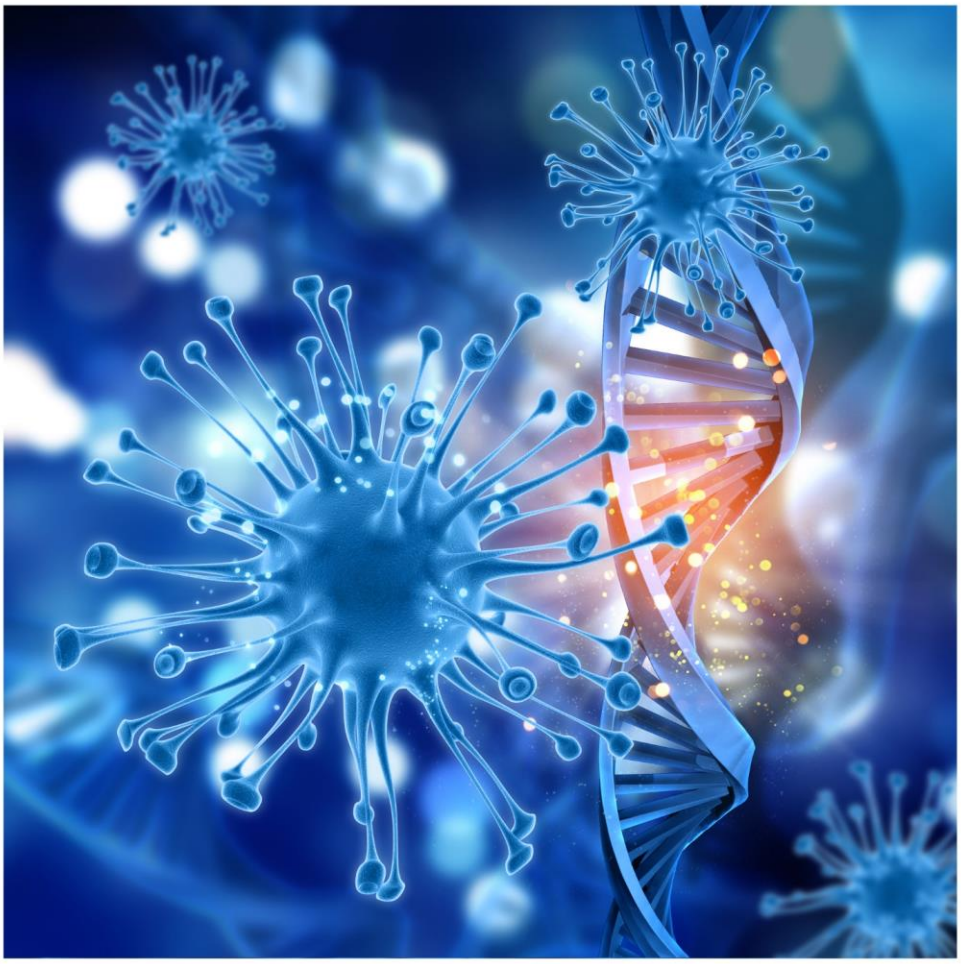
Second Edition: 2017-18

BIOKEMI 2018

The Essense of Life



DEPARTMENT OF BIOCHEMISTRY
SHIVAJI COLLEGE (UNIVERSITY OF DELHI)

MESSAGE FROM THE PRINCIPAL

I congratulate the Department of Biochemistry for launching the second edition of their Departmental magazine '***Biokemi***'. Our college motto *Amritam tu vidya* (Learning is an eternal process) inspires us to strive to help our students in expanding their learning from beyond the confines of the classroom and aid them in becoming bright, hardworking individuals who create a place of their own in the world. *Biokemi* provides the students with the unique opportunity to apply their academic knowledge and mould it into a platform for expressing their perception of science and infusing creativity into it.

As Henry Ford said beautifully, '*Coming together is a beginning, keeping together is progress, working together is success*'. The launch of the second edition of *Biokemi* provides grounds for me to believe that, as an institution, we are heading forward towards success. Turning their academic knowledge about cells and their metabolic processes into activities ranging from interesting articles to scientific jokes that can tickle anyone's funny bones illustrate the students' understanding of the key concepts behind the most intriguing puzzles of life and demonstrate their capabilities as future scientists and leaders of the world.

I congratulate the editorial board and the faculty of the Department of Biochemistry of Shivaji College for their resolution and sedulity towards taking a step ahead in the never-ending journey of biology in the form of the second edition of *Biokemi*. I wish them best of luck for all their future aspirations.

Dr. Shashi Nijhawan

Principal, Shivaji College

MESSAGE FROM THE KEYNOTE SPEAKER

Knowledge is power. Information is liberating.
Education is the premise of progress, in every society, in every family.
Kofi Annan

It fills me with immense pleasure to know that the Department of Biochemistry of Shivaji College has successfully published the second edition of its departmental magazine ***Biokemi***, which is being released on the occasion of their annual academic festival '**BIOCHAPERONES 2K18**'.

I am certain that *Biokemi* has been, and will continue to be, a great learning experience for all the students of Department of Biochemistry as it will provide them with the opportunity to express their scientific temperament in the form of scientific literature, pertaining to not only their prescribed syllabus, but also their specific areas of interest.

I appreciate the efforts of the editorial board and faculty members wish the college success in all their future endeavours.

Dr. Manu Anantpadma

Staff Scientist, Virology and Immunology
Texas Biomedical Research Institute

FROM THE EDITOR'S DESK

To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.
Albert Einstein

It gives us immense pleasure to bring out the second edition of ***Biokemi,*** the science magazine of the department of Biochemistry, Shivaji College. Carrying forward our agenda of presenting scientific information clubbed with entertainment, this edition features variety of articles and soft features along with various activities carried out by faculty and students in the previous year.

Our vision for this magazine, is to provide the students with the opportunity to inspire students to express themselves scientifically and delve into the various aspects associated with publication of scientific literature. Through this magazine, the students would be able to expand their horizons from the specified curriculum to various topics which stimulated their curiosity and interests. It would also provide them with a platform for converging science, humor and art along with other aspects of science.

It is due to the untiring work, dedication and passion of the editorial board, faculty members and all the students of the department, that this magazine could come to fruition. We hope that our readers enjoy reading it as much as we enjoyed the process of preparing it and also attain newer insights into the word of science.

Dr. Jayita Thakur

Editor-in-Chief

FROM THE EDITORIAL BOARD

Welcome to the second edition of ***Biokemi***.

The legacy of *Biokemi* was created in 2017 and our previous editorial team did a lot of hard work in order to light the torch of our departmental magazine. We - the editorial team of 2018 - are carrying this legacy forward with immense pride in our hearts and presenting to you the second edition of *Biokemi* - The Departmental Magazine of Biochemistry department, Shivaji College, University of Delhi.

Biokemi was started keeping in mind the purpose of summarizing the events that had occurred not only inside our department but also the various advances made in science around the globe. Apart from various scientific articles, this issue also includes memes, quizzes and crosswords, prepared by students to make biochemistry even more fun! The students of Biochemistry department are not only excelling academically but also in the various extracurricular activities outside the department. We conclude this edition by enlisting all of these academic and extracurricular achievements.

We, the editorial team of Biokemi - 2018 with huge delight present this edition to you. Everyone from our department contributed towards the making of this magazine and we truly hope that you enjoy reading it and also receive it with utmost delight.

We express our gratitude towards the faculty of our department for their invaluable support and guidance. Without them this magazine would not have been possible in the first place.

Editorial Board (From left to right):

1st row: Ayush Ganguli, Maneshwar Dixit, Rohit Soni

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3rd row: Anisha Grover, Nibedita Roy, Kirti Sharma, Vikram Aditya, Aayush Srivastava, Ujjwal Goyal

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Bioinformatics: Scope and Challenges

Dr. Jayita Thakur, Assistant Professor
Department of Biochemistry, Shivaji College

Bioinformatics is like an amoeba; it comes in various shapes and sizes
Nancy Lorenzi

Bioinformatics is a scientific discipline that employs computer science, engineering and mathematical methodologies to visualize, analyze and manage data in the pursuit of new biological patterns, hypotheses and models[1]. It aids in conceptualization of biological sciences in terms of its constituent molecules and application of information techniques[2]. It includes database development, data management, software development (algorithm), modeling (simulation) and quantitative analysis. Though often described to be in its infancy, bioinformatics emerged with the advent of computers during the early 1960s. Even before DNA sequencing had become feasible, computational biologists sifted through the rapidly accumulation data obtained from protein biochemistry[3].

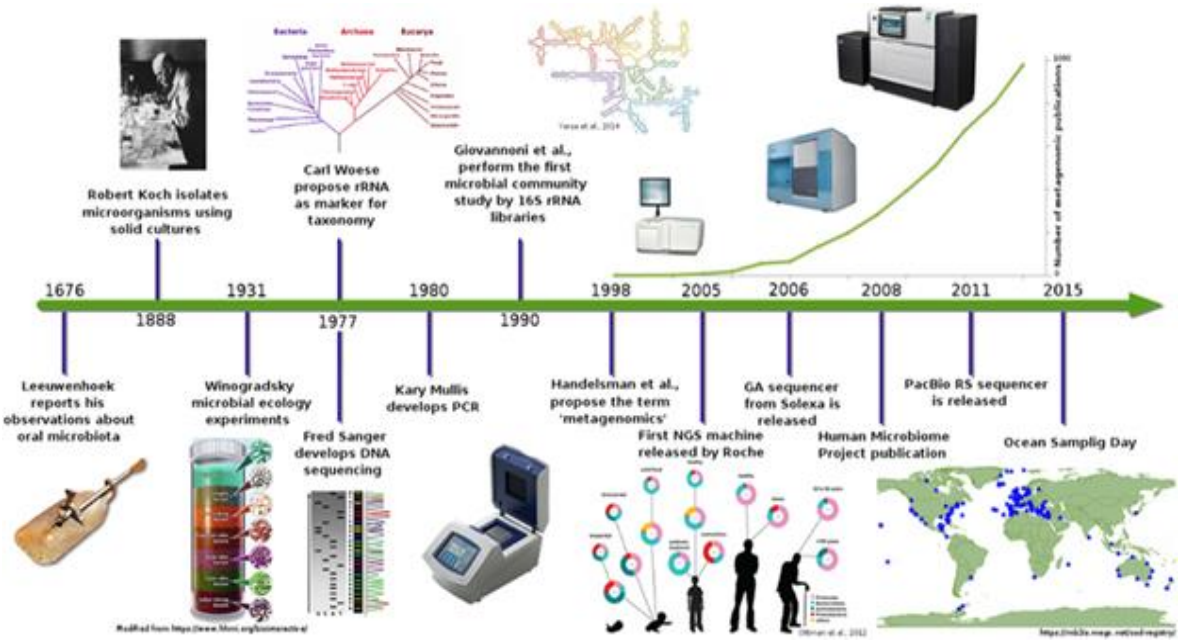

Fig. 1 Milestones and timeline in Metagenomics. Timeline showing advances in microbial communities studies from Leeuwenhoek to NGS (Ottman et al., 2012; Yarza et al., 2014)

It has become an integral part of research and development of biological sciences. Bioinformatics now has a central role deciphering genomic, transcriptomic and proteomic data that has been generated by high-throuput experimental technologies. The availability of the complete genome sequences of a large

number of organisms is enabling bioinformatics to provide both conceptual basis and practical methods for detecting the systemic functional behavior of the cells and organisms[4].

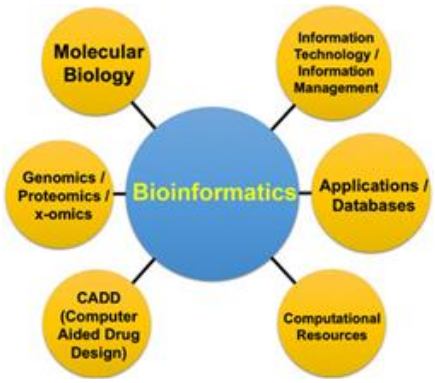

Fig. 2 Components of bioinformatics (Source: EPMA Journal)

The commencement of the Human Genome Project (HGP) alone yielded more than three billion DNA sequences, similarly the genetic databases generated with the sequences of various organisms, generated vast amounts of data which could be studied and interpreted using computational tools[5]. These databases can be freely accessed via the internet. The primary databases include EMBL at the European Bioinformatics Institute (EBI) at Cambridge, UK; GenBank at the National Institutes of Health (NIH) in the USA and the DNA Database of Japan (DDBJ) at Mishima in Japan[6]. The use of Bioinformatics for the characterization of proteins and their interactions with other proteins is crucial for Proteomics. Study of this nature is also referred to as *in silico* research[6].

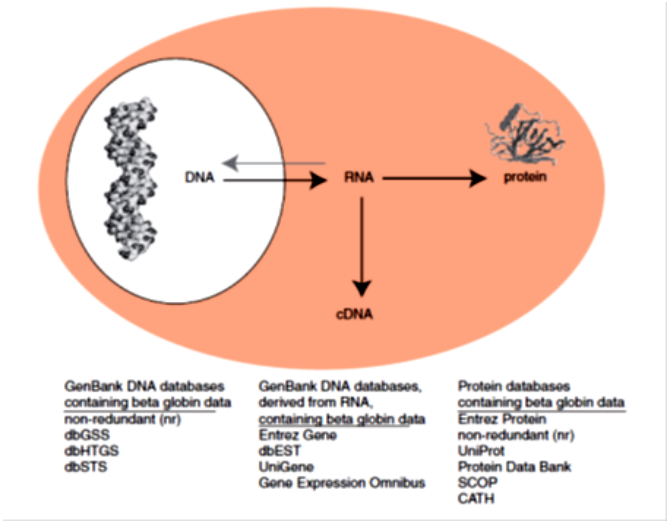

Table 1. Nucleic Acid and protein database resources available on the internet

Database or resource		URL (uniform resource locator)
General DNA sequence databases		
EMBL	European Bioinformatics Institute	<http://www.ebi.ac.uk>
GenBank	US genetic database resource	<http://www.ncbi.nlm.nih.gov>
DDBJ	Japanese genetic database	<http://www.ddbj.nig.ac.jp>
Protein sequence databases		
Swiss-Prot	European protein sequence database	<http://www.expasy.org>
UniProt TREMBL	European protein sequence database	<http://www.ebi.ac.uk/trembl>
Protein structure databases		
PDB	Protein structure database	<http://www.rcsb.org>
Genome project databases		
Human Genome Database, USA		<http://gdbwww.gdb.org>
dbEST	cDNA and partial sequences	<http://www.ncbi.nih.gov/dbEST/index.html>
Généthon	Genetic maps based on repeat markers	<http://www.genethon.fr>

One of the most commonly used bioinformatics resources is termed BLAST (Basic Local Alignment Search Tool), and is located at the NCBI (www.ncbi.nlm.nih.gov). This allows tool a DNA sequence to be submitted via the internet in order to compare it to all the sequences contained within a DNA database[6]. If human sequences are used and have already been mapped, it is possible to locate their specific position to a particular chromosome using NCBI Map Viewer. Further resources such as the ORF (open reading frame) finder allow a search to be undertaken for the ORFs.

Fig. 3 Types of sequence data in GenBank and other databases

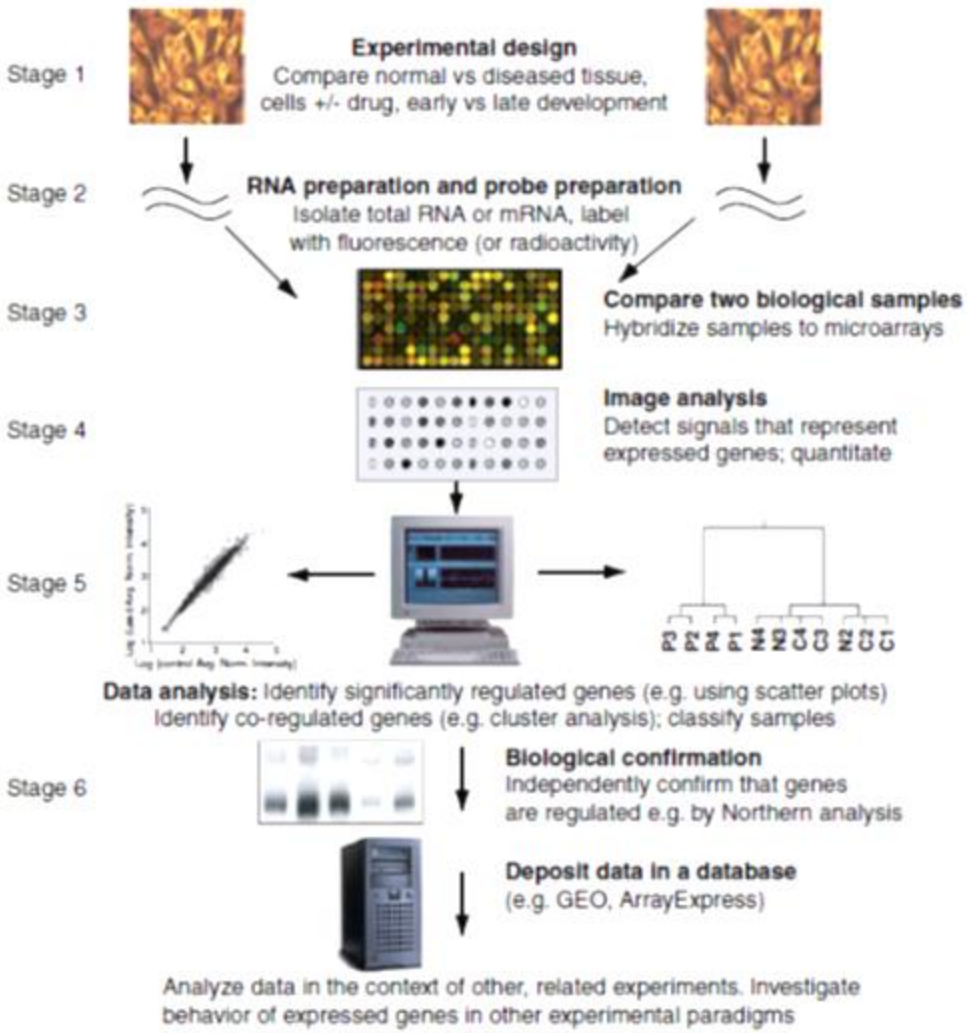

Fig. 5 Overview of the process of generating high throughput gene expression data using microarrays

While Bioinformatics is the answer to most Biocomputing issues, the analysis of challenges posed by bioinformatics and biomedical applications also need to considered.

(i) The data sources (e.g. experimental datasets, local and public biological databases);

(ii) Software tools (e.g. searching of protein sequences in protein databases, sequence alignment, biophysical simulations, data classification, etc.); and

(iii) High level models of application's requirements and results.

(iv) Expensive in terms of finance and infrastructure

From a computational point of view, bioinformatics and biomedical applications bring a wide range of challenges and a huge demand for computing power. The challenging issues involve large number and size of involved datasets, the complexity inherent in data analysis and simulations, the heterogeneous nature of the data, and the need for a secure infrastructure for processing private data.

