathway depends on calcium signaling. These are released either by synaptic like vesicles (vesicular exocytotic release) or astrocyte channels (non-exocytotic release).

It is believed that certain disorders, particularly schizophrenia and epilepsy may be partially caused by varying levels of gliotransmission. The glutamate hypothesis of schizophrenia suggests that glutamate deficiency is believed to cause symptoms of schizophrenia. As glutamate regulates synchronous depolarizations, it has been proposed that it might be involved in epileptic discharges. In Alzheimer's disease, it has been hypothesized that reduced function of the glutamate uptake mechanism results in synaptic

damage. GLT 1 expression level was found to be reduced in subjects with Alzheimer's disease.

Further research and understanding of the correlation between gliotransmission and neurological disorders could lead to novel methods of treating a wide spectrum of disorders ranging from Parkinson's and Huntington's disease to stroke and epilepsy. Thus the exact role of astrocytes and their development is an area which requires active research. Who knows what secrets are harbored deep within the stars!

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Plastic 2.0: Bioplastic as 21st century's Game-Changer

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Plastic, once thought as a revolutionary material, has now turned into a hazard jeopardizing environmental conditions. The accumulation of plastic waste in landfills and oceans has triggered a global outcry for sustainable alternatives. Bioplastics offer a glimmer of hope in this dire situation. These bio-based polymers are derived from renewable resources such as plants, algae and microorganisms, making them inherently eco-friendly.

Unlike traditional plastics, which rely heavily on fossil fuels, bioplastics are crafted from various biopolymers. Commonly used materials include starch, cellulose, polylactic acid (PLA), polyhydroxyalkanoates (PHA) and even proteins. The choice of material depends on the desired properties and applications of the bioplastic, highlighting the versatility of this ingenious material.

The methods by which various biodegradable bioplastics are made -

1. PLA (Polylactic Acid) Production: Polylactic acid (PLA) is produced through fermentation and polymerization process from renewable sources like cornstarch or sugarcane. Corn or sugarcane is processed to extract starch. Then the extracted starch is broken down into simple sugars (glucose) through enzymatic hydrolysis. Microorganisms (usually bacteria like *Lactobacillus* or *Streptococcus*) ferment the glucose to produce lactic acid. The lactic acid is then purified and undergoes a process called condensation to produce lactide. Lactide molecules are polymerized through ring-opening polymerization to form PLA. Catalysts and heat are used to initiate the reaction.

2. PHA (Polyhydroxyalkanoates) Production: PHA is produced by various microorganisms through fermentation using carbon sources like sugar, lipids or even waste materials. Bacteria like *Cupriavidus necator* or *Ralstonia eutropha* are cultured in a bioreactor. The bacteria are fed with carbon sources like glucose, glycerol, or fatty acids. They store excess carbon as PHA granules within their cells. Bacteria are harvested when they have accumulated a sufficient amount of PHA. The cells are broken open to release PHA granules. PHA granules are separated from cellular debris.

3. Starch-Based Bioplastics Production: Starch-based bioplastics are typically made by blending starch with other biodegradable polymers to improve their properties. Starch is extracted from sources like corn, potatoes, or cassava. Then it is mixed with plasticizers (usually water and glycerol) to increase flexibility and processability. Starch is blended with other biopolymers like PLA or PHA to enhance its mechanical properties.

The mixture is processed through methods like extrusion, injection molding, or compression molding to create final products.

4. Cellulose-Based Bioplastics Production: Cellulose-based bioplastics are often produced from sources like wood, agricultural waste, or bacteria. Cellulose is extracted from plant materials through chemical or mechanical methods. Then, it is dissolved in a suitable solvent like an ionic liquid. The dissolved cellulose is then precipitated by adding a non-solvent, forming a bioplastic film.

Applications of Bioplastics:

Bioplastics have already infiltrated numerous industries, ranging from packaging to electronics and agriculture to automotive. In packaging, bioplastics are celebrated for their biodegradability, minimizing the environmental impact of disposable items. Moreover, they are finding their way into durable goods, medical implants, and even 3D printing filaments. As consumer demand for sustainable products rises, bioplastics hold the potential to revolutionize manufacturing practices across the board.

Bioplastics Made from Indian Seaweed:

Using seaweed as a raw material for bioplastic is the most recent innovation. India's vast coastline presents a unique opportunity for leveraging marine resources. Seaweeds, abundant along the shores, offer a rich source of raw material for bioplastic production. Indian seaweed bioplastics have gained traction due to their potential to reduce pressure on land-based agricultural resources and simultaneously address plastic pollution. Seaweeds can grow in both fresh and saline water and do not require any additional substrate to flourish. They have a plethora of vitamins, minerals, antioxidants, and fiber which makes edible packaging a reality. Their cultivation and use facilitate waste management, since it is biodegradable and the container can naturally decay. Seaweeds, such as kelp and agar, are rich in polysaccharides that can be extracted and converted into biopolymers, demonstrating the ingenuity of merging biotechnology and marine science.

Advantages and Environmental Impact:

One of the most significant advantages of bioplastics lies in their biodegradability. Traditional plastics can persist in the environment for centuries, while bioplastics break down more rapidly through natural processes, mitigating the long-lasting ecological harm. However, the degradation process of bioplastics can vary based on composition, environmental conditions and disposal methods. In controlled composting environments, some can decompose within weeks to months, offering a promising solution for reducing plastic waste. Their advantages extend beyond their biodegradability. They typically have a lower carbon footprint compared to their petroleum-based counterparts, as they consume fewer fossil fuel resources during production. Furthermore, they can contribute to agricultural waste valorization, providing an additional revenue stream for farmers. By reducing our reliance on fossil fuels, they have the potential to mitigate greenhouse gas emissions, fostering a more sustainable future.

As the world grapples with the plastic crisis, bioplastics stand as a beacon of hope, offering an avenue to reconcile modern convenience with environmental responsibility. The diverse range of materials, production methods and applications

demonstrates the multifaceted nature of bioplastics in driving sustainable innovation across industries. However, challenges remain, including scaling up production, optimizing degradation rates and managing difficult scenarios. Collaborative efforts among scientists, policymakers and industries are essential to fully unlock the potential of bioplastics and usher in a plastic-free future, where innovation aligns with ecological harmony. As we continue to explore the wonders of bioplastics, one thing is clear: our journey toward a sustainable planet is firmly intertwined with the evolution of these revolutionary materials.