Also, it is now evident that bioinformatics by itself cannot compensate for the lack of knowledge of biological processes such as knowing which factors would lead to a certain allergies or the development of an effective vaccine against HIV/AIDS or other reemerging diseases such as dengue, chikungunya, malaria, and others. But it does enable us to formulate experimentally verifiable hypotheses that may help us to understand and elucidate the biological processes and to guide the direction of conclusive experiments[8].

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- Fig. 1 https://www.researchgate.net/figure/Metagenomics-timeline-and-milestones-Timeline-showing-advances-in-microbial-communities_fig1_289524171
- Fig.2 https://www.researchgate.net/publication/282040422
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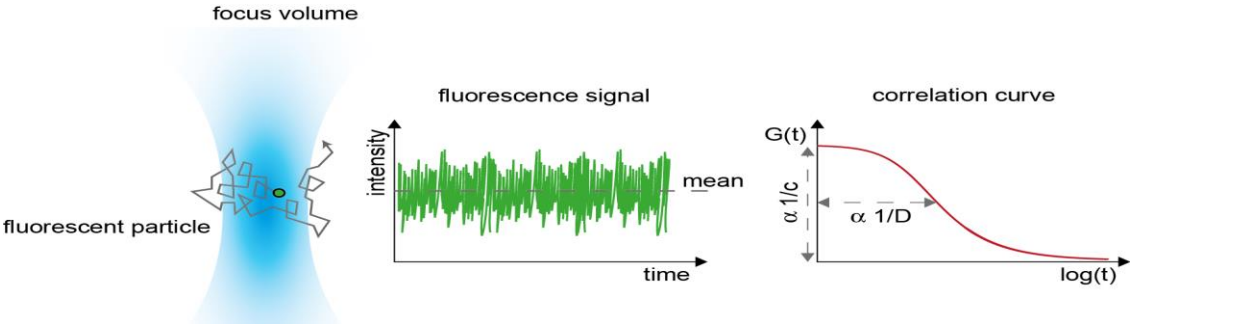
Fluorescence Correlation Spectroscopy: A tool yet to get its rightful due

Dr.V. A. Pratyusha
Assistant Professor (Ad-hoc)
Shivaji College

Fluorescence Correlation Spectroscopy or FCS was first shown in 1972 by Magde, Elson, and Webb [1–3]. Although it was not very popular in the biological community until a few years back, but recently it has gained immense popularity and is being used across disciplines from chemistry to biology, from oncology to membrane biology to signal transduction and so on. The high sensitivity of FCS makes it stand out from the conventional confocal imaging or FRAP or other well-known fluorescence and protein-protein interaction techniques. In FCS, the diffusion of a fluorescent probe is monitored in a small confocal volume, of the order of ~1 fL. The fluorescence signal observed depends on the diffusion of the particle, when sufficiently diluted. This is because, when the sample is sufficiently dilute, at a time, only one (or few) molecules are able to enter the confocal volume. Hence, the fluorescence observed depends on the diffusional dynamics of the fluorescent molecule; giving rise to fluctuations in the fluorescence signal. On the other hand, if many fluorophores are present in a single sample, as in a concentrated sample, they can mask the fluctuations in the fluorescence intensity of each fluorophore, making it difficult to interpret the diffusion of a single molecule Larger the particle, slower will be the diffusion and vice-a-versa (Figure 1).



BioQuant (DKFZ-German Cancer Research Centre)

Figure 1: A schematic showing how FCS (Fluoroscence Correlation Spectroscopy) works.

FCS is used directly or indirectly in a variety of biological applications. For instance, aggregation of the fluorescent particle or a fluorescently tagged protein under particular conditions will give a slow diffusion time and can be studied. Similarly, if one of the reactants of a reaction is fluorescent, and there is a change in fluorescence in the product, then the fluorescence cross correlation can be used wherein two lasers are employed and we can monitor the formation of the product. The beauty of this technique is that it can be adapted and used across disciplines, from chemical sciences to biological sciences, as per the need. People have studied intercalation of various dyes in DNA [4] to formation of amyloid β oligomers in case of Parkinson's disease [5,6] to signaling pathways on modeled membranes [7] and uncovered quite a lot of useful information.

FCS differs from other fluorescent techniques in the sense that the main focus is not on the emission intensity, but on the fluctuations in the intensity caused by minute deviations in the system under study.

When the technique was developed initially by Elson and Webb, it still had poor signal to noise ration because of inefficient background suppression and low detection efficiency. Rigler and his team combined FCS with confocal detection which is used in most experiments till date [8]. The incoming laser is strongly focused by a high numerical aperture objective (NA ≥ 0.9) to a diffraction limited stop (Figure 2). So, only the few fluorophores in the illuminated region are excited, which significantly improves the signal to noise ratio.

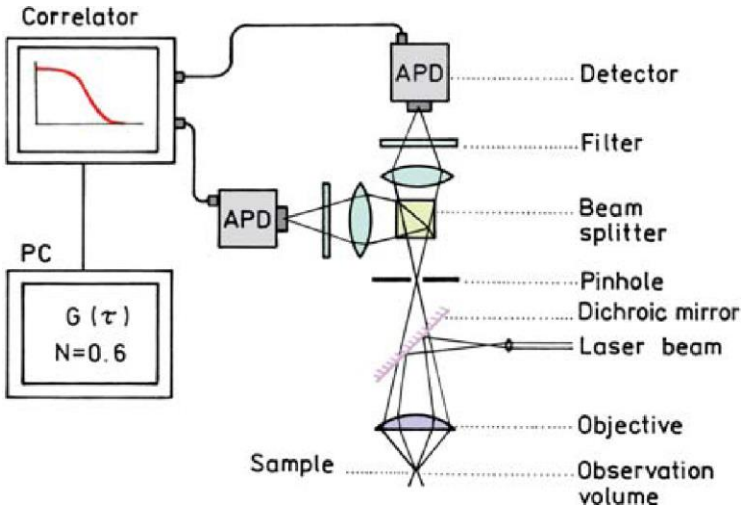


Figure 2: A typical FCS set up. [9]

A typical FCS setup has a laser which is reflected into an objective via a dichroic mirror (Figure 2). The laser beam is focused on the sample, which is dilute enough such that there are about 1-10 particles in the confocal volume of ~1 fL. When the particles cross the focal volume, they fluoresce and give a peak. This signal reaches the detector, a photomultiplier tube, an avalanche photodiode detector or a superconducting nanowire single-photon detector. The resulting electronic signal can be analyzed as an intensity versus time or special correlator cards can be used to give the autocorrelation (or cross- correlation directly. The parameters of interest can be determined after fitting the autocorrelation curve to the desired mathematical model. Also these days, dual color cross correlation is also used to study systems where diffusion times differ by a very small magnitude by exciting the sample with two different lasers and the fluorescent signal is cross correlated to get a direct measure of the reaction efficiency. Other modifications that can be applied to FCS are as follows:

Fluorescence cross-correlation spectroscopy

Two color fluorescence cross-correlation spectroscopy (FCCS) is used to measure interactions by cross-correlating two or more fluorescent laser signals. This distinguishes interactions more sensitively than FCS, particularly when the mass change in the reaction is small. This is particularly useful when studying protein-protein interactions.

FRET-FCS

Here there are two types of fluorescent probes, with a single channel and light is only detected when the two probes are very close, such that there is an interaction between the two. The FRET signal is weaker than with fluorescence, but has the advantage that there is only signal during a reaction.

Scanning FCS

Here the confocal volume is moved across the sample, thereby scanning the sample for correlation. This is mainly used tracking protein translocation in live cells.

Having got a brief overview of this unique fluorescent technique, it is clear how versatile how this can be modulated according to the need of the experiment and can provide a plethora of information; ranging from pH of the surrounding microenvironment to the exact orientation of the molecule in the cell to the dynamics of a protein in vivo under different conditions to physical interaction between any two proteins of interest to name just a few. Also, membrane proteins which were hitherto difficult to study can now be accessed by these techniques. Moreover, since the size of a majority of these fluorescent tags are small in size, they do not disturb much of the natural microenvironment of the concerned membrane protein. Also, to study a protein from scratch, or even a membrane protein, FLIM can be performed initially to check for its exact localization; which could be followed by anisotropy to check for its orientation in the membrane, and then FCS and FRET and other techniques. So these fluorescent techniques that are coming up now can provide so much information without using complex techniques like NMR etc.

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"Pathophysiology of Hepatic Stellate Cell: Alcoholic & Non Alcoholic Fatty Liver Diseases"

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Introduction:

Alcoholic liver disease (ALD) and non-alcoholic fatty liver disease (NAFLD) are the most common cause of steatohepatitis and cirrhosis. Hepatic fibrosis and subsequent cirrhosis results from chronic liver injury, which may be caused by excessive alcohol consumption, hepatitis B and C, autoimmune hepatitis, or NASH. This review summarizes the pathogenesis of activation of hepatic stellate cell on alcoholic and non-alcoholic fatty liver disease.

Alcoholic and Non Alcoholic liver diseases:

Alcoholic liver disease can develop by consuming excessive (>40 g/day) amount of alcohol whereas NAFLD is characterized by the deposition of hepatic fat in patients who did not take or drink alcohol <20 g /day. NAFLD is associated strongly with features of the metabolic syndrome including abdominal obesity, insulin resistance or type2 diabetes mellitus (T2DM), and atherogenic dyslipidemia[1]. Alcohol consumption deregulates lipid synthesis and metabolism, resulting in steatosis. Obesity is a common underlying risk factor for both disorders[2]. The pathogenesis of alcoholic liver disease and non-alcoholic fatty liver disease is a dynamic unknown process. This includes the ethanol metabolism-associated oxidative stress, ethanol-mediated induction of leakage of gut endotoxins and activation of Kupffer cells.
Bacterial intestinal flora is itself responsible for the production of endogenous ethanol through the fermentation of carbohydrates *(fig1).* The intestinal metabolism of alcohol produces a high concentration of toxic acetaldehyde that alters gut permeability and microflora. Furthermore, it causes direct hepatocyte damage and long term consumption of alcohol modifies gut microbiota and specially an increment in gram negative bacteria. Endotoxin, a toxic lipopolysaccharide (LPS) component of Gram negative bacteria, is released in the circulation as a result of increased intestinal permeability caused by alcohol[3].

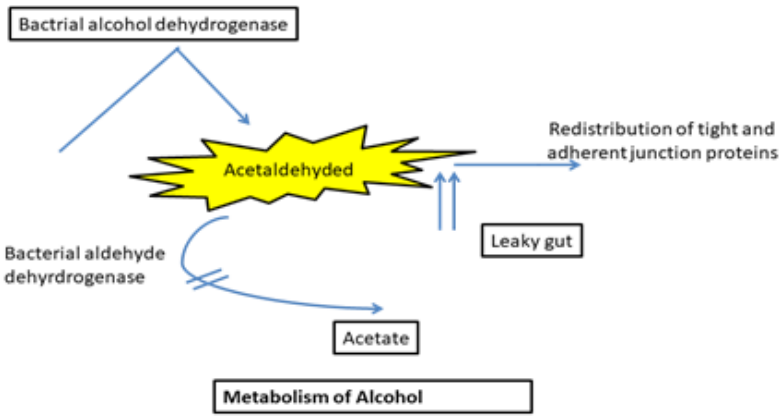


Fig.1. *Metabolism of Alcohol.*

Endotoxin stimulates Hepatic stellate cell activation:

Recent studies on perisinusoidal hepatic stellate cells (HSCs) also known as Ito cells or lipocytes are located in the perisinusoidal space of Disse beneath the endothelial barrier and represent 5 to 8% of all liver cells. Stellate cells are involved in collagen deposition and develop liver fibrosis. During liver injury, perisinusoidal HSC undergo a striking morphologic and functional transition ("activation") from a "quiescent" storing cell to a "myofibroblast-like" phenotype with pro-fibrogenic (i.e. increased secretion of extracellular matrix constituents that collectively form the hepatic scar), contractile immuno-modulatory and migratory potential [4].

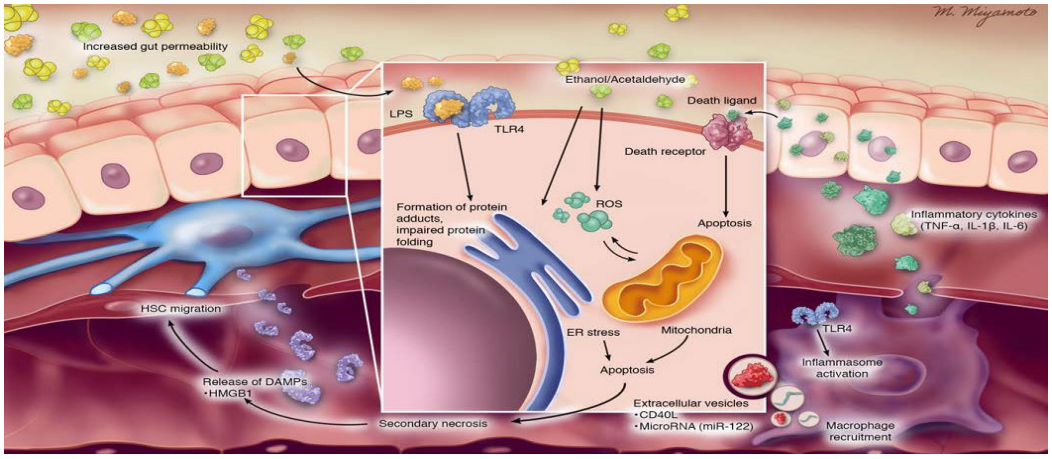


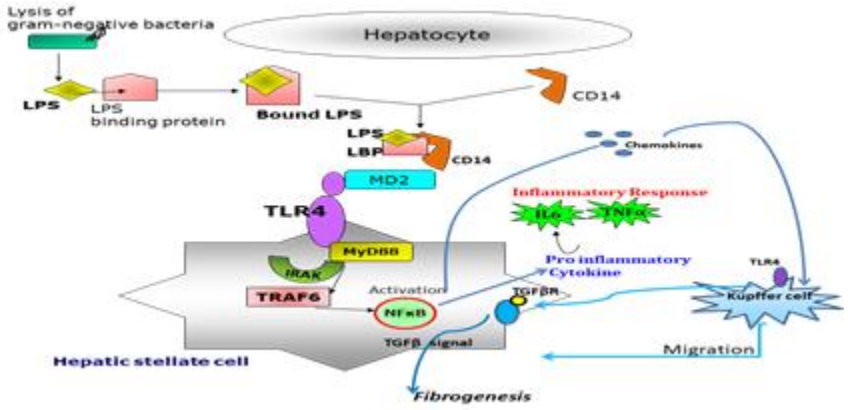
Fig.2. *Pathogenesis of alcoholic liver disease. HSCs proliferate and undergo a dramatic phenotypical activation, secreting large amounts of extracellular matrix proteins. (Vijay Shah et al, 2017)*

Endotoxin LPS form complex of LBP (LPS-binding protein)- CD14- TLR4 receptor on Kupffer cells and produce proinflammatory cytokines, such as TNF-α, leading to hepatocyte damage. This complex also produces ROS reactive oxygen species, NO and leading oxidative stress. Oxidative stress is a prime mediator of alcohol induced liver injury, in which both cellular and circulating innate immune components are activated *(fig2).* Oxidative stress stimulates hepatocyte necrosis and sensitizes them to tumour necrosis factor-alpha (TNF-α) mediated apoptosis. It also promotes release of pro-fibrotic cytokines and collagen by activating hepatic stellate cell (HSCs) [5].

TLR associated with endotoxin and gut liver axis:

TLRs and have long been recognized to be critical determinants in the pathogenesis of cirrhosis. Every type of liver cell expresses specific TLR: TLR1 is found in hepatocytes, TLR2, and 4 in hepatic stellate cells, bile duct epithelium and particularly in Kupffer cells. TLR are identified in mammalian cell, TLR2 and TLR4 are highly expressed in cell that respond to LPS. Both receptors can induce activation of cells through nuclear factor-κ (NF-κB). Initially, cellular transfection experiments suggested TLR2 as the LPS receptor for CD14/LBP-dependent activation of cells. TLR2 respond both gram negative and gram positive bacteria; in contrast, the TLR4 is specific for gram-negative bacteria. Signaling through TLR4 requires MD-2, which is a secreted protein closely associated with the extracellular domain of TLR4 [6]. Hepatic stellate cells (HSCs) are located in the space of Disse and are the principal cellular source for the production of extracellular matrix proteins, such as collagen type I, III, and IV in the liver. Upon liver injury, gut flora-derived LPS stimulates TLR4 on HSCs followed by chemokine production and downregulating TGFβ pseudoreceptor, bone morphogenetic protein and activin membrane bound inhibitor (Bambi) *(Fig3).* Simultaneously, Kupffer cells produce TGFβ, which stimulates unrestricted

TGFβ receptor signaling on HSCs leading to fibrosis. Collectively that leads to HSC activation and TLR4 or TNFα stimulation is reported to upregulate TLR2 expression in HSCs [7].



(Fig3). Scheme representation of lipopolysaccaride bind LBP and form TLR4/CD14 complex for release of proinflammatory cytokine.

Probiotic therpy for altered Gut microbiota in ALD and NAFLD:

Live microorganism which, when consumed in adequate amount, confer a healthy benefit on the host beyond basic nutrition that always reduced tissue damage. Probiotic microflora displays numerous health benefits beyond providing basic nutritional value. They cooperatively maintain a delicate balance between the gastrointestinal tract and immune system. When this balance is disrupted; disease and inflammation results [8]. Endogenous probiotic bacteria of the gut such as *Bifidobacterium* and *Lactobacillus* play a vital role in maintaining the intestinal mucosal barrier[9]. Probiotic bacteria found in the 8-strain preparation VSL#3 containing *Streptococcus thermophilus, Bifidobacteria, Lactobacillus acidophilus, L. plantarum, L. casei, L. debrueckii bulgaricus*, and *Streptococcus faecum* have been shown to modulate intestinal epithelial barrier function and cytokine secretion through effects on epithelial cells and modulation of the NF-κB and PPARγ pathways (32-35). The administration of probiotic bacteria has been shown to reduce the translocation of pathogenic bacteria and reduce tissue damage in various animal injury models[10].

Conclusion:

Various literatures suggest that the disruption of gut barrier function was found through bacterial translocation and increase in endotoxin in the liver. Modulation of TLR and production of proinflammatory cytokines are the main cause of activation of Hepatic Stellate cell and fibroneogenesis, which leads to chronic liver disease. Probiotics are more effective in protecting gut microflora against LPS-induced TLR4 activated ALD and NAFLD. It also improves the activation of quiescent Hepatic Stellate cells and gut liver injury. The study supports the efficacy of probiotic in the reduction of liver fibrosis.

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Why is Vermiform Appendix still considered a Vestigial Organ?