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Literary Articles

Foresight

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Life could be happy
If man realized the essence of his persistence.
Life could be blissful
If man realized the fleeting nature of worldliness.
Life could be enjoyable
If man realized pleasures to be harbingers of pain.
Life could be gratifying
If man realized his ignorance instigating his miseries.
Life could be contented
If man realized his body being an abode of ailments.
Life could be comfortable
If man realized his life as a receptacle of agonies.
Life could be peaceful
If man realized his phases of continuance-
Childhood as a state of helplessness,
Adolescence as the stage of suspense,
Youth coming like a flash of lightning-
Followed by the roaring of clouds
Of infirmities and sorrows of old age.

Vo!d

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A chilly winter descends on this crescent moon night,
Grey floating clouds match its rhythm with the wall clock
Ticking away; time fades and a tranquil quietness prevails
Under the dim streetlights, a cold state of mind conquers.
Those are black rings of smoke, emitted from the neighbour's chimney.
"They are lighting the fireplace," my unconsciousness whispered,
The much-needed warmth on a chilly winter night.
Suddenly, the cookies in my oven call for,
For they have received enough warmth from my bakery!
Tonight, my mind faces a dilemma – the bell of my oven or,
The bell on my door – to whom should I respond first?
Amidst tonight's winter chaos, I receive a letter and a gift.
This lone wolf has a reason to cherish.
Merry Christmas as the freshly-baked cookies wish
And the sounds of happiness from the neighbour's door sing me a carol.
A magical moment indeed, when the first snow on the windowpane appears.
Not a Christmas from a fairy tale but an ambitious young adult in the real world.
The familiar corner of the study room calls,
A picturesque reminiscence of all the Christmas

memories flashes through my mind,
But it's all in my mind – the beating heart is still
young to understand.
I am living my dream, following my ambition every
day,
I have everything yet nothing on this auspicious day.
Gazed outside, the snow-covered street is so happy,
Yet not a stranger to boast its happiness to.
The dimmed streetlights trying to console, hoping for
a happier moment to come.
Finally, I gather all the courage to open the letter.
Destiny, the one drop of tear has to flow by, envious
of the neighbour's door
And the passerby.
The beautifully wrapped gift is only a token of
consolation
To my lonely spent Christmas.
It doesn't feel cold anymore, I am losing all hopes of
warmth.
It's okay! I am used to this!
A void controls my mind

Changing Tides

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You can close this chapter
And move on down your trail,
Never look back;
Or you can flip through the pages
And take a trip down that old lane,
To revisit those memories
And reflect on your familiar self.

That's the authority of
Choosing to write your own story.
You get to greet new characters
And explore exotic places,
Face unique hurdles
And other hindrances along your way.
But the best part is
You deciding to overcome them
And then realizing that you can.

Little Things

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Coffee splashed on porcelain mugs
Books as vintage as iron rust

Sound of pages cutting the air
Snuggled within its warmth and care

Moonlight shining through the mist
The smell of coffee in the wind

All was well and all was safe
Minutes to hours - still I'll stay.

Lost

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I am no one, no one knows my name.
Yet, under the twinkling black canopy,
I feel seen like I mean something.
But I also feel insignificant.
The endless sky makes me feel lost,
Like I am alone on the path of life,
With only the stars to guide me,
But no knowledge of which to follow.
It is a strange feeling,
But I can't bring myself to not like it.

Green & Grey

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It is a tiny thing,
Just a glint of green in a world of grey.
Growing slowly, guided only by nature.
It barely escapes a fate of being trampled –
By expensive leather soles.
Death, it knows, might be just around the corner.
One day, it will bloom into an alluring flower,
That will make those giants stop and stare;
One day, it will have brothers and sisters and a whole family,
And tower over those that dare destroy them;
One day, it will be a world of green with a bare speck of grey.
But for today, it is content with talking softly with the sun and the wind –
Unafraid and free

A Ticking Façade

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It's dark now,
The lights are gone.
And hence I bow,
To the lost shine that I can't turn on.
It's dark now,
But it's not the outside that I speak of somehow.
I speak of the soul,
And how it growls.

As I wait for the clock to stop its ticking facade,
Time passes on, making me look like a Joker card.

Like a Joker card is how I feel.
With my life entangled up as in a movie reel
All these minor problems are a major deal
But I can only smile and don't let them conceal.

The darkness... it encircles my existence
Just like our shadow grows when the sun goes down in its essence.

Van Gogh ate yellow paint,
To make rid of his heart's ache.
Everyone lives for their happiness' sake,
Or else even the sinner would have been a saint.

Ghost in the Frame

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The afternoon light was perfect for photography, bathing everything in a golden haze and throwing shadows into stark contrast. The photographer flitted through the crowd silently, observing. She'd been the silent child for as long as she could remember, always the one in the corner of the classroom with a book, observing the conversations. Corners were good for observing people when they didn't know they were being observed. How that one person's face scrunched up when their nose was buried in a book of their own, the calm on the person's face when they looked out the window.

It was good for noticing all the little details in life – leaning her head against the cold car window and watching the raindrops slide down the glass; the guitarist tucked away at the back, his eyes closed and letting the notes slide over his skin; the girl who was dancing alone, and how her body curved as she moved gracelessly because no one was watching.

It did not come as much of a surprise that she fell headlong in love with photography. A thousand different cities, a thousand different normal people. The photographer refused to work for celebrities; she refused to capture so much artificiality. She preferred capturing through her lens the beauty of the naked truth rather than a filtered, makeup-done-to-perfection model; to capture too wide, eye-scrunching smiles rather than pouty ones. It was all the imperfections that made humanity beautiful.

The photographer remembered. That late afternoon light, somewhere in the middle of yellow chrome and Prussian blue mixed together on a palette. The blanket slipping off her legs. The soft curves of her waist, the stretch marks glowing white in the trained gaze of the camera. A hand stretched out so elegantly, almost slipping off the arm of the sofa. Her sideways smile. The tears caught on her eyelashes as the photographer showed her the pictures. "It's still me, but... You make me look beautiful."

The crowd in the Uffizi Gallery had thinned out by now.

Click. The white stone skyline of Florence against the red-streaked sky.

Click. The lovestruck expression on a boy's face as he watched his girlfriend talk about the art they were seeing. He was more looking than listening, looking at the passion in her voice and her eyes.

Click. A middle-aged woman on a bench, the sunlight playing tag across her face as

she tipped her head back and closed her eyes.

Click. An old man pressed a flower into an almost unnoticeable corner of a hallway in the old gallery. The photographer ventured up to him, shy and hesitant, and asked for a story. And so, he told her. About how, when he was only a teenager, he gave his then-to-be wife a flower here, the very first time he saw her. And left her a flower here every day that summer when they couldn't meet in public. And now she had died, and he still left her flowers. He gave one to the photographer. He said she reminded him of her but did not elaborate on how.

Click. A girl standing motionless, looking up at the edifice built by ancient Roman hands, caught still in a blur of motion.

Stories bloom into existence on the paper in the chemical bath. She couldn't have seen the ghost in the darkroom. The photographer hung up the pictures to dry and closed the door. A ghost remained behind, trapped till when she was seen.

Later, when the pictures were laid out on the dining table, the photographer bent over them. The sweater she was wearing was a gift, left behind in a stolen moment of time on the back of a hotel chair, dark blue in the disconcerting whiteness of the hotel room.

She wore it now to remember the person who had worn it before because she never found that person again. The person's face was committed to her memory as they all were. So many, through the years.

And then she saw the ghost.

It would be so, so easy to miss it but the photographer saw it. A small, small detail in every single frame. A dark head and a blowing scarf caught in the background of every single picture. Silent watcher, reveal yourself. In one picture, only her eyes were visible, her hair wrapped around her face like a mask by the wind. But there was nothing to be done now.

The photographer put her head in her hands. She had seen a ghost and she couldn't unsee it now.

That day, that afternoon, that place. So close, yet so far. She had been there.

The Monster under the Bed

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The rain drumming on the roof is in sync with the beating of her father's heart. A six-year-old girl with eyes too big for her face and masses of midnight-black hair listens with rapt attention, even though her father is falling asleep and the words of the story are slurring.

It's a story about the monster under the bed, about a girl who listened to the darkness she was warned against, who became a witch, and who was saved from burning to death only by the intervention of her sister.

They tell her she learned to read before she learned to walk. She believes them. She loves stories more than she has ever loved anything, even though she doesn't really understand what the word means. To her, love is sharing an orange at lunch with her best friend on the sun-flooded playground. It's her father telling her one last story after coming home from work.

The book slams shut.

Her father's hand is poised on the light switch.

"What does it eat?"

Her father rubs his eyes. "What eats what?"

Verena pokes her head up properly from the mound of blankets and stuffed toys.

"The monster under the bed, Daddy. What does it eat?"

Her father makes a face at her, lifts his hand into a claw like a monster, and proclaims in a growly voice, "On the darkness of our soul."

Verena giggles. "But what about before? Before it gets the soul? Does it eat air?"

Her father switches the light off. "I don't know, Vee. Go to sleep."

Verena settles back into bed, wide awake, staring at the ceiling.

She wonders, what if the monsters were people who turned bad and weren't saved? Then it surely wasn't their fault, was it? Nobody has saved them. And if they ate all the darkness, then maybe people wouldn't pour it into the world.

She has seen people on the TV whose parents beat them, who don't love them. Surely there couldn't be more darkness than that?

Verena rolls over to the edge of her bed and leans off the covers, peering down into the darkness in the space.

"Are you there, monster?"

There is no reply, except for the wind howling through the loose tiles on the roof.

Six-year-old Verena bravely proclaims, "I'll

save you. I'll make you the best monster ever."

The darkness does not reply.

Verena nearly trips over her own feet as she stumbles up the stairs to her room. She is still in her school tunic, her hair bound in neat braids. She crouches by the edge of the bed, looking for the bowl of sugar she left out this morning. At last, she spots the white plastic, much farther under the bed than she remembers. Straining her small arm, she nudges it out with the tips of her fingers. Verena looks down at the bowl in wonder.

It's empty. It's empty.

The monster likes sugar. Verena giggles and ducks under the bed to look at the darkness. Nothing looks back.

"You're so sweet, monster."

Verena is eighteen. She is going away for college. She doesn't know whether the monster will follow her. Sometimes at night, when she lies awake staring at the moon, she hears rustles and groans and thumps that fall into a rhythm the longer she listens. She hums along with it until her eyelids close. The darkness exhales a sigh of relief.

Aren't there supposed to be stars sucked into black holes? Do they still glow, unseen and unknown?

A few years later, she got the degree she always wanted. She has the apartment in the city she dreamed of. She has a small garden on the balcony. There's a piano in the corner of the room.

Last week, she wore a pink blazer to work.

She should be happy. The world has given her all the little joys she has asked of it.

Why then?

Why then is she sitting at the dining table at one in the morning crying for someone who left a year ago?

She thought she had grown out of it and walked past the hurt like the boarded-up gallery on the main street. Let it fall from a thousand rooftops and watch it shatter on the pavement like a dying star.

Why then?

She thumbs over the watch he left her, over the names he scratched into the back of the dial. She thinks that maybe he scratched it on her heart instead.

The shadows are long, twisted forms of themselves. The curtains flutter in the wind like ghosts.

The shadows are really long, Verena thinks.

And then they are not shadows at all. The darkness draws itself up, grabbing onto the sofa for support and bumping into that god-awful side table she always forgets to move.

The darkness puts a hand under her chin.

The streetlight outside flickers and goes out, and blinks again into existence. And it is no longer the darkness.

It's her.

It's her with a slightly crooked nose and eyes, and that strand that always falls onto her eyes. Her if she had a clone.

But her eyes aren't the warm brown she

sees in the mirror. They are all white with black iris.

Verena would have fallen off the chair if she could have move.

“Who are you?”

The clone tilts its head, considering.

“I’m the monster. Don’t you remember? You left me sugar... Nobody ever left me sugar; they’re all too scared of me. You were the first. Please don’t be cry; I love you very much.”

There’s something stuck in Verena’s throat.

“I don’t...”

The monster steps back and holds out its arm to her. Her arm. There’s a bracelet of bruised black and purple skin around the wrist, where the watch in her hand once rested. The monster moves her hair aside and bares its neck, and there’s the outline of the pendant her mother gave her before she ran away—a ring of purple bruises. Scars she does not have.

“What...”

The monster looks down in wonder at its scars.

“They’re the scars you gave me. The scars of your emotions.”

It tears the buttons of its jacket apart to show her the skin over its back. There are a thousand freckles on it—the kind of freckles she’s always wished to have.

When the monster turns back around, it’s smiling.