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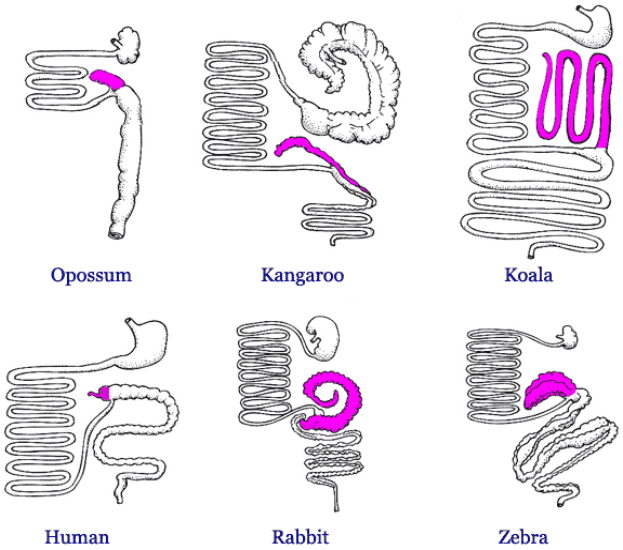
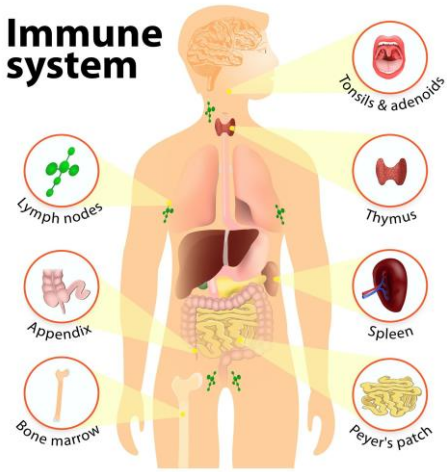


Introduction: The Vermiform appendix, *aka* appendix, is identified as a GALT i.e. Gut Associated Lymphoid Tissue and an important constituent of not only mammalian mucosal immune function, but also B-cell mediated immune response and extrathymically derived T-cells. This usually ignored structure



helps in the proper removal of waste matter from the digestive system, acts as a storehouse for healthy gut bacteria, and might even produce early defences via the immune system that prevent deadly diseases. It is also proposed that the appendix may provide more immune defences to the body from invading pathogens and fetching the lymphatic system's B and T cells to fight the viruses and bacteria that infect that portion of the bowel as well as training them, so that the body's immune responses are targeted and more able to reliably and less dangerously fight off such pathogens. In spite of these functions, vermiform appendix is considered a vestigial organ in humans. Let's see how the notion of appendix being vestigial started, and why it is still considered to be a vestigial organ in humans.

History: The idea that the vermiform appendix is a vestigial organ originated when Charles Darwin, in his book *The Descent of Man, and Selection in Relation to Sex*, stated that early primates used vermiform appendix to digest leaves, so it gradually became vestigial as humans began shifting towards cereals and meat as their food source. This theory was also supported by the presence of very long cecum in herbivores, such as koala and horse. But the biggest push to this theory was provided by Vinay Kumar and colleagues (in 1989) who, as stated in their book *Robbins' Pathologic basis of Diseases (4th edition)*, removed vermiform appendix from the bodies of patients, but were unable to find any side-effects. This helped the notion that vermiform appendix is vestigial spread like a forest fire.

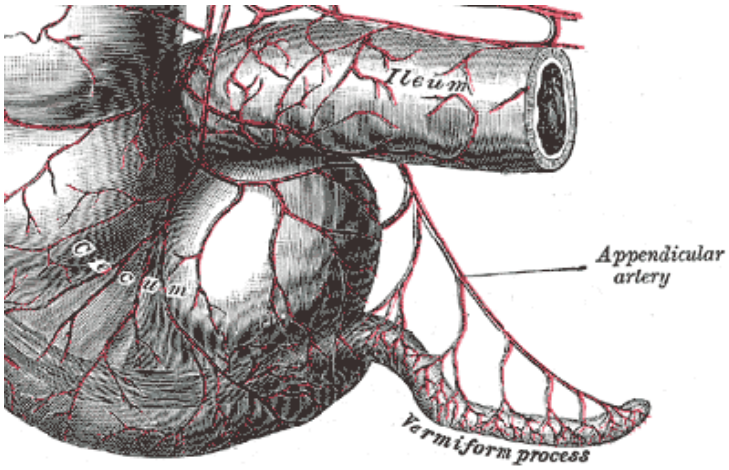
However, this theory got its first challenge when W. Parker, R. R. Bollinger and colleagues, in 2007, suggested that the vermiform appendix acts as a safe house for healthy gut bacteria when illness, like diarrhoea, flushes most of them out of the body. It was based on the understanding, established separately by J. L. Sonnenburg and colleagues and M. L. Everett and colleagues in 2004, about how the immune system supports the growth of healthy intestinal bacteria which, in turn, came from the studies of Rob Dunn which showed that individuals without an appendix were four times more likely to have a recurrence of *Clostridium difficile* colitis.

Later, studies by Aliya Zahid (in 2004) and Lucile C. Rankin and colleagues (in 2016) gave large support for identification of vermiform appendix to be more related to immune system than the digestive system in humans. Also, research by M. Laurin and colleagues (2011) and H. F. Smith and colleagues (2013) concluded that, during the course of human evolution, the vermiform appendix has evolved 38 times and lost as many as 6 times, suggesting that it has a selective advantage in many situations and strongly argues against its vestigial nature.

Conclusion: To have a better idea of why vermiform appendix is still considered a vestigial organ, let us look at the definition of *vestigiality* as stated by Bernard Delahousse and Martin Meganck (2009):

> *Vestigiality is the retention during the process of evolution of genetically determined structures or attributes that have lost some or all of their ancestral function in a given species.*

What becomes clear from this definition is that vestigial is a relative term, not an absolute one i.e. something can be vestigial when compared to its original function, or, to put it in simpler words, something is vestigial when it does not perform its original function, not when it does not perform *any* function. Now, as is known since Darwin's time, vermiform appendix no longer performs its *original* function of digestion of leaves in humans. Thus, no matter how important vermiform appendix might be in other functions in the human body, it will be considered vestigial forever (or as long as it does not disappear completely by further evolution).



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Vitamin B_{17} and Cancer

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There's been a lot of debate about the so-called 'vitamin B_{17}' lately. Although much of the scientific world seems quite ignorant about this topic, conspiracy theorists and pseudoscientists have been pushing this topic into layman minds for years. What exactly is this *vitamin B_{17}* and what is the whole scenario about? Let's have a closer look at the bigger picture.

Fig: News article claiming amygdalin as cancer cure

To begin with, there is no such thing as *vitamin B_{17}* in the first place. It is a term given to the compound Amygdalin (or Laetrile), which is not a vitamin, as noted by Lerner, 1981[2]. Indeed, amygdalin is poisonous for humans since its metabolism inside the body leads to production of cyanide[3]. So how did a poisonous substance come to be called as a vitamin?

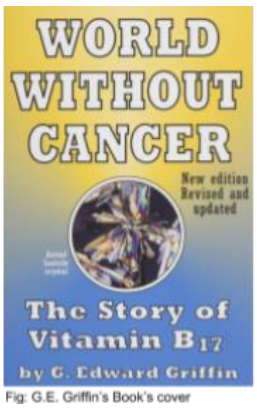

Fig: G.E. Griffin's Book's cover

Looking back: All this began when Ernest Krebs Jr. modified amygdalin to make laetrile and rebranded it as a vitamin to get through the (then) new FDA drug regulations, just to be able to sell it as a diet supplement instead of a medicine[4]. Much before that, Ernest Krebs Sr. had formulated a theory in the 1920s, suggesting that amygdalin could indeed kill cancer cells[5]. This notion was carried forward by his son, Ernest Krebs Jr. albeit Krebs Sr. himself deemed amygdalin too dangerous for human consumption. This theory got some great support by 'leaked' data (which could never be reproduced) claiming laetrile as a potential anti-cancer agent[6], in 1973 by a public relations officer at Sloan Ketterings Hospital, appointed by NIH for performing a series of laetrile trials. But the most prominent thing still keeping this debate alive is a book *World without Cancer: the Story of Vitamin B_{17}* by G. E. Griffin, reviewed by *Dr.* Ernest Krebs Jr. himself.

What its supposed to do: According to all the papers, amygdalin/laetrile works via following mechanisms of action[7]:

- There is higher expression of β-glucuronidase as well as β-glucosidase in malignant cells than normal cells, which makes them more vulnerable to effects of laetrile.

- Cancer is actually caused due to deficiency of laetrile (‘vitamin B_{17}’) since laetrile is required by all cells to restore their health.
- Cyanide released by metabolism of laetrile increases the acid content (or decreases pH) of neoplastic cells,thereby rupturing their lysosomes, which then release their content and kill cancer cells and arrest tumor growth.
- Laetrile is proposed to increase the red blood cell count of blood, be an effective treatment of sickle cell anaemia, cure parasitic diseases, help maintain the gut fauna, cause lowering of blood pressure and relieve arthritis.

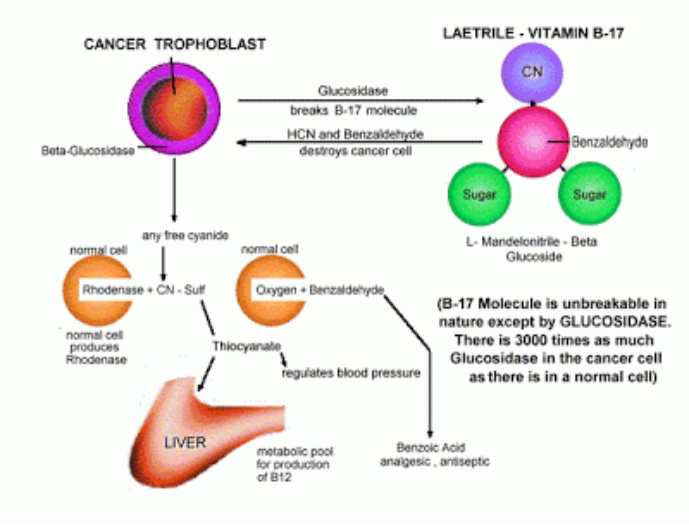

Fig: how amygdalin is supposed to cure thyroid cancer

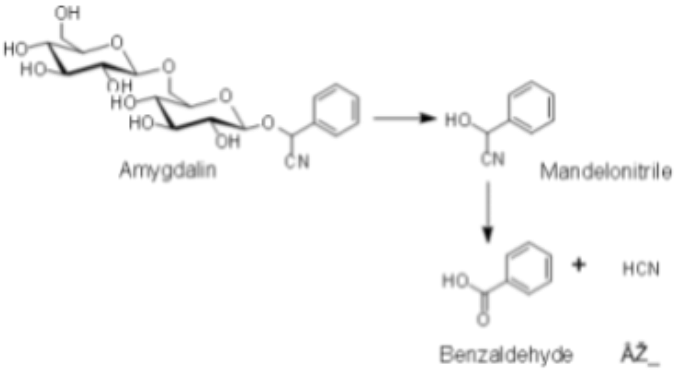

Fig: how amygdalin metabolism causes cyanide poisoning

What it Actually does: All clinical tests have concluded that laetrile is indeed poisonous to humans due to accumulation of cyanide[8,9], and that its use has, in fact, led to several number of deaths worldwide[10]. When laetrile is ingested, the enzymes β-glucosidase and amygdalase break it down into glucose and L-mandelonitrile. L-mandelonitrile is then broken down into benzaldehyde and cyanide, leading to cyanide poisoning[11].

When taken under the acceptable daily intake limit of 0.05 mg/kg body weight[12], enzymes like rhodanese easily convert the CN^- ion into SCN^- ion, which is harmless to the body. But since a single apricot seed contains enough amygdalin to produce 0.5 mg cyanide[13], a typical intake often exceeds this limit and leads to cyanide poisoning.

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POVERTY CHANGES PEOPLE’S DNA

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Draped in shabby drabs, frail and ailing, in dingy shells, lies 23.7% of India’s population, bearing a curse to their lineage. The statistic might not sound alarming but a sight of their inadequate living condition is frightful indeed. Poverty poses a major challenge to our country’s growth. In a report issued by UNICEF, India is home to 30% of almost 385 million children living in extreme poverty i.e. about 25% of our nation’s building blocks are subjected to resource scarcity.

Poverty, over years, has debilitated people physically, socially, mentally and now according to a report published in the journal *Molecular Psychiatry*[1], has even had cost them their genes!

Children from impoverished families are more prone to mental illness, and alterations in DNA structure could be to blame, according to a study published on 24 May 2016 in *Molecular Psychiatry*[1]. Different stressors that accompany poverty, such as malnourishment, increased prevalence of substance abuse and the general struggle to survive can affect a child's development, particularly in the brain, where the structure of areas involved in response to stress and decision-making have been linked to low socioeconomic status. Poor children are more predisposed to mental illnesses such as depression than children from financially and socially sound families. Studies suggest that prenatal exposure to stressors might be linked to low cognitive control and flexibility amongst them. Some of these differences are clearly visible in the brain structure and seem to appear at birth.

Neuroscientist Ahmad Hariri of Duke University in Durham, North Carolina, has proposed that continual exposure to inadequate biological and environmental conditions might affect older children as well. He decided to test this idea by studying chemical tags known as methyl groups, which alter DNA structure to regulate how genes are expressed. There is some evidence that methylation patterns can be passed down through generations, but they are also altered by environmental factors, such as smoking.

To correlate his proposal with increased chances of depression, the scientist along with his team worked on a gene called SLC6A4 that transcribes a protein whose identified task is to transport molecule serotonin into neurons. Gene SLC6A4 has too been associated with depression. Any alteration done to the above mentioned gene is associated with increased activity of a part of the brain involved in the 'fight or flight' response and panic attacks. The team worked on 132 adolescents aged between 11 and 15 over a period of two years and recorded changes in the gene SLC64A. They found that children from deprived backgrounds had more methylation in this region compared to children who had appropriate access to resources. The methylation near the gene has caused low levels of serotonin transporter's production leading to low levels of serotonin available to the brain-a condition linked to depression.

A yet another experiment conducted by Dan Notterman, a molecular biologist at Princeton University, reveals that telomeres, DNA sequences found at the end of chromosomes are shortened in children living in extreme poverty, beckoning increased chances of DNA damage. "This research shows how clear the links between epigenetics, behaviour and socioeconomic status are"- says Dr Dan Notterman

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ARE THE GREAT PERSONALITIES ALWAYS MAD OR IS IT THEIR MADNESS WHICH MAKES THEM GREAT?

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'Great men are not born great, it is their madness which grows…'

Madness, according to the basic oxford dictionary means to be insane or to have severe mental disorder and if someone is suffering from such disorders he/she can't even react to basic stimulus.

So, the question lies here that, is it necessary for great personalities to be a little whacko or is it their insanity which makes them great. A number of scientists from Edison to Darwin, from Benjamin to Lincoln all suffered from some type of mental disorders. In other words, if you see letters dancing on the blackboard, like Ishaan of Taare zameen par, you could be well on your way to have your name on the list of greats .

Did a disorder motivate such people to become great in some field or if related to the superstitious world, it can be said that, as we know God has made all of us equal, so as these people have a disorder, God gives them a special ability to compensate this loss. Or maybe human brain is simply not equipped to cope with the kind of brilliance they are born with.

Is it really practical and possible to think that it is their insanity which makes them DIFFERENT from commoners or is it their DIFFERENCE which makes them insane. A number of explanations can be cited to explain this phenomenon, however we must remember that in order to become great adequate amount of hard work and dedication is required and not a 'disorder'. And after all, these people are great because they are the best in their fields and not necessarily because they suffer from a disorder

Researchers have found that there is a very thin line between genius and madness because somehow they share the same *genes*. Psychologists have discovered that exceptional and creative people possess a *gene* in common, that is also linked to psychosis and depression. They believe that the findings could explain why "geniuses" like Vincent van Gogh and Sylvia Plath displayed such destructive behaviour.

This *gene*, which is called neuregulin 1, plays a vital role in development of the brain. However, a variant of it is also associated with mental illnesses such as schizophrenia and bipolar disorder. A group of volunteers who considered themselves to be highly creative and accomplished were recruited by scientists from Semmelweis University in Hungary. Volunteers with the specific variant of this *gene* were more likely to have higher scores on the creativity assessment and also greater lifetime creative achievements than volunteers with a different form of the *gene*

People who can be bipolar in a possible future tend to be creative when they're coming out of deep depression," Fallon said. When a bipolar patient's mood improves, his brain activity shifts, too: activity dies down in the lower part of a brain region called the frontal lobe, and flares up in a higher part of that lobe. Ironically, this shift happens when people have bouts of creativity. "There is this nexus between these circuits that have to do with bipolar and creativity," Fallon said

“MADNESS and GENIUS” , the relationship between these two words is quite hazy, and not everyone who's mad is a genius. Not everyone who's a genius is mad. Keeping the scientific part aside, it’s very difficult to contest the correlation of madness and genius in more practical terms. I suppose that’s why Aristotle once said, “no great mind has ever existed without a touch of madness.” As it was once told that, “there is a link between creative genius and madness with both schizophrenia and bipolar disorder frequent in highly selective and intelligent people.”

According to world renowned researcher Waugh, a very specific gene – referred to as DARPP-32 – allegedly connects genius and madness. A trans version of this *gene* that “enhances the ability to think and perform various tasks with higher folds of efficiency. Importantly, elevated use of DARPP-32 in the brain was linked with higher intellectual levels in the carrier, however, “preliminary analysis indicated that this variant was also associated with an increased risk of schizophrenia.”

The various molecular factors that are associated with many mental disorders but are present in many healthy people may have an higher order of thinking enabling them to think more creatively. Researcher Dr Szabolcs Kéri said that this is the first study to show that a genetic variant associated with psychosis may have some beneficial functions.The study was published in the journal Psychological Science

A clinical psychologist and professor at Johns Hopkins University School of Medicine, said the papers of some scientific studies focuses on the notion of the "tortured genius." Out of the many types of psychosis, creativity has appeared to be most strongly related to mood disorders, and especially bipolar disorder, For example, one study tested the intelligence of 800,000 Swedish 15-year-olds & then followed up a decade later to find out which of them had developed mental illnesses. The shocking results were published in 2014. "They found that children who excelled at the age of 15 years were four times as likely to go on to develop bipolar disorder.

Hence, summarizing the idea of finding a relationship between these two words, “MADNESS & GENIUS”.... Which are having vast differences in their meanings yet an uncanny resemblance to each

other is nothing but short of a miracle. As it was said by cosmologist Janna Levin, “Every advance of intellect beyond the ordinary measure, as an abnormal development, disposes to madness.”

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Deinococcus radiodurans: Conan the bacterium

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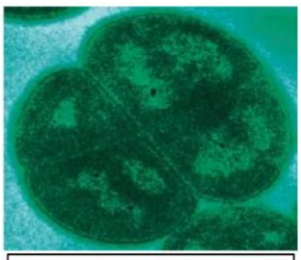
The tag for the most epic, mind boggling bacterium in the world is definitely claimed by *Deinococcus radiodurans* [1,2]. *D. radiodurans* managed to make it into the Guinness Book of World Records which is quite the feat in the field of microbiology and is pretty close to being invulnerable. It can withstand upto 5000 Grays of ionising radiation. But luckily, it has no pathogenic qualities. In fact, there is no proof of it ecologically interacting with any other organism.

D. radiodurans is an extremophilic bacteria present all over the world and can survive extreme cold, heat, dehydration, vacuum as well as oxidising agents.

It was isolated by Arthur W. Anderson in 1956 while conducting experiments to determine whether canned food could be sterilised using high doses of gamma radiations.

Cell and genomic structure

D. radiodurans is a large, spherical and red pigmented bacterium (with a diameter of 1.5-3.5 µm) that usually grows in pairs or tetrads [3]. It is gram positive although it has a complex outer cell membrane that is somewhat similar to the gram negative microbes and can replicate in 80 minutes. It is non sporulating, non motile, obligate aerobic chemoorganoheterotroph. It is multi genomic and in its stationary phase contains four copies of the genome whereas during multiplication, each bacterium contains 8-10 copies of the genome. Its genome consists of two circular chromosomes, a megaplasmid and one smaller plasmid [4].



Spherical tetrad shape of D. radiodurans. From NCBI Genome Project

Mechanism of radiation resistance

Deinococcus accomplishes its resistance to radiation by having multiple copies of its genome and rapid DNA repair mechanisms [5]. It usually repairs breaks in its chromosomes within 12–24 hours by a 2-step process. DNA damage, apart from base mutations, occurs in two forms: single - strand breaks and double - strand breaks. Genome sequencing and scientific research has shown that *D. radiodurans* use simple repair systems much more efficiently along with expanded systems involved in salvage [6].

It uses four types of repair mechanisms to fix breaks:

1. Homologous Recombination

It uses an intact copy of the DNA as a template to fill in or fix the break or the mutated section of the DNA.

2. Extended synthesis-dependent strand annealing

This also employs an existing copy of DNA to connect and build DNA from fragments.

3. Single-strand annealing

It synthesises mudding sections on a strand using another copy of DNA.

4. Non homologous end joining

This type of repair does not require another copy of DNA. But, in this broken strands are recognised and proteins join the ends together.

Other than these mechanisms, *D. radiodurans* also has many traits that help in resisting radiation damage and help in repair [7]. The thick, complex outer cell membrane helps protect against radiation damage. Also, their DNA is densely packed, preventing loss of damaged fragments of DNA. Multiple copies of their genome provide templates for DNA repair. Lastly, the presence of manganese [8] in its cytoplasm prevents protein oxidation.

In 2009, nitric oxide was reported to play an important role in the bacterium's recovery from radiation exposure: the gas is required for division and proliferation after DNA damage has been repaired. A gene was described that increases nitric oxide production after UV radiation, and in the absence of this gene, the bacteria were still able to repair DNA damage, but would not grow.

Applications to Biotechnology

A lot of research is being done on the possible uses of *D. radiodurans* in bioremediation. Currently, the organisms that are used for chemical and biological clean-up are not resistant to radiation. Since *D. radiodurans* is very resistant to radiation, scientists are interested in using the bacteria to clean up waste sites containing hazardous materials [9]. *D. radiodurans* is already known to be able to break down solvents such as toluene, but work needs to be done to try and make the bacteria capable of breaking down other compounds and materials that are common at radioactive waste sites. Strains of *D. radiodurans* have been created with a gene cloned into them providing ionic mercury resistance. This allows them to not only flourish in these radioactive sites but to grow on ionic mercury and detoxify it, helping remediate these waste sites. Other researchers have engineered strains of these bacteria to express acid phosphatase, which allows the remediation of aqueous nuclear waste that results from reprocessing spent fuel rods (heavy in beta and gamma radiation), and another gene to precipitate uranium.

Research is being done for post-apocalyptic data storage in such microbes. One scientist has already created a patent for storing information in a manner that would survive a nuclear apocalypse. Commenting on how "bones and stone erode, paper disintegrates, and electronic memory degrades," Pak Chung Wong *et al*. describe the process for storing information in DNA inside of bacteria such as *D. radiodurans*.

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Cryo-ET made way for the discovery of a new structure in the tails of the human sperms

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BSc. (Hons.) Biochemistry, 1st year

Spirals discovered at the tip of sperm tail-help in preventing their growing and shrinking, while swimming-conservation of their energy-a new way for the fertility experiments.

You may be thinking that you have studied it all in your high school, but scientists have uncovered something unanticipated – a whole new structure on the wriggly guy's tip using an imaging trick that combines electron microscopy with the 'slice-by-slice' action of CT scans. Researchers at the University of Gothenburg in Sweden and the University of Colorado have identified a tiny structure at the very end of the sperm's tail that wax earlier unobserved. Its actual function is still unclear, but the team think it could help us understand why some little swimmers are stronger than others.

Human sperms are incredibly important for reproduction. It is therefore a need to have detailed knowledge about their structure.

What is a sperm and what is its function?

Sperm, also called **spermatozoon,** plural **spermatozoa**, male reproductive cell, produced by most animals. The sperm unites with or fertilises an ovum (egg) of the female to produce a new offspring. Mature sperms have two distinct parts, a head and a tail.

In humans, the sperm head is four to five micrometers long and two to three micrometers wide. Its head has half the no. of chromosomes i.e. 23.The sperm carries X or Y chromosome which determines the sex of the future child.

Acrosome cap is present at the head of the sperm cell which contain enzymes which help the sperm in entering the ovum. A small middle portion of the sperm (mid-piece) contains the mitochondria. The tail of the sperm, also called as the flagellum, is a slender and has hair like bundle of filaments that connects to the head and middle portion of the sperm. The tail is about 50 micrometers long; its thickness is of one micrometer near the mitochondria and it gradually diminishes to less than one-half micrometer at the end of the tail. The tail gives movement to the sperm cell. It whips and undulates so that the cell can travel to the egg.

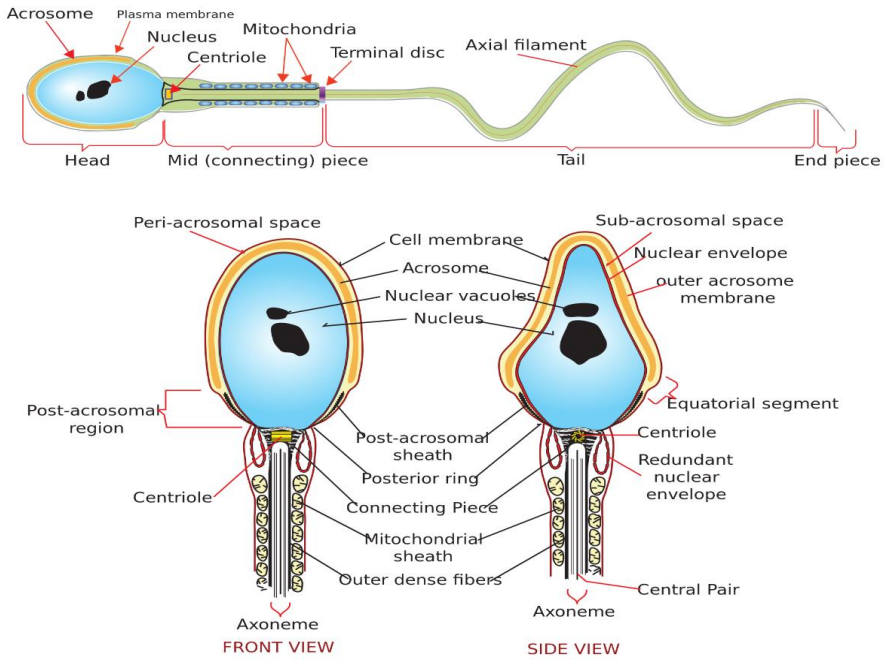

Fig. 1: Diagram of a human sperm cell

The discovery:

There is a lot known about protozoa as many studies have been done on them. But there is very less information on human cells. This research started because the researchers wanted to determine the 3D structure of the human sperm and to get a better idea of how the sperm cells work.

Researchers were able to produce 3D images of the extremely small cellular structures of the sperm using the Nobel winning Cryo-Electron Tomography. The method for which Joachim Frank, Jacques Dubochet and Richard Henderson were awarded a Nobel Prize in 2017, produces 3D images of cellular structures.

"Since the cells were frozen in ice,
without the addition of chemicals which obscure the smallest cell structures, even the
individual proteins inside the cell can be observed" explains Johanna Höög, a researcher
at the University of Gothenburg's Department of Chemistry and Molecular Biology. Using this
technology we can freeze tiny structures, such as sperm, and take a series of 2D pictures that can later be combined to make a detailed 3D image.

"When we looked at the first 3D images of the tip of a sperm tail, we spotted something we had never seen before inside the microtubules: spiral that stretched in from the tip of the sperm and was about a tenth of the length of the tail.", said the head of the team.

A sperm tail has many types of building blocks that build up three sections: the mid-piece, the propeller and a small terminus at the tip.

In the propeller, there are proteins called tubulins that form long tubes (microtubules) to make up more complex structures. Thousands of motor proteins - molecules that can move, are affixed to these tubes.

The motor proteins in the sperm tail pull and the tail bends as motor proteins are attached to one motor protein roll over the other, enabling the sperm to swim. "It's actually quite incredible that it can work," study senior researcher Johanna Höög, a researcher in the Department of Chemistry and Molecular Biology at the University of Gothenburg, in Sweden, said in a statement. "The movement of thousands of motor proteins has to be coordinated in the minutest of detail in order for the sperm to be able to swim," said Johanna. Inside these microtubules is where researchers spotted a cellular structure wound into a left-handed helix. The researchers published their findings as scientific reports.

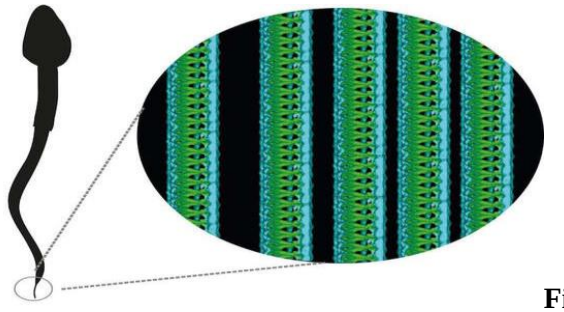

Fig. 2: The left-handed helix present on the tip of the sperm tail. (CREDIT: University of Gothenburg)

The researchers named the helix as: a Tail Axoneme Intra-Lumenal Spiral(TAILS).The function of TAILS is still unclear but scientists are guessing and researching for the same.

"We believe that this spiral may act as a cork inside the microtubules, preventing them from growing and shrinking as they would normally do, and instead allowing the sperm's energy to be fully focused on swimming quickly towards the egg," said Davide Zabeo, the lead author behind the discovery, in a statement.

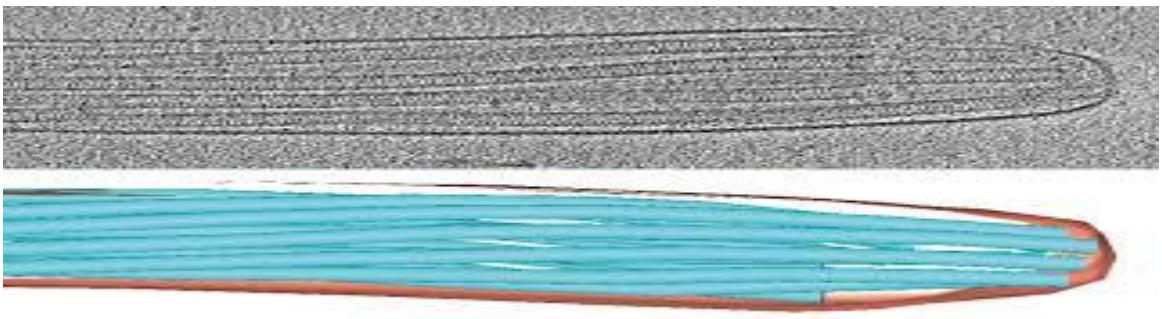

Fig. 2: A 3D model of the sperm tip shown in panel B. The microtubules are shown in turquoise, the membrane in brown. (Credit: University of Gothenburg)

The researchers also surmised in their study that the structure can make the sperm to move rapidly in the right direction. Some more research needs to be done to clear up its role in sperm motility.

Advantage-

While there are many causes of infertility among men, abnormal tails of sperms (ciliopathy), is one of the contributing factors, in many cases.

To reduce the potential global male crisis, every little bit of information can help to diagnose the infertility causes due to slow sperms. Various drugs can be made using such findings, which would ultimately help to treat conception problems and infertility.

It also makes us wonder just how many other hidden structures of our bodies are waiting to be discovered. It is customary in science that often a discovery raises more questions than answers: what is its function? what is it made of? We'll just have to wait, think and discover.

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7. https://medicalxpress.com/news/2018-02-human-sperm-tails.html

EATING BACTERIA HELPS TO LOSE WEIGHT

Rohit Soni
B.Sc. (H) Biochemistry, 2nd year

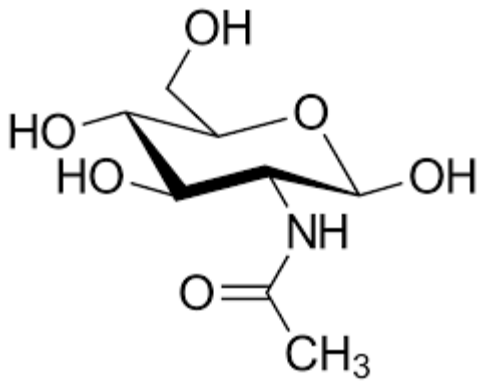

Figure-N-acetylphosphotidylethanolamine

Forget about spending three hours in a gym doing strenuous exercise in order to lose weight; scientists have developed microbes that make corpuscles which inhibit hunger. Now losing weight will be as simple as drinking water laced with bacteria.

As quoted by WHO, over 90 million people around the globe are overweight or obese. Many people take fat-burning pills in an attempt to lose weight in a very small amount of time, but the results are highly variable, and these pills have to be taken regularly. The need of the hour was to create a drug that would not be needed every few hours.

The investigator resolved this by modifying the genes of probiotic microflora so that it produced molecules of N-Acetylphosphatidylethanolamines (NAPEs) .

N-acetylphosphatidylethanolamines (NAPEs) are a relatively abundant group of plasma lipids of unknown physiological significance. It was observed that NAPEs are secreted into circulation from the small intestine in response to ingested fat.

Also, it was found that administration of NAPE in the rats decreased their food intake without causing conditioned taste aversion.

Furthermore, It was seen that C_{14}-radiolabeled NAPE enters the brain and is particularly concentrated in the hypothalamus and intracerebroventricular system. An infusion of even nanomolar amounts of NAPE reduces food intake, collectively suggesting that its effects may be mediated through direct interactions with the central nervous system. Finally, chronic NAPE infusion results in a reduction of both food intake and body weight, suggesting that long term exposure to NAPE is probably a novel therapeutic target for the treatment of obesity.

In the near future, you might simply take a pill containing some bacteria that would release NAPE in your stomach. The remedial bacteria would live in the stomach for months and provide a firm current of Anti-obesity drugs.

The investigators want to genetically modify the bacteria so that they are not transmitted from one person to another, before administering them for human trials. This will prevent the bacteria from entering the body of someone who doesn't want them.

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Use of cyanobacteria for the treatment of heart attack

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B.Sc (Hons) Biochemistry, 2nd year

According to a WHO report more than 17.7 million people in the world die due to heart attack per year and this rate is incredibly increasing worldwide.
Heart attacks are mainly due to obstructive flow of blood towards heart due to blockage in coronary artery this condition is also called cardiac ischemia. During heart attack the muscle is trying to pump oxygen so that the heart muscles can work properly but due to obstruction carbon dioxide accumulates this causes heart attack. To resolve this issue scientists are trying to find new ways to deliver oxygen to the heart.
Scientists have found that using cyanobacteria and illuminating them with light triggers photosynthesis inside the heart, this will lead to release of Oxygen by Photolysis of water takes place which will fulfill the need of heart muscle's oxygen requirement.

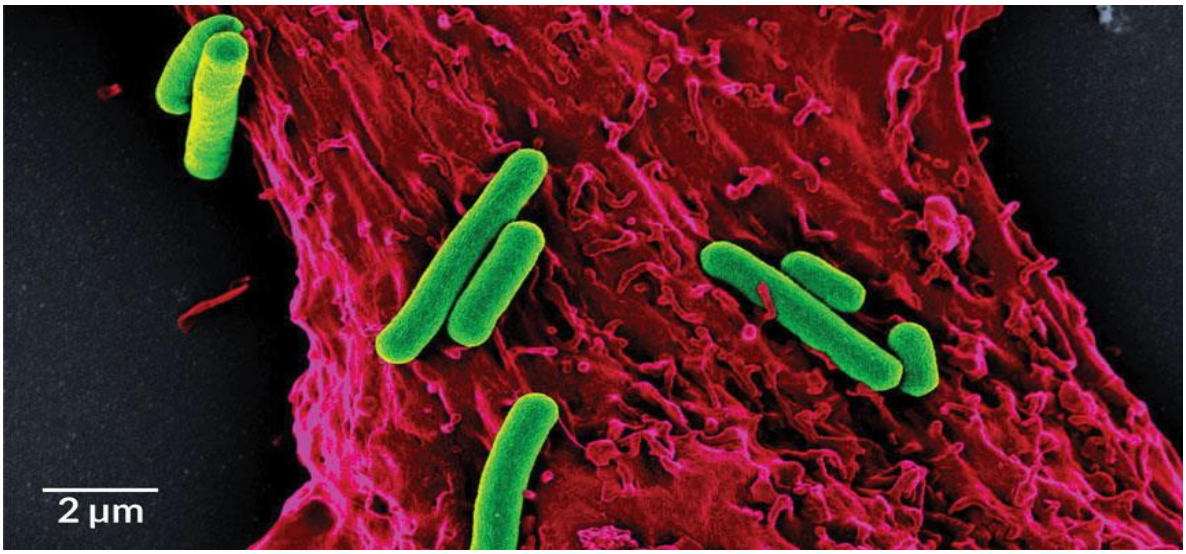

figure-Cyanobacterium

Scientists injected cyanobacteria into the hearts of anaesthetized rats with cardiac disease. Using light to trigger photosynthesis, they were able to increase the flow of oxygen and improve heart function.

Dr. Joseph woo who is working on this system quoted that *"The beauty of this system is that it's a recycling system and when we supply the carbon dioxide to bacteria, they take up the carbon dioxide, and with the energy from the light, and they form oxygen*"

Cyanobacteria have a more rough structure necessary for living in water. Another experiment was performed where they injected the cyanobacteria into the beating hearts of anaesthetized rats with cardiac ischemia. They then compared the function of diseased rat's heart with the hearts exposed to light to those who were kept in the dark and the results were astonishing and profitable.