“That’s love. Your love”

The monster swirls the word around in its mouth like candy, relishing the taste on its tongue.

“That is your love, Vee.”

So I Thought Beauty Is a Liar

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Beauty is a fallen flower on the dry summer road – beauty is not the dry summer road. The fallen flower, gentle and insignificant, calms the mind that the summer road had so unapologetically exhausted. Yet, the beauty of the flower strikes against the dust and dread of the concrete – none complete without the other.

Beauty is a photograph in a glossy, elite magazine – a street amongst many in the colors of the country; beauty is not a sorrowful child the camera failed to capture.

So, I thought beauty is a liar – it pretends nothing is wrong and that we are happy people in a happy little world. I was miserably wrong.

Time is fluid and ebbing and nothing will be forever – a concept we all know. Maybe beauty is for that, that it is what comes after – a cool breeze that blows the dust on the summer road, a happy home that cures the sorrowful child. All within us – hope, love, kindness – big words but all the more important is to see good things around us. Beauty has no business with pretending; it is difficult to find beautiful things when we are living on a dying planet, but the fact that we can still do so is comforting at its best. We live for that – the hope that we can still find good things, people, memories, and happy roads that lead to better homes and stronger souls and that we can hold on to that for some time. That, I realized, is beauty.

মাতৃত্বের সুতো

রিতম দাস
সেমিস্টার ৯
জৈবপ্রযুক্তির স্নাতকোত্তর ও গবেষণা বিভাগ
সেন্ট জেভিয়ার্স কলেজ (স্বশাসিত), কলকাতা

আজ বিকেল থেকেই রেডিও'র আওয়াজটা পাঁচ-এ করে
রাখতে হয়েছে।
পেশীগুলো আজ বোধহয় একটু বেশি মোচড় দিচ্ছে রনির
এবং তার সঙ্গে চিৎকারের মাত্রাটাও
কত বার যে বারণ করেছি ওকে অথবা আপনাদের ভাষায়—
'বুঝিয়ে দিয়েছি' হুইলচেয়ারটাকে জানলার কাছে না নিয়ে
যেতে,
কিন্তু কিছুতেই বুঝতে চায় না আমার কথা।
ওর গোঙানির শব্দ যে বাড়িওয়ালার ঘুম নষ্ট করে।
"সুস্থ পাড়াকে অস্বাস্থ্যকর করে তোলে"—
বলেছিল এক বার এক প্রতিবেশী
কিছু উত্তর দিইনি, শুধু হেসেছিলাম ফ্যাকাশে মুখে...

অনেক বার মনে হয়েছে যেন ও আমাকে বোঝাতে ব্যর্থ হয়ে
অন্য কাউকে জানাতে চায় ওর কষ্ট—
চিনিয়ে দিতে চায় ওর অবস্থান।
কেউ যেন ওকে খুঁজে বার করে ওকে মুক্তি দেবার কর্মে
মগ্ন—
এমনটাই হয়তো ওর অপূর্ণমস্তিষ্কের ভাবনা।
এমনকি যাতে ওর ভাবনা সত্যি হয়, যাতে মুক্তি পায় ও
আমিও এখন তাই প্রার্থনা করি,
একটার জায়গায় দুটো সন্দেশ দিই
এখন ওই মূর্তিরূপের ঈশ্বরকে— বিশ্বাস করুন।

জন্ম থেকেই সেরিব্রাল পলসিতে আক্রান্ত আমার রনি।
এই "আমার রনি" কথাটা বলতেও খুব লজ্জা হয় এখন—
নিজের ওপর, নিজের শরীরের ওপর
মাতৃত্বের নামে পঙ্গুত্ব আর সান্ত্বনায় মোড়া এক জীবন ছাড়া
কী দিতে পেরেছি আমি ওকে?
ডাক্তার বলেছিল গর্ভে থাকাকালীন মাথায় চোট পেয়েছিল

রনি,
হ্যাঁ, আমার গর্ভে।
জানেন আমার এক ফুটফুটে মেয়ের খুব স্বপ্ন ছিল
রনির 'কোট-আনকোট' ঠাকুরমা, মানে আমার শাশুড়ি,
আমার চুলের মুঠি ধরে বলেছিলেন—
আমার মেয়ে হয়নি বলে আমি আমার সন্তানকে
পঙ্গু করে পৃথিবীতে এনেছি (.....হুমহুম)
অতএব পরিত্যাগ করো এই কলঙ্ককে।
যার জন্য নিজের স্বপ্নকে হেলায় ভাসিয়ে
তার স্বপ্নের মরীচিকা হয়ে হাত ধরেছিলাম
সেও যে দিন হাতটা আলগা করে দিল,
সে দিন মনে হয়েছিল শেষ করে দিই দুটো প্রাণকে,
কিন্তু কী জানেন— নিজের অংশে তৈরি ওই স্বল্পমেয়াদী
পথটাকে
পুরোটা দেখার অদম্য জেদ চেপেছিল মনে।

আজ খুব মনে হয় জানেন, সমাজ এবং একটা নতুন প্রাণকে
যতটা দূষিত করা যায় তার ভাগীদার নয় হয়েছি-
কিন্তু নিজেকে কী দিতে পেরেছি?
কী দিতে পেরেছি সেই সম্ভাবনাময় স্নাতকোত্তরের শেষ বর্ষে
থাকা ওই ছাত্রীটিকে....
যার সামনে ছিল সম্পূর্ণ পৃথিবী!