The group that received the cyanobacteria and light had more oxygen and the heart working better than normal. The bacteria spread out within 24 hours, but the improved cardiac function continued for at least four weeks.

This experiment can resolve the problems of heart attack and save millions and millions of precious life.

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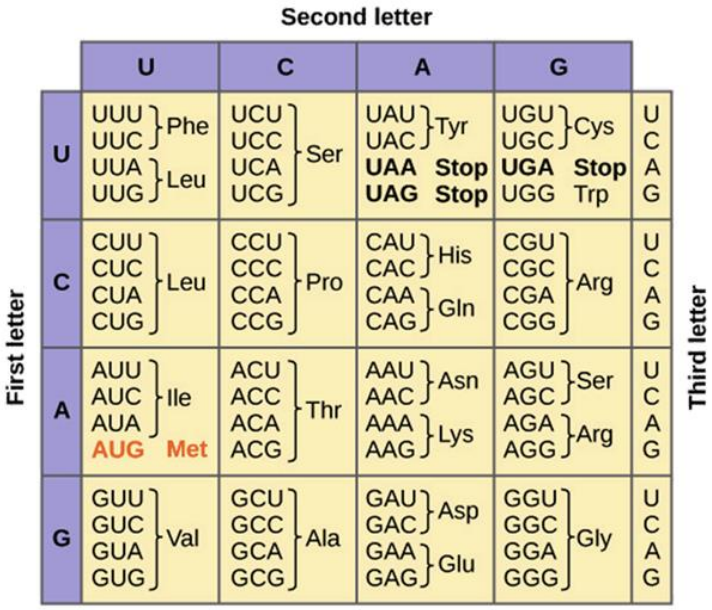
Why there are three stop codons and only one start codon in an mRNA?

Harsimran Kaur

B.Sc. (Hons.) Biochemistry, 3rd year



We all are familiar with the central dogma which states that DNA is transcribed into mRNA and this transcribed mRNA consists of codons according to which amino acids are added and protein is translated. The question here is not regarding the processes and how they are performed within a cell but about why there is only one start codon AUG coding for Methionine whereas there are three stop codons UAA, UAG and UGA not coding for any amino acid?

Primarily presence of three stop codons compared to one stop codon has an evolutionary significance. If a frameshift mutation occurs in the DNA hence in mRNA the probability that this mutated mRNA subscript will have a stop codon within the protein coding region is high as compared to if there was only one stop codon. This leads to premature termination of a futile translation cycle because of the frameshift in the mRNA. It was observed that in some archaea there is only one stop codon and other codons UAG and UGA are coding for Pyrrolysine and Selenocysteine whereas there are four stop codons in some vertebrae mitochondria. This further establishes the fact that maybe in the primitive organism there was only one stop codon but further during evolution this number was increased to reduce the production of unwanted protein.

This hypothesis was further tested by a group of scientists who established this fact by applying the binomial theorem and estimating the probability of finding a stop codon within a frame shifted mutated mRNA. There calculations that on every 15 codons the probability of finding a stop codon is increased to 50% and at 96 codons it becomes more than 90%. If there is only one stop codon probability is very less it becomes 50% after 45 codons [1].
They further substantiated the above theoretical data by analyzing a *Drosophila* chromosome with frameshift mutation. The data observed in the real genome was even higher than the calculated value for reading a frameshifted stop codon at every 13 codons becomes 50% [2]. They attributed this increase to the AT richness of the Drosophila DNA as compared to GC richness.

Also, the same reason explains the phenomenon of only one start codon. The presence of only one start codon reduces the probability of having a start codon between the coding regions of an mRNA due to frameshift mutation i.e. further reducing the chances of a futile translation cycle.
An explanation for the relative absence of Cytosine in the start and stop codons is because it is easily delaminated to form Uracil or thymine (from 5-methylcytosine).

The reason for this difference in the number of start and stop codons is to avoid any futile protein production which takes up a lot of cell's energy. Further, a large amount of energy will be wasted to degrade these unwanted proteins, to avoid all of this hassle cells evolved and increased the number of stop codons compared to start codons.

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Predatory Journalism: An introduction and measures to avoid

Harsimran Kaur
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Predatory journalism a term first coined by Jeffrey Beall, a librarian at the University of Colorado in Denver; described it as mediocre publishing houses that is offering publication in exchange for an article processing charge (APC) and fail to provide basic facility of Peer review and editing to authors because of lack of a true editorial board. They publish papers with little regard to the quality of the scientific paper.

To fulfill the current need of quantity of scientific papers rather than the quality scholars are often trapped by these predatory journals. These predatory journals often publish journals covering variety of areas so as to capture large number of scholars from different areas.
The problem with predatory journalism is it pollutes the scientific literature with scientific papers with little or no reproducible data as their sole purpose for being a publishing house is monetary benefits from the scholars, so no paper is rejected by them. But because they care about the funding from the scholar

and not the quality of paper Peer review and editing is often avoided. This poses major threat to science in general because the experiments cannot be reproduced and the data present is often fake.
''Peer review is at the heart of academic evaluation. Publishing without peer review [while pretending that peer review was done] gives poor and mediocre academics a chance for jobs and promotions which should go to better qualified researchers," says Prof. Sunil Mukhi, J.C. Bose Fellow and Chair, Physics Programme, IISER Pune.''

Hence it becomes really important for the researchers to be careful and avoid Predatory journals. Given are some points that researchers can keep in mind while going for a publication:

1. The editors are often not from the same area of expertise as the journal itself.
2. The contact us information only includes email also self-proclaimed as the
3. Many people have not heard about it.
4. The name of journal does not justify its origin i.e. including a country's name in the journal's name whereas no editor is from that country.
5. There is no proper indexing and these predatory journals are filled with mediocre papers.
6. The website is poorly maintained and includes many dead links.

These are some of the facts which should be kept in mind when sending a journal a research paper. Predatory journalism poses real danger to the science as it is increasing day by day. Often providing last resort to the scholars whose papers are rejected from the leading journals but these should be avoided as they pollute the scientific literature with hoax data.

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A New Form Of Matter-Superionic Water Ice

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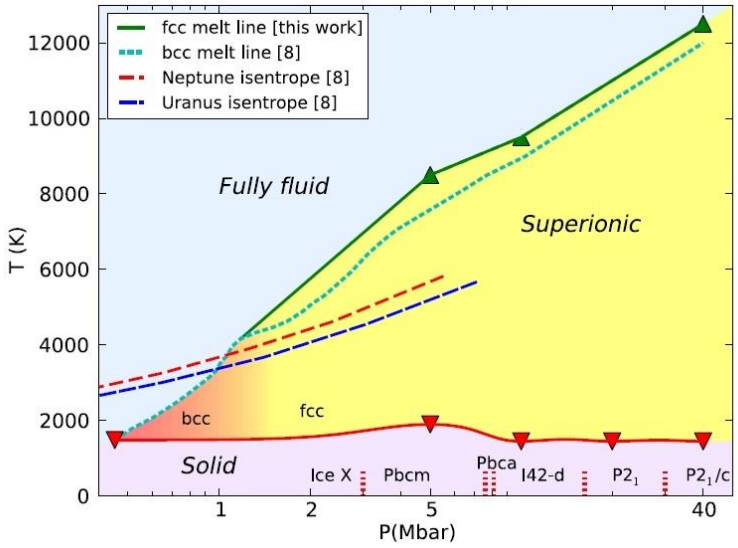

Fig. 1: Graph showing the tempertaure-pressure curve for the formation of Supersonic Water Ice.

Great piece of intelligence has made something which is really phenomenal I.e. a new form of matter known as *Superionic Water Ice*[1]. The speciality of it is that it acts like a cross between a solid and a liquid. This means that it has properties of liquid as well as solid at the same time plus some added unique properties which make it different from both liquid and solid. According to a report from The New York Times[2], it is a fluid formed from hydrogen ions running through a lattice of oxygen atom.

This lattice was formed due excessive compression of water. This compression was achieved by passing water between two diamonds while simultaneously zapping it with laser. This results in enormous rise in pressure which is equivalent to more than a million times the earth's atmospheric pressure. The temperature is also increased simultaneously to thousands of degrees.

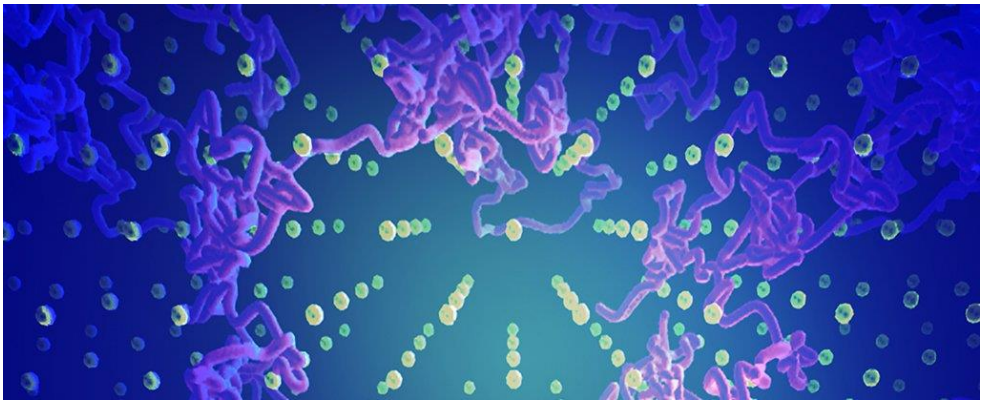

Fig. 2: Figure showing the motion of hydrogen ions over lattice of oxygen.

According to a report in Nature Physics Journal[3] this kind of water doesn't exist naturally on earth. Superionic water was previously theoretical, but predictions were made about its properties[4]. If it were present on Earth, it would rapidly decompress and explode. Under the conditions theorized to cause water to enter the phase, it is believed that superionic water would be as hard as iron and would glow yellow.

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Defying the Biological Law Of Aging

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Adult naked mole rats have a daily chance of dying of about one in 10,000.

National Geographic Creative/Alamy Stock Photo

It is well said, "*Exceptions are always there in nature*". Recently, naked mole rats[1] were reported to support this quote. Naked mole rats are burrowing rodents[2] with wrinkled pink skin,and large protruding teeth that live in large, subterranean colonies. The uniqueness[3]

of these animals lies in their resistance towards cancer and to some sort of pain along with their ability to survive for up to 18 minutes without oxygen.

Comparative biologist Rochelle Buffenstein, who has studied the animals for more than 30 years, surprised the scientific community with her studies, showing that these creature rarely show signs of aging.

The law of Benjamin Gompertz states that the risk of dying rises exponentially with age. For instance, in humans, it doubles roughly every 8 years after the age of 30, and applies to all mammals after adulthood. But Rochelle reported that for each animal in her care, she recorded the date of birth and death date and was astonished to found that naked mole rats outrule the Biological Law of Aging. After attaining sexual maturity (at 6 months of age), it stays the same the rest of their lives. Standardizing mice, based on their size, naked mole rats would not be expected to live past 6 years while, breaking expectations, some live as long as 30 years and females even remain fertile at that age.

All the credit goes to their very active DNA repair system and high expression level of chaperones, proteins which assist other proteins in folding correctly. One more hypothesis supporting their immortality says that the animals keep their cells clean and damage-free rather than accumulating them, which would cause physical deterioration with age.

The big mystery now is what, and how, happens in these animals after sexual maturity and age of 20 to 30 years. There may be chances that aging does happen, but only much later than usually seen in mammals. This mystery is still unresolved but the data is quite interesting regarding our understanding of molecular biology and aging.

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A prospective treatment: Stem Cell Therapy for Alzheimer’s disease

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Introduction: Alzheimer's disease (AD) is a progressive neurodegenerative disease which is associated with loss of cognitive function of brain such as memory, reasoning, thinking etc. it is the most common form of dementia i.e. a decline in memory or thinking skills. This disease generally occurs in middle age or old age. Initially it develops slowly with symptoms being disorientation and memory loss but later it gets worse as functions of brain declines and eventually results in brain cells die.

Stem Cell Therapy (SCT) is one of the treatment which is recently used to cure the effects of AD. Stem cells are undifferentiated (unspecialized) cells that have ability to differentiate into other cells and self - regenerating cells. They are self – renewing cells and maintain their own population level by cell division. These cells divide to produce two daughter cells at a time in which one remains a stem cell and other one gets differentiates in other cell types. This serves as a source for production of differentiated cells throughout life. Stem cells remains inactive for a long time till they enter cell division again. For the first time in 1981, researchers could isolate stem cells from mouse embryos. After that mouse stem cells led to discovery of methods for separation of stem cells from the human embryo in 1998. In most tissues, stem cells are rare. The ideal scientific outcome is to treat cancer at the level of stem cells. Stem cell transplantation through cell replacement or as vector for gene delivery is a potential strategy for the treatment of neurodegenerative diseases like Alzheimer's disease.

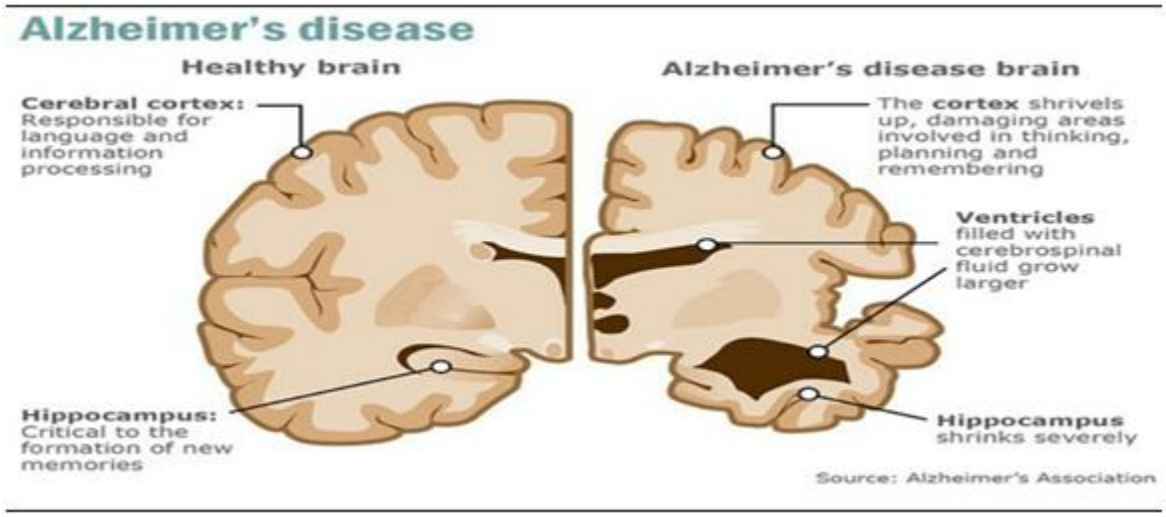

Fig.1: Figure showing the difference of a healthy brain and an Alzheimer's disease brain

History: In the year 1907, A German psychiatrist and neurologist Dr. Alois Alzheimer observed the brain of a woman who recently died Of dementia by autopsy which revealed that the reason behind the symptoms of diseases are formation of abnormal clumps of amyloid plaque and tangled bundle of fibres. After this he named it as Alzheimer's disease in 1910. After the discovery of this disease in cognitive measurement scales was done and recognized Alzheimer as the common form of dementia.

Mechanism: Mechanism starts when the protein produced by neurons of CNS called APP (ATP- binding precursor protein) which then converted to amyloid beta protein Amyloid beta (A beta). Alzheimer's disease is due to increased accumulation of this protein which is derived from proteolytic cleavage of APP. Increased abnormal production of this protein results in imbalance between level of amyloid beta production, aggregation and clearance. Clearance of amyloid beta is mediated by proteolytic

enzymes(neprilysin),chaperones molecules(apoE),lysosomal and non- lysosomal pathways. Failure of clearance mechanism in sporadic AD by mutation results in accumulation of amyloid beta which is then converted to amyloid beta oligomers constitutes the principle component of plaque , it generally occurs in age of 60-70 years. Developing models have shown overexpression of mutant APP in combination with mutant PS1. Many studies have shown various processes like signaling protein(fyn kinase, glycogen synthase kinase 3 beta , and cyclin dependent kinase 5) are involved in neurodegenerative progression of AD. Abnormally activated signaling pathway that results into synaptic failure by promoting abnormal Tau phosphorylation.

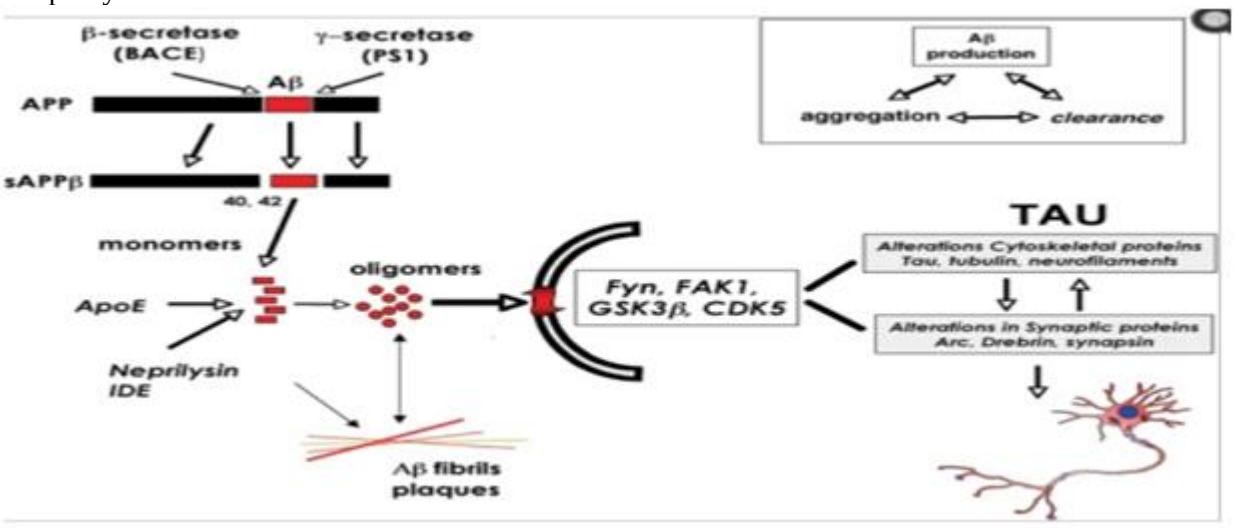

Fig. 2: Figure showing APP mechanism and signaling involvement in mechanism of synaptic damage in AD

AD is also linked with the hyperactivation of the CDK5 and its activator p35& p25 which results in increased level of CDK5 .CDK5 plays an important role in synaptic plasticity. A neuronal development study shown that destabilization of microtubules involved A beta /CDK5 neurotoxic pathway since CDK5 associated with microtubules indirectly with its substrate MAPs

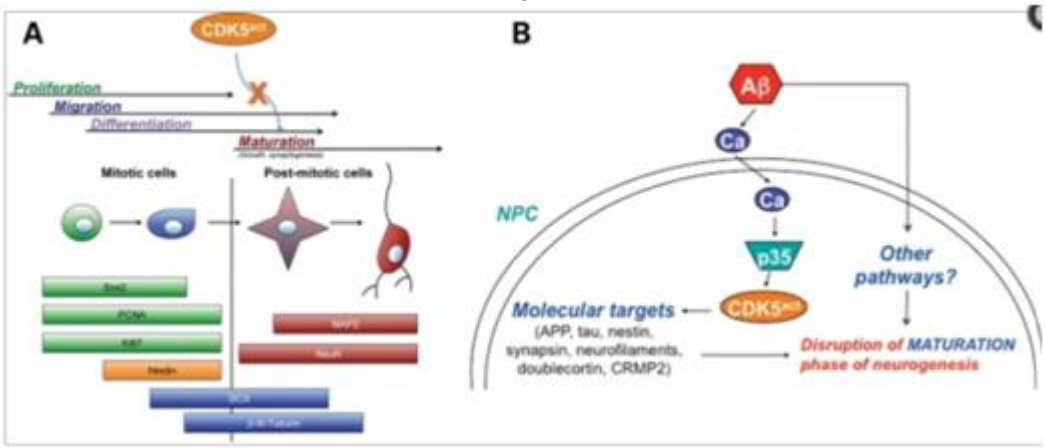

Fig. 3: Figure showing (a) comprise neurogenic process of NPC development in adult brain and (b) signaling through CDK5 that disrupts maturation stage of adult neurogenesis.

Stages of Alzheimer's disease:

Early stage	Middle stage	Last stage

General forgetfulness	Language and communication difficulty	Inability to recognize familiar people and objects
Losing track of time	Difficulty in performing regular activities	Major personality changes
Feeling lost of disoriented	Repeated forgetfulness and constant questioning	Physical and emotional instability

Hallmarks:

1. Plaques (clumping of Proteinaceous fragment (beta-amyloid)).
2. Tangles (twisted strands of tau protein).
3. Loss of connection between brain cells due to deposition tangles.
4. Inflammation
5. Death of brain cells and severe tissue shrinkage.

Treatment:

The stem cell therapy mainly involves the proper administration of adult autologous stem cells which will travel to various area of brain where actual damage is occurred. These transplanted cells have potency to replace the damaged cells with the new ones. It also helps in making suitable environment for secretion of enzymes required to replace damaged connections. For this purpose different stem cells have been used such as: -Neural stem cells and mesenchymal stem cells. Patient's stem cells are obtained by two sources: Adipose derived stem cells or Bone marrow derived stem cells. As the cells are isolated from patient own body, this makes the therapy with no side effects, non- invasive and effective.

Steps of treatment:

1.Pre- treatment assessments includes routine blood and urine tests, x ray, physical examination etc.

2.Pre- operative assessment includes MRI, CT scan, medical history etc.

3.Source extraction includes isolation of stem cells from adipose tissue or bone marrow of patient's body by giving local anesthesia.

4. Laboratory processing includes sample processing by minimum manipulation that makes the cells suitable for treatment and enriched them as pure culture of stem cells.

5. Stem cell implantation includes injecting the enriched stem cells back into patient's body by two ways either intravenous injection or intra thecal injection.

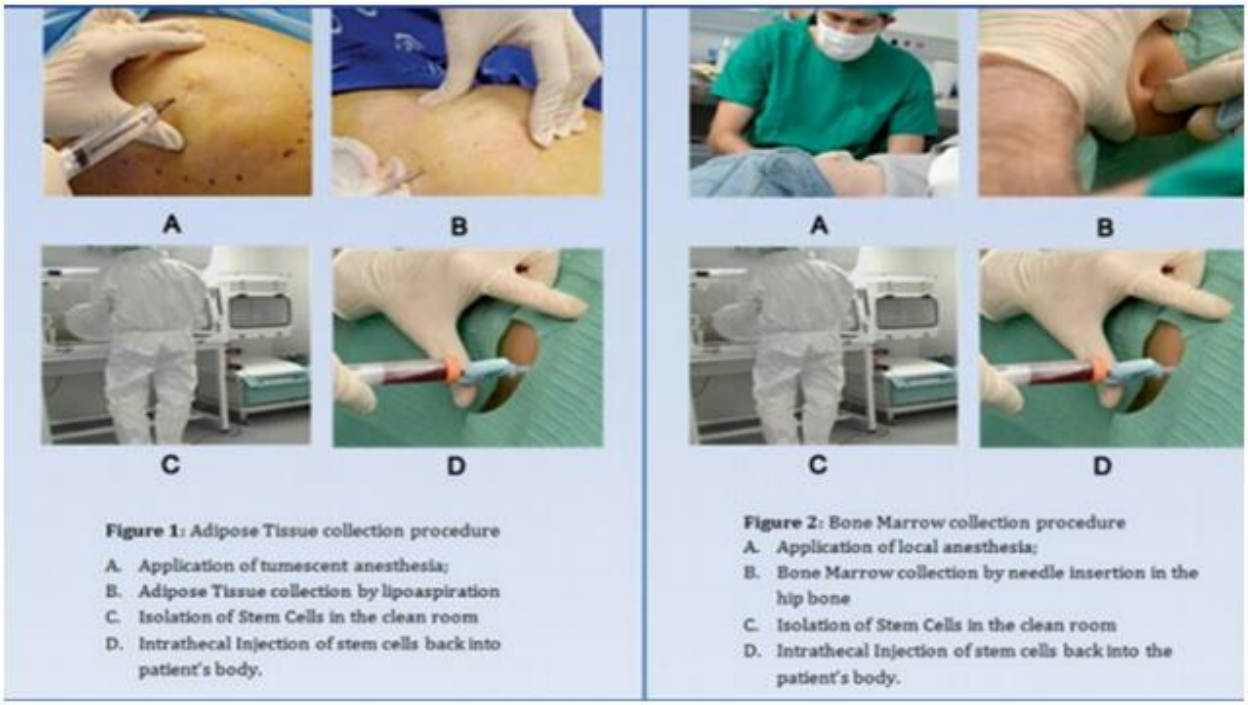

Fig. 4: Figure showing stem cell extraction from (a) Adipose tissue and (b) Bone marrow

Challenges:

Despite of all advantages, stem cells based treatments have an overarching issue of donor to donor variation. In generating neurons and glial cells for transplantation, the genetic defects that cause biochemical symptoms of AD must be corrected in donor cells by using CRISPR. Risk of generating tumorigenesis due to epigenetic memory of donor cells. Another challenge is to determine the target for transplantation throughout the CNS in AD, this can be overcome by using hippocampus and lateral ventricles that are known to contain NSCs in human brain.

Conclusion

stem cell therapy is a vast area of research that holds potential for treatment of various diseases like neurodegenerative disorders. It becomes a rapid and advanced techniques that can used in directly or indirectly treatments of AD.

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The little known danger of using microwaves

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BSc. (Hons.) Biochemistry, 3rd year

Isn't it quite amazing how a form of non-ionizing electromagnetic energy device can change our lives to such a huge extent? Microwaves are a simple and feasible cooking option. It is a reheating device for food that also has a number of health risks associated with it.

Microwave cooks the food in a short period of time at a high temperature. However, this overheating of food leads to the loss of various vital minerals and vitamins from food. It has been reported that a typical microwaved food loses approximately 60-70% of its total nutritional value. It also converts vitamin B_{12} from its active form to inactive form. The antioxidant content of the food is also depleted.

Microwaving creates carcinogenic compounds in food as the chemical nature of food changes due to high cooking temperature. In milk and cereals, some amino acids are converted into carcinogens. Meat prepared in microwave have a higher percentage of D-Nitrosodiethanolamine, a well-known carcinogen. Even very short exposure of raw, cooked, or frozen vegetables to microwaves is found to convert their plant alkaloids into carcinogens.

Consumption of microwaved food also changes the composition of blood as it decreases the erythrocyte count and increases the leukocyte count.

Since science is all about conducting experiments to establish hypotheses, an experiment was performed to observe the effect of microwaved water on plant growth. One plant was grown in microwaved water and tested against a control with purified water. The results were as shown in the following figure, establishing that microwaved food consumption is indeed harmful.

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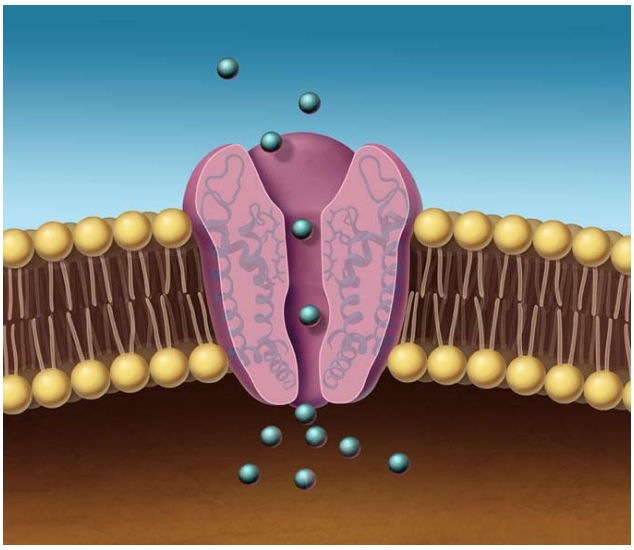
How are ion channels so specific?

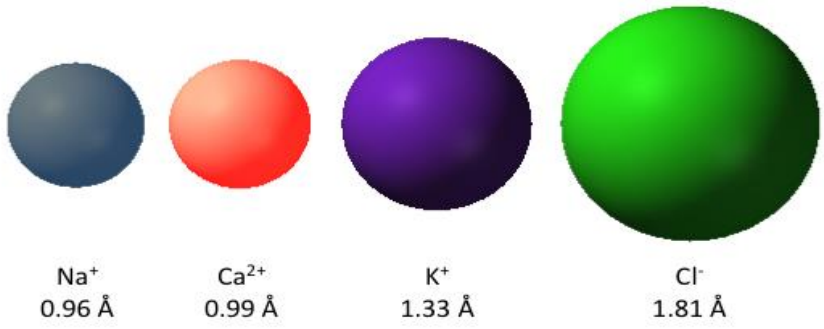
Aayush Srivastav
B.Sc. (Hons) Biochemistry, 1st year



Biological ion channels, like Na^+ or K^+ channels, are highly specific in nature. You would have (hopefully) never heard of a sodium ion channel that also transports lithium ion. But, as interesting as it may sound, these large pores use surprisingly simple methods to become extremely specific in nature. To give a general idea, lets just pick up two such channels i.e. Na^+ and K^+ channels, to get a clearer individual, as well as comparative, picture of the scenario.

For beginning, lets look at the properties of the ions (i.e. Na^+ and K^+ ions) that their respective ion channels exploit for maintaining their specificity. In general, they exploit two properties, as discussed below:

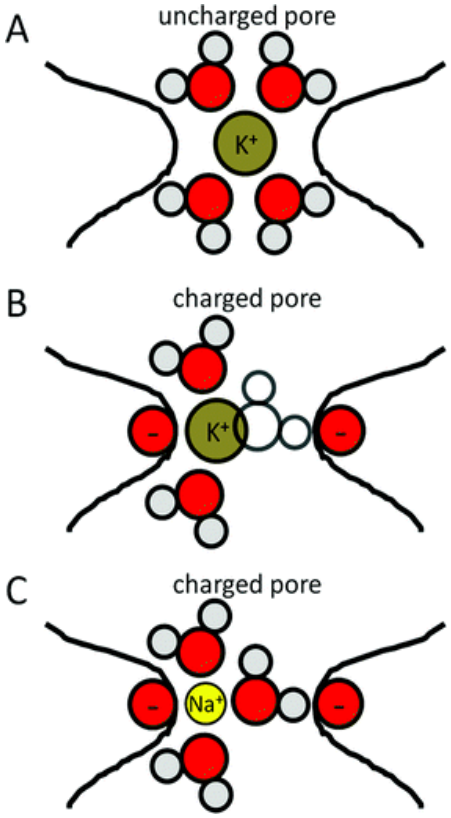
- **Ion Size:** the size of a sodium ion is approximately 0.96 Å, while that of a potassium ion is 1.33 Å, where 1 Å equals 10^{-10} m. This seemingly negligible small size difference is a critical factor for the specificity of ion channels. Here's a size comparison of common ions found in our body, for a clearer picture:



- **Hydration Enthalpy:** there is a stark difference between the hydration enthalpy of sodium ion (-105 $kcal.mol^{-1}$) and potassium ion (-85 $kcal.mol^{-1}$). What these numbers actually mean for our discussion, shall be a point of discussion very soon.

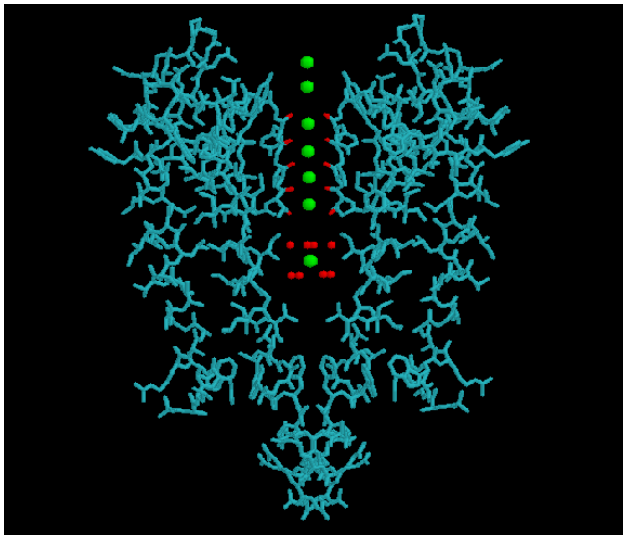
Now, having discussed what properties of ions the ion channels exploit, lets come to the big point i.e. *how* these ion channels exploit these properties. Lets begin with sodium ion channel.

1. ***Na^+ channels***, although not studied as much, are found to work through the following mechanism:



Na^+ ions pass through these channels, as shown by Hille in 1971, in a partially hydrated form. These channels, in mammals, have two rings of selection filters in humans (Guy *et. al.*, 1986). In short, the inner ring contains amino acids Asp-Glu-Lys-Ala, which mimic the hydration shell of sodium ion. Potassium ion, on the other hand, is unable to pass through this channel in its hydrated form due to difference in its hydration shell and larger ionic size. See the diagram on the right to illustration of the mechanism.

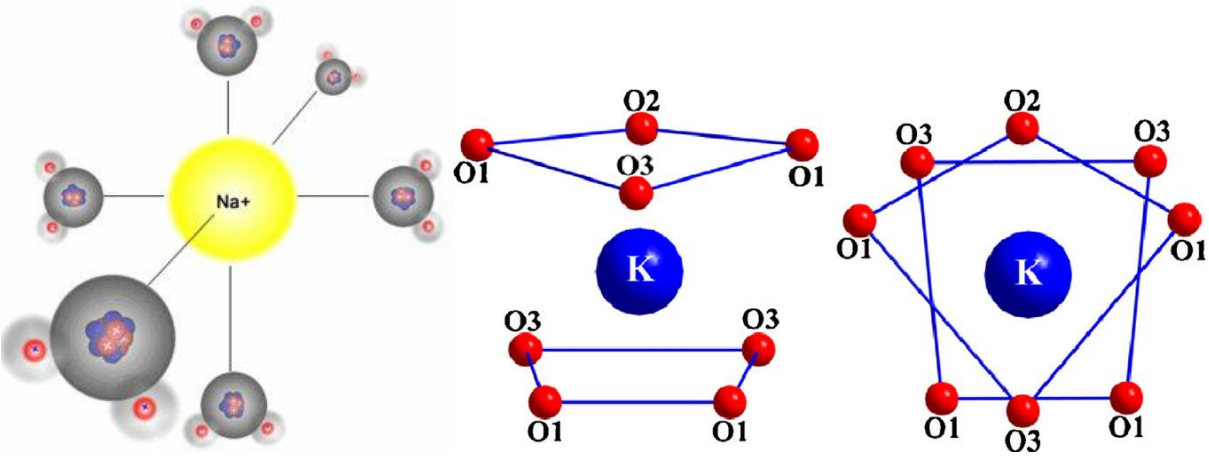
2. ***K^+ channels***, on the other hand, have been studied much more extensively. Thus, their mechanism of specificity is known in a more elaborate manner than that of sodium ion channels. In an introductory manner, the mechanism goes as follows:



The innermost region of the ion channel contains the amino acids Thr-Val-Gly-Tyr-Gly (as shown by Zhou and colleagues in 2001). Potassium ion can only pass through this channel in the dehydrated state, which is easier to accomplish than sodium ion since potassium ion has much lower hydration enthalpy. Also, sodium ions are forbidden to pass through these channels in two ways. First, the hydration enthalpy of sodium ion is much higher, which makes it difficult to completely remove its hydration shell. Second, sodium ion, being smaller than potassium ion, is unable to bind all the negatively charged amino acids in the innermost region of the ion channel, which makes its passage through the channel thermodynamically much less favorable (as proved by Thompson and colleagues in 2009). In this manner, the specificity of potassium ion channels is maintained (*the above image illustrating the passage of potassium ion through the potassium ion channel was reconstructed from PDB ID 1BL8*).

Connecting the dots: To finish this discussion, lets talk a bit more about hydration shells. As shown already, sodium and potassium ions have different hydration enthalpies. *But what exactly do these numbers mean?* Talking about hydration, these numbers not just mean that solvation of sodium ion yields more energy than solvation of potassium ion. It also means that sodium and potassium ions have different

hydration shells i.e. arrangement of water molecules surrounding the ions. To boost up your imagination, here's a diagram of hydration shells of sodium ion (left) and potassium ion (right):



While the hydration shell of a sodium ion is a regular octahedron, the hydration shell of potassium ion, on the other hand, is in the shape of square antiprism. *Still, what does it mean?* Well, we have talked about how ion channels need to dehydrate the ions in order to let them pass through the channel. This is only possible if the ion channels are somehow able to replace the water molecules surrounding the ions, since simply removing the water molecules is thermodynamically unfavorable. To replace these water molecules, the amino acids of the ion channel assume a 3D structure that mimics their hydration shell. And since all ions have different hydration shells (we have only talked about Na^+ and K^+ here), mimicry of the hydration shell of one ion simply prevents other ions to pass through. In this manner, therefore, ion channels maintain their specificity that they proudly boast about.

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Metaphysics: The Science of Being and Identity

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B. Sc (H) Biochemistry 2nd Year

Metaphysics - is a branch of philosophy exploring the fundamental questions, including the nature of concepts like being, existence, and reality. It has two branches – cosmology and ontology. Traditional metaphysics seeks to answer, in a "suitably abstract and fully general manner", the questions:
What is there?
And what is it like?