আজ যখন রেডিও'র আওয়াজ জোরে করে
ওর কষ্টের আওয়াজকে সমাজের থেকে লুকোই...
খুব আশা করি রেডিও'টা বন্ধ করে দেবার পর ওই আওয়াজ
আর থাকবে না।
সামান্য জীবিকার প্রয়োজনে যতটুকু বাড়ির বাইরে থাকতে
হয় রনিকে ছেড়ে,
আজ বারো বছর পর খুব আশা করি যাতে
বাড়িতে ফিরে আমার যাত্রার শেষ স্টেশনে পৌঁছই।
খুব স্বার্থপর হতে ইচ্ছা করে, পালাতে ইচ্ছা করে,
কিন্তু প্রতি বারই ওই জানলার ধারের গোঙানিটা —
এই ভাড়ার এক কামরার ঘরে প্রতিধ্বনিত হয়ে,
মাতৃত্বের সুতোয় টান দিয়ে যেন বলে—
"আর কিছু দিন অপেক্ষা করো, সে শুনতে পেয়েছে,
আসছে, নিয়ে যাবে আমায়।"

বাংলার তিন যুবকের বীর গাঁথা

শ্রাবন্তী মুখার্জী
সেমিস্টার ৯
জৈবপ্রযুক্তির স্নাতকোত্তর ও গবেষণা বিভাগ
সেন্ট জেভিয়ার্স কলেজ (স্বশাসিত), কলকাতা

কলকাতার মেডিক্যাল কলেজ হসপিটালের কেবিনে শায়িত বছর কুড়ির এক যুবক।প্রবল কড়া পাহারা এই যুবক কে ঘিরে।বাইরে অতন্ত্র প্রহরায় ব্রিটিশ পুলিশ। ডক্টর ও নার্স ছাড়া সকলের প্রবেশ নিষেধ যুবকের কেবিনে। দিন পনেরো ধরে ডক্টর নার্স দের অক্লান্ত পরিশ্রম এ একটু একটু করে চিকিৎসায় সারা দিচ্ছেন যুবক। এই কদিনে বছর কুড়ির এই যুবকটির সেবা করতে করতে কেমন যেন এক মায়া জমে গেছে বিদেশিনী নার্সের। হাজার হোক তিনি নারী, মায়ের প্রতিমূর্তি।অজান্তেই স্নেহ মমতায় তার মন ভরে উঠেছিল দুঃসাহসী এই দামাল ছেলেটির জন্য।মাঝে মাঝেই তাই উঁকি মারতেন যুবকের কেবিনে,এক পলক শুধু দেখার জন্য। ব্যাপার টা একদিন লক্ষ্য করলেন বিছানায় শায়িত যুবক, নার্স কে লক্ষ্য করে বলে উঠলেন-"sorry nurse I am still breathing!"

নার্স এর মুখ থেকে ঝরে পড়লো আশিস বার্তা - "May God grant you long life."

তিনি এগিয়ে এলেন যুবকের কাছে,জানতে চাইলেন,- "Why did you take poison and shoot yourself?"

-"Just to finish myself after the completion of work." - সহাস্যে উত্তর দিলেন যুবক।

-"It was nothing of a suicide. It was self-emotion - a voluntary death and death of fulfilment and not despair."

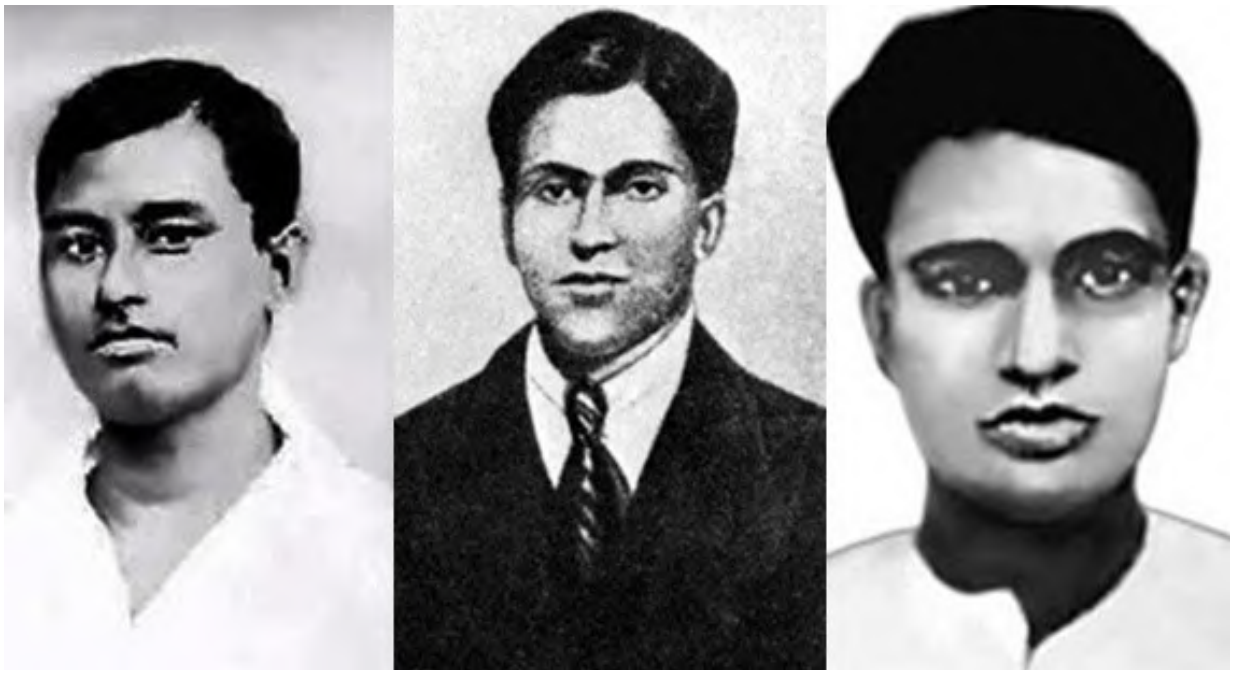
যুবকের উত্তর শুনে ব্যাকুল ভাবে জানতে চাইলেন বিদেশিনী- "Do you hate me? Do you hate all the Britishers?"

-"No I hate those who want to rule over us directly or indirectly."উত্তর যুবকের|

মেডিকেল কলেজের কেবিনে শায়িত সেদিনের সেই যুবকের নাম দীনেশ গুপ্ত - বীর বিপ্লবী দীনেশ গুপ্ত। মাত্র কিছু দিন আগে বিনয় বসু ও বাদল গুপ্ত র সাথে নাড়িয়ে দিয়েছেন ব্রিটিশ সাম্রাজ্যের ভিত, ব্রিটিশ সাম্রাজ্যের দুর্ভেদ্য দুর্গ রাইটার্স বিল্ডিং। সেই দুর্গে ঢুকে দিনে দুপুরে চরম আঘাত হেনেছেন ব্রিটিশ সাম্রাজ্যবাদের উপর। বিনয়-বাদল-দীনেশ এর পিস্তলের গুলি স্তব্ধ করে দিয়েছে তদানীন্তন বাংলার আইজি প্রিজন কর্নেল নরম্যান সিম্পসনকে।সেই কর্নেল সিম্পসন যিনি কারাবন্দী বিপ্লবীদের উপর নির্মম নির্যাতন করে পেতেন পৈশাচিক