Topics of metaphysical investigation include existence, objects and their properties, space and time, cause and effect, and possibility. A central branch of metaphysics is ontology, the investigation into the basic categories of being and how they relate to one another.
There are two broad conceptions about what "world" is studied by metaphysics. The strong, classical view assumes that the objects studied by metaphysics exist independently of any observer, so that the subject is the most fundamental of all sciences. The modern view assumes that the objects studied by

metaphysics exist inside the mind of an observer, so the subject becomes a form of introspection and conceptual analysis. Some philosophers, notably Kant, discuss both of these "worlds" and what can be inferred about each one.
Some philosophers, such as the logical positivists, and many scientists reject the entire subject of metaphysics as meaningless and unverifiable, while others disagree and think that it is legitimate.

The word "metaphysics" derives from the Greek words μετά and φυσικά . It was first used as the title for several of Aristotle's works, because they were usually anthologized after the works on physics in complete editions. The prefix meta- indicates that these works come "after" the chapters on physics. However, Aristotle himself did not call the subject of these books metaphysics: he referred to it as "first philosophy."
-physical: "**Metaphysical healing**" means healing by means of remedies that are not physical."

Necessity and possibility.
What is the origin of the Universe? What is its first cause? Is its existence necessary?
What are the ultimate material components of the Universe?
What is the ultimate reason for the existence of the Universe? Does the cosmos have a purpose?
Mind and matter
The nature of matter was a problem in its own right in early philosophy. Aristotle himself introduced the idea of matter in general to the Western world, adapting the term hyle, which originally meant "lumber." Early debates centered on identifying a single underlying principle. Water was claimed by Thales, air by Anaximenes, Apeiron by Anaximander, fire by Heraclitus. Democritus, in conjunction with his mentor, Leucippus, conceived of an atomic theory some 24 centuries before it was accepted by modern science. It is worth noting, however, that the grounds necessary to ensure validity to the proposed theory's veridical nature were not scientific, but just as philosophical as those traditions espoused by Thales and Anaximander.

Metaphysics in science
Prior to the modern history of science, scientific questions were addressed as a part of natural philosophy. Originally, the term "science" simply meant "knowledge". The scientific method, however, transformed natural philosophy into an empirical activity deriving from experiment, unlike the rest of philosophy. Philosophy. Thereafter, metaphysics denoted philosophical enquiry of a non-empirical character into the nature of existence.
Metaphysics continues asking "why" where science leaves off. For example, any theory of fundamental physics is based on some set of axioms, which may postulate the existence of entities such as atoms, particles, forces, charges, mass, or fields. Stating such postulates is considered to be the "end" of a science theory. Metaphysics takes these postulates and explores what they mean as human concepts. For example, do all theories of physics require the existence of space and time, objects, and properties? Or can they be expressed using only objects, or only properties? Do the objects have to retain their identity over time or do they change? If they change, then are they still the same object? Can theories be reformulated by converting properties or predicates into entities. Is the distinction between objects and properties fundamental to the physical world or to our perception of it?
Much recent work has been devoted to analyzing the role of metaphysics in scientific theorizing.

In physics, new metaphysical ideas have arisen in connection with quantum mechanics, where subatomic particles arguably do not have the same sort of individuality as the particulars with which philosophy has traditionally been concerned. Also, adherence to a deterministic **metaphysics in the face of the challenge posed by the quantum**-mechanical uncertainty principle led physicists such as Albert

Einstein to propose alternative theories that retained determinism. A. N. Whitehead is famous for creating a process philosophy metaphysics inspired by electromagnetism and special relativity.
In chemistry, Gilbert Newton Lewis addressed the nature of motion, arguing that an electron should not be said to move when it has none of the properties of motion
By all such above example we conclude that science is incomplete without metaphysics.

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Image Source: Google Images

Mind Body Interventions

Anisha Grover
B.Sc. (H) Biochemistry, 2nd year

Beyond the scope of material sense, beyond instruments of measurement and beyond the brain conjectures, there lies an entity that thinks and perceives-the 'mind'. Can strands of DNA possibly induce the feelings and willing capacities of the human beings? Man and his infinite capabilities cannot be explained by mere atoms and molecules. One of the great capabilities we humans possess is the power to heal, to heal our bodies. Hippocrates once wrote "healing force within each of us is the greatest force of getting well."

Most ancient healing practices have emphasised the links between mind and the body. In 1964 psychiatrist George Solomon observed that depression worsened people with rheumatoid arthritis. He then began to investigate the impact emotions had on inflammation and immune system in general.

The key feature of this technique is to "edify" the mind to focus on the body without divergence. This state of "focused concentration," improves their health. The phrase "mind over matter" that has been around for years, has only recently been substantiated. Scientists have found solid evidence that mind-body techniques confer protection against diseases and improve health.

In a yet another experiment conducted by David Spiegel, M.D at Stanford university school of medicine, where women undergoing treatment with late stage of breast cancer had been analysed differently. Of 86 women 50% received standard medical care while the rest were subjected to additional healing sessions.

These sessions had women sharing their experiences-all good and bad. Results revealed that the women who participated in the social support group lived twice as long as the women who did not. Similar studies suggested how these power sessions improved the quality of responses patients depicted.

One such mind-body intervening practice-yoga has been observed to reverse DNA reactions which cause stress as published in the journal Frontiers in Immunology[1]. Practicing yoga has been known to affect gene expressions i.e. it's known to control the activity of the genes and therefore influences biological make-up of the body, the brain and the immune system.

Stressful event triggers a person's sympathetic nervous system that is responsible for fight and flight response that in turn stimulates increased production of a molecule called nuclear factor kappa β (NF-κβ) which regulates gene expression.

NF-κβ translates stress by activating genes to produce proteins called cytokines that cause inflammation at cellular level- a reaction useful for short lived fight or flight reaction but if persistent leads to higher risk of cancer. Yoga is known to dissolve this reaction in time therefore reversing the reaction that might cause cancer.

With increasing global acceptance, mind body intervening practices have been able to re- establish the undying truth and been able to defy the modern practices that regard mind and body separate.

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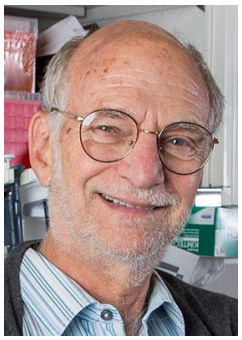
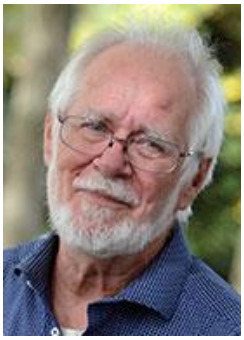
NOBEL HALL OF FAME

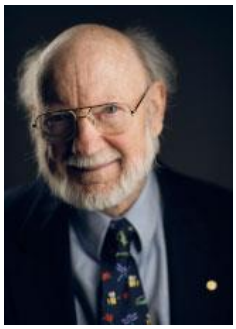
The Nobel Prize in Physiology or Medicine 2017 was awarded jointly to Jeffrey C. Hall, Michael Rosbash and Michael W. Young *"for their discoveries of molecular mechanisms controlling the circadian rhythm"*


The Nobel Prize in Chemistry 2017 was awarded to Jacques Dubochet, Joachim Frank and Richard Henderson *"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution"*.


The Nobel Prize in Physiology or Medicine 2015 was divided, one half jointly to William C. Campbell and Satoshi Ōmura "*for their discoveries concerning a novel therapy against infections caused by roundworm parasites" and the other half to Youyou Tu "for her discoveries concerning a novel therapy against Malaria*".


The Nobel Prize in Chemistry 2015 was awarded jointly to Tomas Lindahl, Paul Modrich and Aziz Sancar *"for mechanistic studies of DNA repair"*.



The Nobel Prize in Physiology or Medicine 2009 was awarded jointly to Elizabeth H. Blackburn, Carol W. Greider and Jack W. Szostak *"for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase"*.



The Nobel Prize in Chemistry 2009 was awarded jointly to Venkatraman Ramakrishnan, Thomas A. Steitz and Ada E. Yonath*"for studies of the structure and function of the ribosome"*.

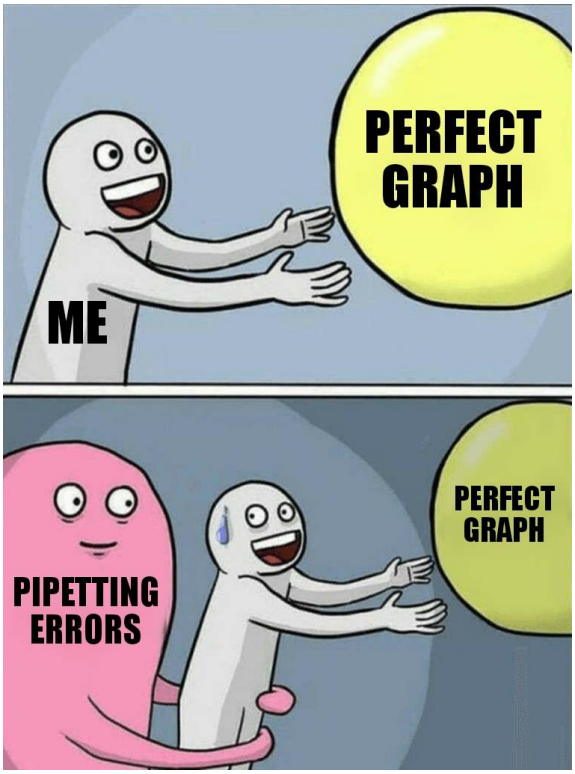


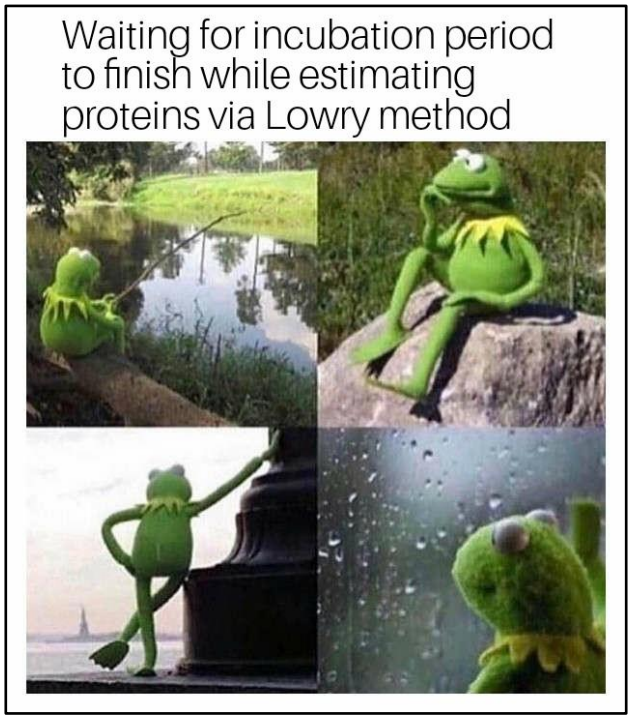
The Nobel Prize in Physiology or Medicine 2008 was divided, one half awarded to Harald zur Hausen *"for his discovery of human papilloma viruses causing cervical cancer"*, the other half jointly to Françoise Barré-Sinoussi and Luc Montagnier *"for their discovery of human immunodeficiency virus"*.

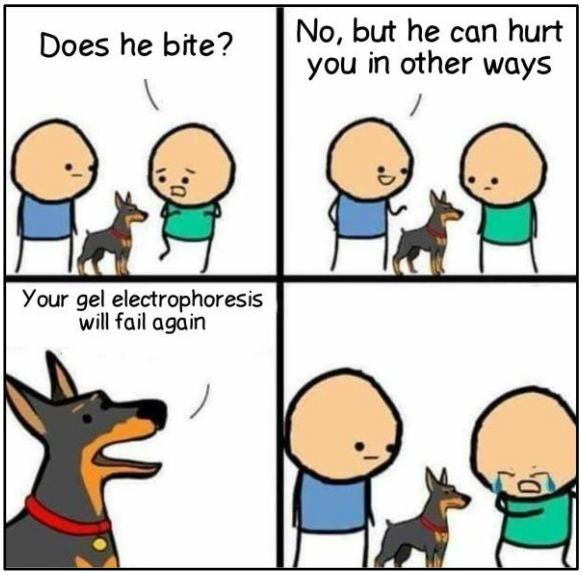


HUMOR IN SCIENCE

Ujjwal
BSc. (Hons.) Biochemistry, 1st year

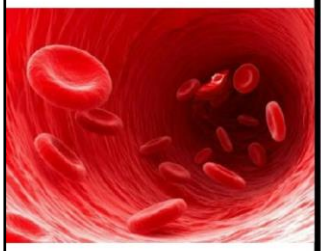




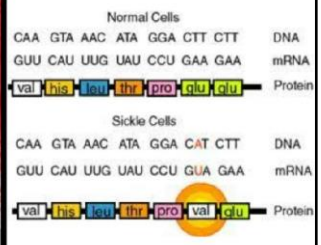


When metastasized cells meet again via blood circulation

WHO WOULD WIN?

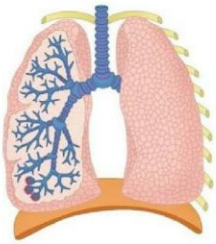


A widespread fluid tissue with millions of cells



One amino acid switch

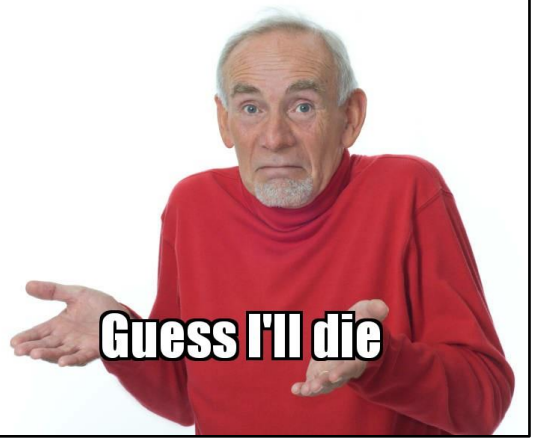
WHO WOULD WIN?



A well organised organ comprising millions of cells

One smoky boi

When the cell's ER stress response fails to deal with accumulated unfolded proteins



When you think your sample preparation is going well but you can't remember if you added a particular reagent already

BRAINSTORMING

- Your skull is made up of 29 different types of bones.
- The only part of the body that has no blood supply is the cornea of our eye . It receives oxygen directly from the air.
- A single human brain generates more electrical impulses in a day than all the telephones of the world combined.
- Nerve impulses sent from the brain move at a speed of 274 km per hour.
- The human heart pumps 182 million litres of blood during the average lifetime.
- The average human body contains enough of sulphur to kill all the fleas on the average dog , enough carbon to make 900 pencils, enough potassium to fire a toy cannon, enough fat to make 7 bars of soap, and enough water to fill a 50 litre barrel.
- 50,000 of cells in your body died and were replaced by new ones while you were reading this .
- Females have heart beat faster than males.
- The human embryo acquires fingerprints within 3 months of conception.
- Right handed people live on average nine years longer than the left handed people.
- The average person forgets 90% of their dreams.
- By the end of a person's life , they can recall on average about 150 trillion pieces of information.
- Onychophagia is the technical term for biting your nails.
- Sulfhemoglobinemia is a rare condition when a person starts developing green blood.
- Within three days of death, the enzymes that once digested your dinner , starts eating you from inside.
- A new born baby has about one cup of blood in his body.
- When you blush your stomach also turns red.
- Right handed people chew most of their food in the right side of their mouth while left handed do so in the left side.
- The total weight of the bacteria in the human body is 2 kg.
- The total strength of masticatory muscles on one side of your jaw is equal to 195 kg.
- Human beings are the only animals that can draw a straight line.
- Human skin is completely replaced about 1,000 times during a person’s lifetime.
- Women blink about 2 times less often than men.
- Fingernails grow about 4 times faster than your toenails.
- People with blue eyes are more sensitive to pain than the others.
- Nerve impulses in the human body move at about 90 meter per second.
- 100,000 chemical reactions occur in human brain every second.

- The surface area of the human lungs is nearly equal to the area of a tennis court.
- Newborn human baby can breathe and swallow at the same time for upto seven months.
- The strongest muscle in the human body is the tongue.
- During a person's lifetime the small intestine is about 2.5 meters long. After they die, the muscles in the walls of their intestine relax and its length increases to 6 meters.
- Your right lung can take up more oxygen than your left lung.
- An adult person performs around 23,000 inhalations and exhalations in a day.
- The smallest cells in a man's body are sperm cells.
- Each of us has around 2,000 taste buds.
- The human eye can distinguish 10 million different colours.
- The human heart pumps blood at such pressure that it would be able to raise the blood up to the fourth floor of building.
- A person uses 17 muscles when they smile and 43 muscles when they frown.
- Bones are 5 times stronger than the steel.

Aakanksha singh
B. Sc. Biochemistry (H), 3rd year

You are biology

You were a cell, Having your own identity
Became a tissue, Which maintains cell's integrity,,
The journey from tissue to organ
You had your own organ system,

For its development, Biological changes occurred more,
Now you're biology, And you're not you anymore,,
Liver is a kind of fruit, Which contains bile juice,
Helps in fat emulsification, And vitamin absorption too,
Not in physics also, our Biology tells us the role of gravity,
Our alimentary canal is so interesting,
Food enters from mouth, From the anus It is leaving,

In the wonders of biology
I'll become crazy
Oh God! It's so interesting and cool
I'm swimming in its pool...

Tarushi
B. Sc. Biochemistry (H), 3rd year

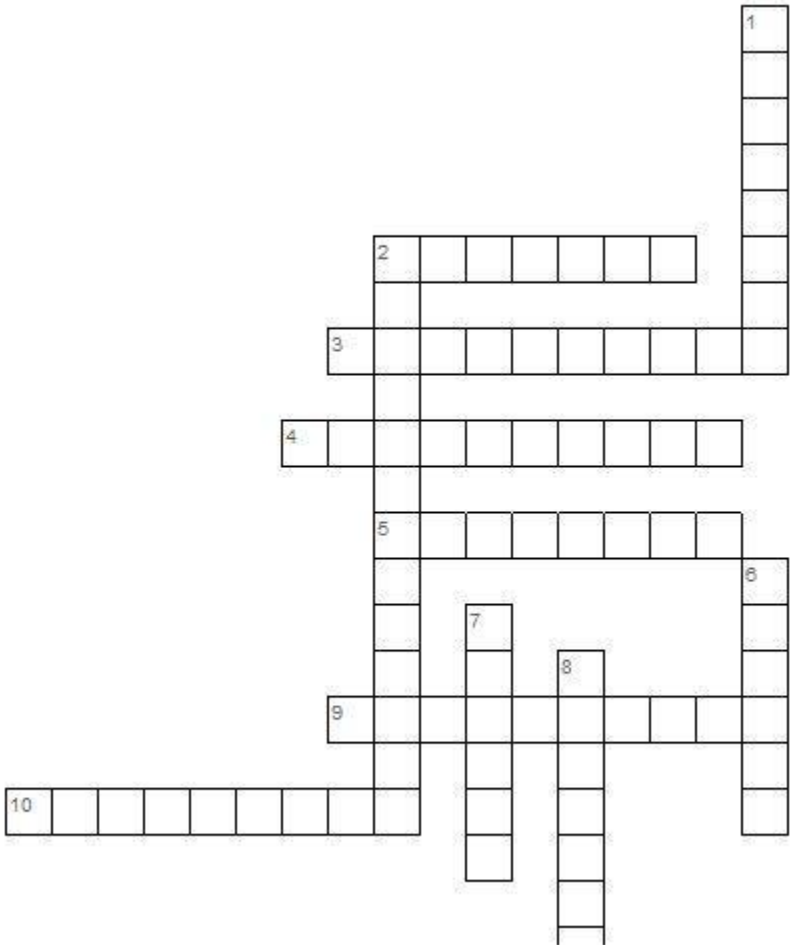
ORIGIN OF THE NAMES OF MEDICINES

Medicine	Origin
Ambien	Used in the treatment of insomnia – the word "ambient" means good morning, as "Am" represents morning and "Bien" represents Good in Spanish.
Penicillin	originated from the name of fungus it is isolated from *Penicillium notatum.* The word "penicillium" comes from the Latin for "paintbrush", reflecting the shape of the fungus. It is used as an antibiotic.
Warfarin	Takes its name from Wisconsin Alumni Research Foundation (WARF) it is the group which supported the research and "arin" comes from coumarin (the natural synthetic precursor of warfarin)
Premarin	isolated from pregnant mare's urine (treats menopausal symptoms)
Morphine	Named after the god of dreams, Morpheus, as it has a tendency to cause sleep (acts on CNS to decrease the feeling of pain)
Aspirin	Named after the plant from which it was extracted- *spiraea.* As aspirin is an acetylated version, an 'A' was added to create "aspirin"
Atropine	Named after Atropos, one of the three Fates of Greek mythology who chose how a person will die (used to keep the heart beat normal)
Fosamax	Comes from Latin, with "Os" referring to bone and "max" referring to great (used to treat bone disorder)
Lopressor	The active ingredient of Lopressor, metoprolol. (is used to lower blood pressure)

Nisha
B. Sc. Biochemistry (H), 2nd Year

PUZZLING PROTEINS

Ujjwal Goyal
BSc. (Hons.) Biochemistry, 1st year



ACROSS

2-The only standard imino acid

3- Amino acid that is the cleavage point in peptide chain for cyanogen bromide

4- Amino acid with indole ring

5- A basic amino acid

9- Uncommon amino acid which is an intermediate in the urea cycle

10- Amino acid with imidazole ring

DOWN

1- Amino acid involved in forming disulphide linkages

2- Aromatic amino acid present in aspartame

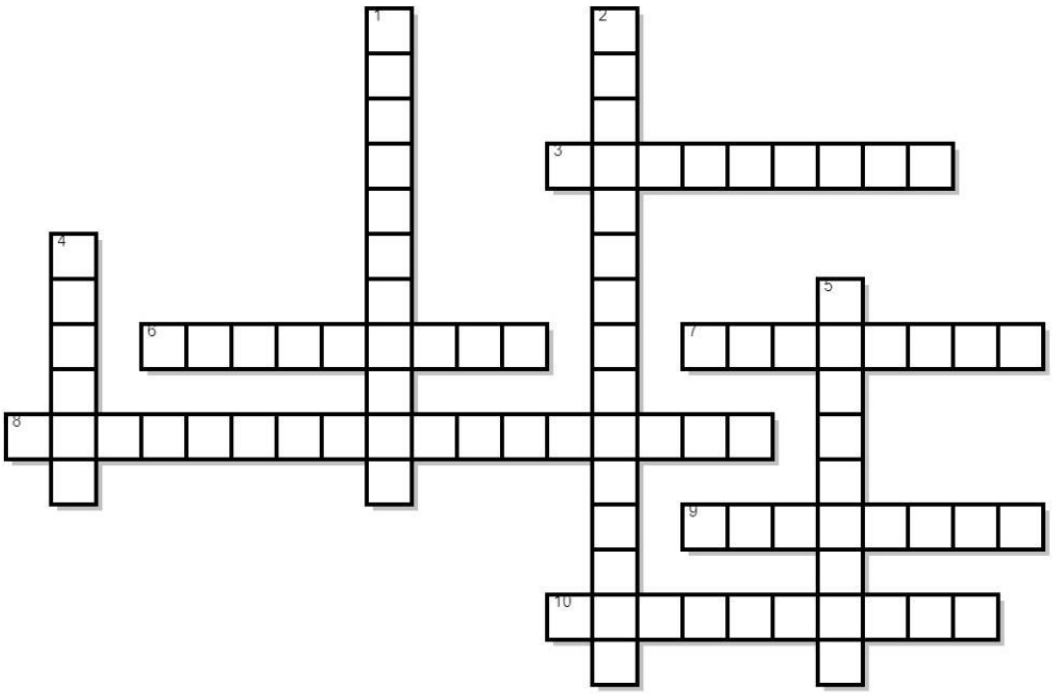
6- A phosphoprotein found in milk

7- A polar uncharged amino acid

8- The only achiral amino acid

ANSWERS: ACROSS: 2-Proline 3-Methionine 4-Tryptophan 5-Arginine 9-Citrulline 10-Histidine
DOWN: 1-Cysteine 2-Phenylalanine 6-Casein 7-Serine 8-Glycine

Palak Khandelwal
B. Sc. (H) Biochemistry, 2nd Year



ACROSS

3 An animal that eats only plants
6 Change over time usually refers to the development of new species over time
7 A group of atoms that are held together by covalent or ionic bonds
8 A system consisting of the heart,bloodvessels and the blood that carries nutrients and oxygen to the body's tissues and removes carbon Di oxide and waste product
9 An animal that eats only other animals
10 The part of the human brain that controls movement,coordination and balance located below the cerebrum at the base of the skull

DOWN

1 To change from liquid to a gas
2 The system of the body that breaks food down into nutrients and the body can use and convert into leftover wastes
4 The preserved remains or imprint of a once living thing.
5 one of the lower chambers of the heart

WORD BANK: CEREBELLUM, CIRCULATORYSYSTEM, DIGESTIVESYSTEM, EVAPORATION, EVOLUTION, FOSSIL, HERBIVORE, MOLECULE, OMNIVORE, VENTRICLE

"BIOSHUFFLE"

1) NCPEPITOLADYG
(Hint:is present in bacterial cell wall.)
2) LLCOENAG
(Hint:major structural protein in extracellular matrix)
3) IBTOIN
(Hint: coenzyme in carboxylation reactions)
4) ZEIROBMY
(Hint : an RNA molecule)
5) IILPYCHOSBN
(Hint:am accessory pigment)
6) NOPRI
(Hint :a pore - forming protein)
7) SNISEKIN
(Hint:motor protein moves along microtubules)
8) ENICIHCLOC
(Hint:binds tubulin subunits amd prevents their polymerization)
9) TMES LLCE
(Hint:ability to differentiate into other cells)
10) SIRVURRTEO
(Hint :virus)
11) PNAHYRTPOT
(Hint:an amino acid having aromatic side chains)
12) YCSURV
(Hint:deficiency of ascorbic acid)
13) NIBOLHGOEM
(Hint:an allosteric protein)
14) NIRDYHINN
(Hint: test is used to detect amino acids, peptides and proteins)
15) CTHRAS
(Hint: branched chain of D-glucose units).

ANSWERS :

1) Peptidoglycan, 2) Collagen, 3) Biotin, 4)Ribozyme, 5)Phycobilins, 6) Porin, 7)Kinesin,

8)Colchicine, 9)Stem cell , 10)Retrovirus , 11)Tryptophan, 12)Scurvy, 13)Hemoglobin,

14) Ninhydrin, 15)Starch.

PRIYANKA
B. SC (H) BIOCHEMISTRY, 3rd YEAR

UNJUMBLE THE JUMBLED WORDS:

1) OMINCYTINA.
2) DENAEOSIN
3) TORAGRAPYHUAOID.
4) EMINBIOSCULENCE.
5) ISNGEMUTAES
6) LUCOENGGOSSIEEN
7) GRETOUSZYHEO.
8) OGLOMBULMUNINI.
9) AIXUN.
10) NOTRIN.
11) RENETCHOOIK.
12) ECINTLS.
13) STAPHOMORMESI.
14) IKAZOAK
15) ECOOGNEN
16) CAPTDPOEIGLYN
17) ROXOMPEISE
18) HURIPTALONENYKE
19) NEEPROHMO
20) LAEPQU
21) ORINPHRY
22) IPRNUE
23) ROSSEREPR
24) NLAPOOSRUTI
25) STEISORD

ANSWERS:

1. Actinomycin 2. Adenosine 3.Autoradiography 4. Bioluminescence 5. Mutagenesis 6. Gluconeogenesis 7. Heterozygous 8. Immunoglobulin 9. Auxin 10. Intron 11. Kinetochore 12. Lectins 13.. Metamorphosis 14.Okazaki 15.Oncogene 16.Peptidoglycan 17.Peroxisome 18. Phenylketonuria 19. Pheromone 20.Plaque 21. Porphyrin 22. Purine 23. Repressor 24. Sporulation 25. Steroids

Yashica Adlakha
BSc. (H.) Biochemistry, 2nd year

DEPARTMENTAL ACTIVITIES

EDUCATIONAL TRIP
National brain research centre (NBRC)

EDUCATIONAL TRIP
FICCI Research and Analysis Centre
Dwarka, New Delhi

BIOQUEST 2017
Department of Biochemistry, Shivaji College

FACULTY PUBLICATIONS

S. No	Name of Faculty Member	Name of the Research Paper/Textbook	Year of Publication	Name of the Journal/Publisher
1.	Dr. Shashi Nijhawan	Irregularities of the Ovarian Cycle in Young Females: Etiology, Awareness and Management	2016	*International Journal of Biotechnology and Biomedical Sciences.* 2(1). 57-59
	Dr. Shashi Nijhawan	Yoga as a therapy for lifestyle disorders	2016	*Conference proceedings of 2nd International Conference on Public Health, Organized by Krishi Sanskriti at Jawaharlal Nehru University, New Delhi, on 21st May, 2016*
2.	Dr. Rashmi Wardhan	Textbook of Membrane Biology	2017	*Springer* ISBN 978-981-10-7100
	Dr. Rashmi Wardhan	Carcinogenic and Organo toxic compounds in milk. Available Online at:	2016	*LIFE: International Journal of Health and Life-Sciences. Vol. 2 (2), pp. 55-70.*
	Dr. Rashmi Wardhan	Isolation and Identification of Microorganisms with high activity of L–Asparaginase: Anti-Cancer enzyme.	2016	*DU Journal of Undergraduate Research and Innovation. Vol 2 (1) pp 171-179, ISSN-2395-2334*
	Dr. Rashmi Wardhan	Milk borne pathogens: Isolation and Identification, Health risk to population especially young ones.	2016	*Proceedings of the International Conference on "Medical, Medicine and Health Sciences (MMHS-2016)" ISBN-978-969-670-722-6*
3.	Dr. Drashan Malik	Estimation of blood glucose, serum calcium and Blood pressure on measures of risks of lifestyle disorders in young Adults	2017	*International Journal of Biotechnology and Biomedical Scienc.* 2(3). 253
4.	Dr. Drashan Malik	Kinase inhibitor: Hope for cancer	2017	*International journal of Biochemistry and Biomedical Science.* Vol.3 (1). 39
	Dr. Drashan Malik	Quetelet's Index and Body Fat Percentage Assessment in Indian Undergraduate Students.	2016	*DU Journal of Undergraduate Research and Innovation*, 2(1). 56-69
5.	Dr. Drashan Malik	Cardiovascular diseases and Yoga: Non Pharmacological Interventions.	2016	*International Journal of Biotechnology and Biomedical Sciences.* 2(2). 134-138
6.	Dr. Drashan Malik	Simultaneous Bioremediation of Phenol and Cr (VI) from Tannery Wastewater Using Bacterial Consortium	2016	*International Journal of Applied Sciences and Biotechnology.* 30(1). 50-55
7.	Dr. Drashan Malik	Irregularities of the Ovarian Cycle in Young Females: Etiology,	2016	*International Journal of Biotechnology and Biomedical*

		Awareness and Management		*Sciences.* 2(1). 57-59
	Dr. Drashan Malik	Yoga as a therapy for lifestyle disorders	2016	*Conference proceedings of 2nd International Conference on Public Health, Organized by Krishi Sanskriti at Jawaharlal Nehru University, New Delhi, on 21st May, 2016*
8.	Dr. Jayita Thakur	Estimation of blood glucose, serum calcium and Blood pressure on measures of risks of lifestyle disorders in young Adults	2017	*International Journal of Biotechnology and Biomedical Science.* 2(3). 253
	Dr. Jayita Thakur	Quetelet's Index and Body Fat Percentage Assessment in Indian Undergraduate Students.	2016	*DU Journal of Undergraduate Research and Innovation,* 2(1). 56-69
9.	Dr. Jayita Thakur	Cardiovascular diseases and Yoga: Non Pharmacological Interventions.	2016	*International Journal of Biotechnology and Biomedical Sciences*
10.	Dr. Jayita Thakur	Irregularities of the Ovarian Cycle in Young Females: Etiology, Awareness and Management	2016	*International Journal of Biotechnology and Biomedical Sciences.* 2(1). 57-59
11.	Dr. Sunita Singh	A IFT and friccohesity study of formulation, wetting, dewetting of liquid systems using oscosurvismeter	2017	*Journal of Molecular Liquids*, Vol. 244, 7–18
12.	Dr. Sunita Singh	Physicochemical Synergetics of Liquid Mixtures of Functional Molecules: Osco-survismeter and Survismeter	2016	*International Conference on Informatics, Management Engineering and Industrial Application (IMEIA 2016)*, 330-338, ISBN: 978-1-60595-345-8.
13.	Dr. Sunita Singh	The Forensic Psychological Tools Employed Towards a Crime free Society	2016	Proceedings of International Conference on Public Health: Issues, challenges, opportunities, prevention, Awareness (Public Health: 2016) Vol 1; 161-169

Toppers (2017-2018)

Third Years


Sheetal Bhardhwaj | Aakanksha Singh
(1st Position)

Kirti Sharma
(2nd Position)

Priyanka
(3rd Position)

Second Years



Maneshwar Dixit | Ayush Ganguli | Rohit Soni
(1st Position)

Somoshri Banerji
(2nd Position)


Bhoomika Arora | Nisha Pandey
(3rd Position)

First Years

Mansi Tanwar
(1st Position)



Aayush | Ujjwal Goyal | Deepanshu
(2nd Position)

Niharika
(3rd Position)

A WALK DOWN THE MEMORY LANE

Subhasis Sahoo (2014-17)
(Currently doing M.Sc. in Biochemistry from ACBR)
My 3 years of life at Department of Biochemistry, Shivaji College was one of the best part of my life so far. Under the guidance of a great faculty and helpful lab assistants, my knowledge increased day by day. I was the President of the biochemical society in final year and Secretary in my second year. The best part about these posts was Interaction with my juniors and seniors which was always an enlightening for me. I really feel very proud to say that I was, I am and I will be a part of Biochemistry Department, Shivaji College. Thanks to all…

Anjali Nagar (2014-17)
(Currently doing M.Sc. in Biochemistry from BHU, Varanasi)
Being a part of Shivaji College was a tremendous thing that happened to me and being a part of Biochemistry Department is something beyond tremendous that such a good experience I had here was amazing. It is with the help of our professors and fellow students that we were able get through with such flying colors. Also our overall skills flourished. We experienced contemporary things like project work, seminars, lectures, camps and many more. Over all , it has been a radiant journey surrounded with magnificent people.

Hritika Verma (2014-17)
(Currently doing M.Sc. in Biochemistry from BHU, Varanasi)
The three years i have spent in Shivaji College was well-experienced. It was a magnificent journey. I feel very proud to be the part of such institute. The educational trips, project work, seminars, lectures and many extra curricular activities helped me to know the correct definition of science and how beautiful it is. Last but not the least being in the hands of esteemed and supportive teachers transformed me into a better person and helped me to enlarge my knowledge.

Deepshikha Singh (2014-17)
(Currently doing Integrated PhD in Biochemistry from IISc)
Taking Biochemistry in Shivaji was a decision much influenced by my friend from school and terrace and sitting through the recess time on the staircase will always be amongst my treasured memories.

Rashmi Singh (2013-16)
Biochemistry department, Shivaji College, is a platform as well as opportunity for the students who want to make their future in the research field .The well equipped infrastructure with the generous faculty and much helpful lab staff, who together motivate & inspire the student for the hard work in a definite directions.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March 27, 2017
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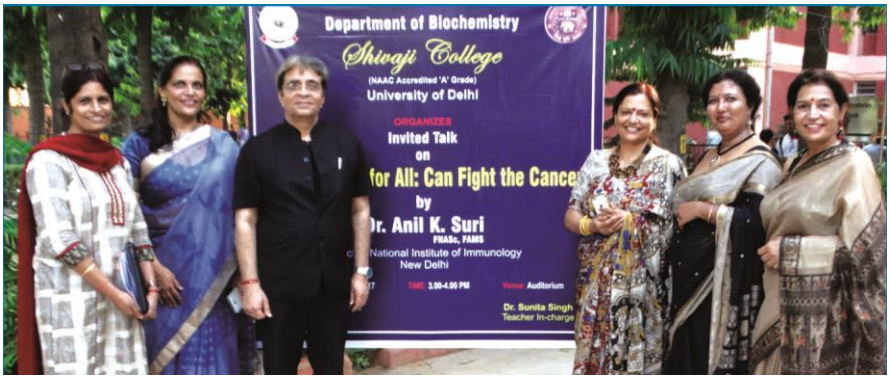
Padma Shri (Dr.) K. K. Aggarwal
Cardiologist
KEYNOTE SPEAKER:
Prof. Sudhanshu Vrati
Executive Director
Regional Centre Biotechnology
INQUIZITA
POSTER
PRESENTATION
PLACARD
COMPETITION
BRAIN MATRIX
VENUE: College Auditorium
LAUNCH OF MAGAZINE
OF BIOCHEMISTRY DEPARTMENT
ATTRACTIVE PRIZES


Department of Biochemistry
Shivaji College
(NAAC Accredited 'A' Grade)
University of Delhi
ORGANIZES
Invited Talk
on
for All: Can Fight the Cance
by
Dr. Anil K. Suri
PNASc, FAMS
National Institute of Immunology
New Delhi
TIME 2.00-4.00 PM
Venue Auditorium
Dr. Sunita Singh
Teacher In-charge

DEPARTMENT OF BIOCHEMISTRY
SHIVAJI COLLEGE (UNIVERSITY OF DELHI)