আনন্দ। যার নির্দেশে রাজবন্দী সুভাষ চন্দ্র বসুর উপর ঝাপিয়ে পড়েছিল জেলের গুন্ডা কয়েদীরা। সুভাষের সাথে সেই দিন নিগৃহীত হয়েছিলেন দেশপ্রিয় যতীন্দ্র মোহন সেনগুপ্ত,কিরণ শঙ্কর রায়,সত্য গুপ্ত প্রমুখরা।জল্লাদ আইজি প্রিজনের প্রানদণ্ডের নিদান দিয়েছিলেন বাংলার দামাল বিপ্লবীরা। সিদ্ধান্ত হল প্রিজন কে হত্যা করা হবে তার অফিসে,খোদ রাইটার্স বিল্ডিং এ। শাসকের প্রশাসনিক সদর দফতরে অভিনীত হলো প্রতিরোধের রক্তক্ষয়ী অধ্যায়। মাত্র তিনজন স্বাধীনতা কামী যুবকের বিরুদ্ধে সেদিন নামাতে হয়েছিল সুপ্রশিক্ষিত গোর্খা বাহিনী। তাতেও দমানো যায়নি বাংলার তিন দামাল যুবককে। অদম্য সাহসে তিন যুবক লড়ে গেলেন গোর্খা বাহিনীর বিরুদ্ধে।একটা গুলি লেগেছে দিনেশের পিঠে। বাকি দুজন তখনো অক্ষত।

এক সময় ফুরিয়ে গেল পিস্তলের গুলি।একটা খালি ঘরে নিজেদের বন্ধ করে নিলো তিন



চিত্রগাথা।

সিম্পসন কে হত্যা করেই থামলেন না তিন যুবক,তাদের অগ্নিবর্ষণ কারী পিস্তলের সামনে লুটিয়ে পড়লেন জুডিসিয়াল সেক্রেটারি নেলসন। অল্পের জন্য রক্ষা পেলেন রাজস্ব সচিব মিস্টার মারে। ভারতের স্বাধীনতা সংগ্রামের ইতিহাসের বীরগাঁথায় “অলিন্দ যুদ্ধ” নামে চিরস্মরণীয় 1930 সালের 8 th ডিসেম্বরের সেই যুবক। নির্দ্বিধায় মুখে সায়ানাইড এর পুড়িয়া পুড়ে দিলেন তিনজন।দীনেশ আর বিনয় এখানেই থামলেন না। নিজেদের কপাল লক্ষ্য করে চালালেন পিস্তলের অবশিষ্ট শেষ গুলি।

বাদল মারা গিয়েছিল সাথে সাথেই। বিনয় আর দীনেশ কে পুলিশি তৎপরতায় নিয়ে যাওয়া হলো মেডিকেল কলেজ হাসপাতালে।যে করে হোক বাঁচাতেই হবে দুজনকে।চেষ্টার কসুর করলেন

না ডাক্তাররাও। একটু একটু করে সেরে উঠতে লাগলেন দুজনেই।পুলিশ এর হাতে ধরা না দেওয়ার অদম্য মনোভাব থেকে ডাক্তারীর ছাত্র বিনয় নিজের মাথার খতে আঙ্গুল ঢুকিয়ে বিষিয়ে দিলেন ঘাঁ। ডাক্তার-নার্সদের সব চেষ্টা ব্যর্থ করে ১৩ই ডিসেম্বর অমরত্ব লাভ করেন বিনয়। থেকে গেলেন এক দীনেশ। চিকিৎসায় সারা দিয়ে আস্তে আস্তে সুস্থ হয়ে উঠলেন তিনি। মেডিকেল কলেজ থেকে তার জায়গা হলো আলিপুর জেলের কনডেম্ড সেলে। সেশন জর্জ গার্লিকের নেতৃত্বে গঠিত স্পেশাল ট্রাইব্যুনালে শুরু হলো বিচারের নামে প্রহসন। ধার্য হলো প্রাণদণ্ড।

১৯৩১ এর ৭ই জুলাই- অলিপুর জেলের ভোর পৌনে চারটে,ফাঁসির মঞ্চে এসে দাঁড়ালেন উনিশ বছরের দীনেশ। মৃত্যু মুখে দাঁড়িয়ে বজ্র কণ্ঠে উচ্চারণ করলেন – বন্দেমাতারম্! মাতৃবন্দনার সেই ধ্বনি মূহূর্তে আলোড়ন ফেললো গোটা আলিপুর জেলে |হাজার হাজার রাজনৈতিক বন্দীর কণ্ঠে ধ্বনিত হলো বন্দেমাতারম্ | মাতৃবন্দনার ধ্বনির মধ্যে নিজের জীবন নৈবেদ্য দিলেন দেশমাতৃকার পায়ে। মৃত্যু কে বরণ করে হলেন মৃত্যুঞ্জয়।

বিনয় বাদল দিনেশের মতো অসংখ্য যুবকের আত্ম বলিদানে ভারতবর্ষ স্বাধীনতা পেলেও আমাদের সমাজ এখনো মুক্তি পায়নি এই সাম্রাজ্যবাদের বেড়াজাল থেকে।স্থান কাল পাত্র নির্বিশেষে যখনই সাম্রাজ্য বাদের আগ্রাসী থাবা গ্রাস করেছে সাধারণ মানুষের অধিকার , যখনই শাসকের আইন সুশাসনের লক্ষ্য ভুলে হয়ে উঠেছে শোষণের অস্ত্র , কতিপয় মানুষের ব্যক্তি স্বার্থ যখনই বড় হয়ে উঠেছে সমাজের সামাজিক সুরক্ষার থেকে ঠিক তখনই যুগে যুগে এগিয়ে এসেছে দিনেশের মতো দামাল ছেলেরা। নিজেদের স্বার্থ ভুলে ঝাঁপিয়ে পড়েছে দশ এর জন্য| নিজেদের নিবেদিত করেছে দেশ মাতৃকার পায়ে,সত্যের জন্য,ন্যায় এর জন্য, কখনো পিছু পা হয়নি নিজেদের চরম বলিদান দিতে।.....

এক টুকরো ইচ্ছে

শ্রেয়ান ঘোষ
সেমিস্টার ৩
জৈবপ্রযুক্তির স্নাতকোত্তর ও গবেষণা বিভাগ
সেন্ট জেভিয়ার্স কলেজ (স্বশাসিত), কলকাতা

আমার বাড়ি ভবানীপুর।বেশ পুরনো পাড়া।তার মধ্যে আমাদের বাড়িটা খুবই পুরনো। এই বাড়িটা তৈরি করেছিলেন আমার ঠাকুরদার ঠাকুরদা। সালটা ১৯৩৭।তখন পাড়াতে মাত্র ৬ -৭ টা বাড়ি ছিল। আর এখন চারদিকে বাড়ির জঙ্গল। আবার সেই সব বাড়ি ভেঙে যাচ্ছে ,তৈরি হচ্ছে উঁচু উঁচু ফ্ল্যাট।কিছুদিন আগে আমার বাড়ির পাশের বাড়িটা ভেঙে দেওয়া হল। অনেক পরিচিত লোক সেখানে থাকতেন। তাঁরা চলে গেলেন কলকাতা থেকে অনেক দূরে। এই ভাঙ্গা বাড়ির জায়গাটা পোড়ো অবস্থায় পড়ে রয়েছে বেশ কিছুদিন ধরে ।তারপরে এখানে তৈরি হবে আর এক অট্টালিকা ।কিন্তু এই জায়গাটা এখন পড়ে আছে একেবারে অবহেলায়। গ্রীষ্ম পেরিয়ে সমস্ত শহর জুড়ে নেমেছে ঘন বর্ষা। বর্ষার জলের অনবরত সিঞ্চনে এই পোড়ো জায়গাটি ভরে উঠছে গাছ-গাছালি আগাছায়। গাছগুলো বড় হয়ে উঠছে। সবুজে সবুজ হয়ে যাচ্ছে আমাদের পাশের জায়গাটা। জানি কিছুদিন পর এই সবুজ আর থাকবে না, কংক্রিটের জঙ্গল তৈরি হবে আগাছার জঙ্গলকে সরিয়ে দিয়ে। কিন্তু ধরুন এমন যদি হতো যে প্রতিটা পাড়ার মধ্যে এমন এক একটি সুন্দর বাগান তৈরি করা যেত। যেখানে নানা গাছ গাছালি ভরে উঠত। সেই গাছ ক্রমশ সুন্দর ফুলে ফুলে ভরে যেত। সেখানে উড়ে এসে বসত কত নাম না জানা পাখি। সেখানে প্রতিদিন সকালে সূর্যের আলো এসে প্রতিটি গাছের পাতা কে ঘুম থেকে জাগিয়ে তুলতো। প্রতিটি ফুল জেগে উঠতো নিদ্রা ভেঙে। পাপড়ি মেলে ছড়িয়ে দিত অপূর্ব সুগন্ধ। আবার যখন দিন শেষ হয়ে আসতো পাখিরা তাদের সারাদিনের কাজ সেরে ফিরে আসত তাদের নীড়ে ।তখন গাছের বুক থেকে ধীরে ধীরে দিনের আলো মুছে যেত। সেই ঝিকিমিকি আলোয় ছায়ায় যে অপূর্ব মায়াময় পরিবেশ সৃষ্টি হতো তা অবর্ণনীয় সুন্দর।

প্রতিটি ঋতুর পরিবর্তন প্রত্যক্ষ করতো সেই বাগান। বসন্তের ফুলে ফুলে ভরে উঠতো গাছগুলি পাখিদের কূজনে গুঞ্জনে মুখর হয়ে উঠতো সমস্ত প্রকৃতি। তারপর গ্রীষ্মের দাবদাহে রুক্ষ শুষ্ক হয়ে উঠতো সেই বাগান । এরপর নামতো বর্ষা। আকাশ বাতাস ভরিয়ে দিয়ে নিয়ে আসতো এক অপরূপ শ্যামলিমার ছোঁয়া ।তার ছোঁয়ায় প্রতিটি গাছ প্রতিটি পাতা ধারণ করতো নবকলেবর। হয়তো কোন পথভোলা পাখি বর্ষণ মুখরিত দিনে আশ্রয় খুঁজে নিত সেই গাছের কোটরে। তারপর শরৎ তার অরুণ আলোয় ভরিয়ে দিত সমস্ত বিশ্বসংসার ।প্রকৃতিতে প্রকৃতিতে বেজে উঠতো আগমনী সুর।হেমন্তের সন্ধ্যায় শুকনো পাতা ঝরে যেত আর শীতকালে সমস্ত পাতা ঝরে গিয়ে রুক্ষ হয়ে উঠতো প্রকৃতি । হয়তো সেই বাগান এক ভারি সুন্দর দর্শনীয় বস্তু হয়ে উঠতো। তার মধ্যে হয়তো তৈরি হতো এক পুষ্করিনি। তাতে হয়তো ভাসতো শতদল দল, খেলা করত মরাল মরালী। তার ওপর হয়তো

একটি ছোট্ট সাঁকো তৈরি হতো যে সাঁকো দিয়ে তরুণ তরুণী একে অপরকে কাছে ডেকে নিত। হয়তো পৃথিবীটা আরো একটু সুন্দর আরো একটু মায়ময় হত। আমাদের এই কলকাতা শহর হয়ে উঠতো এক সবুজের পীঠস্থান। সত্যিই সে হয়ে উঠতো কল্লোলিনী। আমরা যেন ফিরে গেছি সেই কালিদাসের কালে, উজ্জয়নীর বিজন প্রান্তে যেন কানন ঘেরা এক বাড়ির কল্পনা ফিরে ফিরে আসছে মনের মধ্যে।

কিন্তু হায়রে ভাগ্য ! এমন হওয়া আমাদের কারোর কপালে নেই। তাই শিগগিরি গাছ কেটে ফেলা হবে, পরিষ্কার হয়ে যাবে জঙ্গল ,তৈরি হয়ে যাবে বিশাল অট্টালিকা ।সেই অট্টালিকার আড়ালে চাপা পড়ে যাবে সবুজের হাহাকার।

QUIZ

Uttrino Nath
Semester IX
Postgraduate & Research Department of Biotechnology
St. Xavier's College (Autonomous), Kolkata

Can you seal the gaps by filling them up?

1. The Replica Plating Experiment on mutations in bacterial colonies was performed by the scientists _____ and _____.

2. Antibiotic resistance genes against penicillin and its derivatives usually code for proteins which cleave the _____ ring.

3. The extract of *Azadirachta indica* finds extensive use as a biopesticide. It is commonly known as _____.

4. _____ was the first 'test-tube' baby in the world.

5. The phenolic compound and plant hormone _____ _____ is used to treat skin conditions in humans.

6. The special amino acid found in collagen is _____.

7. The enzyme _____ derived from raw papaya is used as a meat tenderizer.

8. The _____ _____ is found on the logo of World Wide Fund for Nature (WWF).

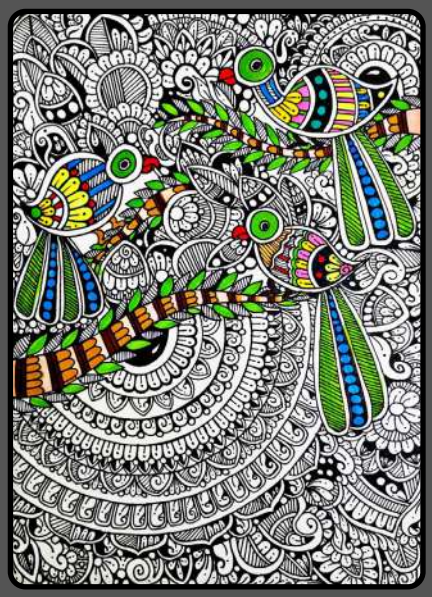
Answers

1) Joshua Lederberg, Esther Lederberg
2) β-lactam
3) Neem
4) Louise Joy Brown
5) Salicylic acid
6) Hydroxyproline
7) Papain
8) Giant panda

Photography and Artworks

SAHELI MAJUMDER, SEMESTER 9

SAPTARSHI BHATTACHARYYA, SEMESTER 9



SAHELI MAJUMDER, SEMESTER 9

LIFE AROUND THE DNA
ANKUR PAUL, SEMESTER 9

CROSSING THE STARRY NIGHTS
ANKUR PAUL, SEMESTER 9

SAPTARSHI BHATTACHARYYA, SEMESTER 9

RUPANGI BISWAS, SEMESTER 5

SOHAM MAITI, SEMESTER 5

DEBOLINA PAUL, SEMESTER 1

MANJISTHA SIKDAR, SEMESTER 1

SANSTHITA SAHA, SEMESTER 1

DEBOLINA PAUL, SEMESTER 1

PHI PHI ISLANDS, THAILAND
SAHELI MAJUMDER, SEMESTER 9

FLUCTUAT NEC MERGITUR
DR. DITIPRIYA HAZRA, ASSISTANT PROFESSOR

MT. SINIOLCHU AT GURESTERU DONGMAR LAKE
RITTIKA DHAR, SEMESTER 1

GUDVANGEN, NORWAY
BISHAKHA DAS, SEMESTER 5

WATER FALLING FOR THE RAINBOW
RITISHA CHAKRABORTY, SEMESTER 1

COPSYCHUS SAULARIS (MAGPIE ROBIN)
SURYA SARATHI DAS, SEMESTER 9

LARUS CANUS
BISHAKHA DAS, SEMESTER 5

SALTICIDAE ON A TAGETES
BAIBHAB CHAKRABORTY, SEMESTER 5

FELIS SILVESTRIS LYBICA
SUPRATIM BANERJEE, SEMESTER 7

ELEPHAS MAXIMUS INDICUS
SWASTIK KUNDU, SEMESTER 3

DICRURUS MACROCERCUS (BLACK DRONGO)
AISHANI BHATTACHARYA, SEMESTER 3

CERVIDAE
SUDIPA DEB, SEMESTER 3

MEROPS ORIENTALIS
SUDIPA DEB, SEMESTER 3

SCIURUS VULGARIS
ADARSH PRASAD, SEMESTER 1 (PG)
DEPARTMENT OF POLITICAL SCIENCE

RITISHA CHAKRABORTY, SEMESTER 1

FUNAMBULUS PALMARUM
SHAHMEER MONDAL, SEMESTER 5
DEPARTMENT OF COMPUTER SCIENCE

ADARSH PRASAD, SEMESTER 1 (PG)
DEPARTMENT OF POLITICAL SCIENCE

Podcast

UNVEILING NUCLEAR REALITIES: ENERGY, WEAPONS AND UNATTENDED CONSEQUENCES

This is the first episode in this year's podcast series. Here you will be listening to a discussion about the nuclear energy scenario. Nuclear energy can be harnessed via nuclear power plants for the production of electricity. This allows us to reduce our reliance on fossil fuels for electricity production and subsequently cut down the overall greenhouse gas emissions. But the same powerful technology when used in nuclear-powered weapons, transitions itself from a boon to mankind to a source of mass destruction. These aspects are discussed thoroughly in this podcast.

Recitation by:

- Sampoorna Dey (Third Year)
- Roopkatha Sen (Third Year)
- Aniket Deb (Fifth Year)

AI IN HEALTHCARE - UNVEILING SCIENTIFIC FRONTIERS

This is the third and last episode in this year's podcast series. Here we will be discussing about the current talk of the town, that is, AI and its impact on healthcare sector. AI helps in drug development, tumour detection, robotic surgeries and many other aspects of healthcare. AI in healthcare has the potential to enhance patient care, reduce costs, and improve overall healthcare system efficiency. But it has its own share of drawbacks which can adversely impact our lives. These aspects are discussed thoroughly in this podcast.

Recitation by:

- Dayeeta Bera (Fourth Year)
- Sakshi Angela John (Fourth Year)
- Aniket Deb (Fifth Year)

TECHNICAL ADVANCEMENTS IN THE MEDICAL FIELD: IMMUNOTHERAPY AND IMMUNODIAGNOSTIC TECHNIQUES AND IVF

This is the second episode in this year's podcast series. Here we will explore the technical advancements in the medical field with respect to immunotherapy, immunodiagnostics and IVF. IVF is a type of assisted reproductive technology (ART) that help a lot of parents in realising their dream of experiencing parenthood. Immunodiagnostics is one of the most widely used techniques now in the medical field around the world. It is used for the detection of a number of diseases like cancer, HIV and HCV among many others. Immunotherapy is an advanced and promising procedure that offers a more targeted approach to treat diseases like cancer by harnessing the body's own immune system. These techniques although being promising but is still inaccessible to a vast majority of population due to its expense. These aspects are discussed thoroughly in this podcast.

Recitation by:

- Tania Banerjee (Third Year)
- Urjashi Chatterjee (Third Year)
- Aniket Deb (Fifth Year)

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