ANVESHNA

Imbibe. Innovate. Inspire.

The Anveshna Newsletter

Issue 15.1

Optogenetics: Shiny New Neuroscience Technique

T. Swetha, 4th Year, B.Tech. (Biotech.)

INTRODUCTION

Can light be the cure of all the disease? The answer is yes, with the development of a powerful method called Optogenetics. It is basically a light based neural-modulation technique where we combine genetics and optics to control well-defined events within specific cells of living tissue. It includes the discovery and insertion into cells of genes that confer light responsiveness; it also includes the associated technologies for delivering light deep into organisms as complex as freely moving mammals, for targeting light-sensitivity to cells of interest, and for assessing specific readouts, or effects, of this optical control.

This technique was invented in 2006 by Karl Deisseroth, MD. As we can see the key reagents are the light sensitive proteins i.e. channel-rhodopsin (protein which activates the neuron), halo-rhodopsin (protein that silence the neuron) which allow scientists to turn neurons on or off selectively with unprecedented precision. Introducing these proteins into cultured cells or the brains of live animals allows investigation of the structure and function of neural networks. These 'optogenetic tools' also hold clinical promise, with the potential for modulating activity of brain circuits involved in neurological disorders or restoring vision loss.

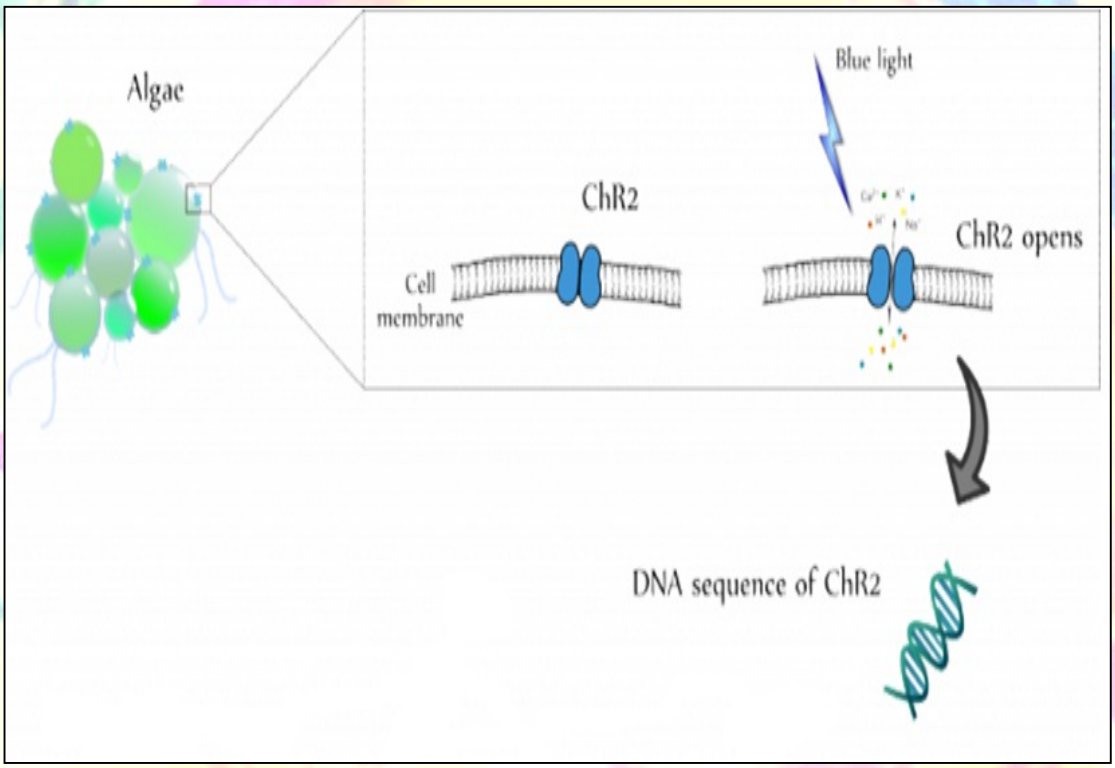
HISTORY

The early development took place around 1990's when scientists were able to discover and study the light sensitive proteins in halo bacterium. It was reported that different proteins respond to selective wavelength of light for e.g. Sensory rhodopsin 1 (orange light), Sensory rhodopsin 2 (blue light). In the year 2002 the three-gene photo-transduction cascade (Channelrhodopsin-2) was discovered which is

used to activate neural cells. This seven-transmembrane protein adapted from organisms found throughout the world, which react to light by transporting ions across the lipid membranes of cells in which they are genetically expressed.

How It Works ?

The first step involved in optogenetics is the isolation of channel rhodopsin encoding gene from unicellular alga *Chlamydomonas reinhardtii*.



Courtesy: Google's Database

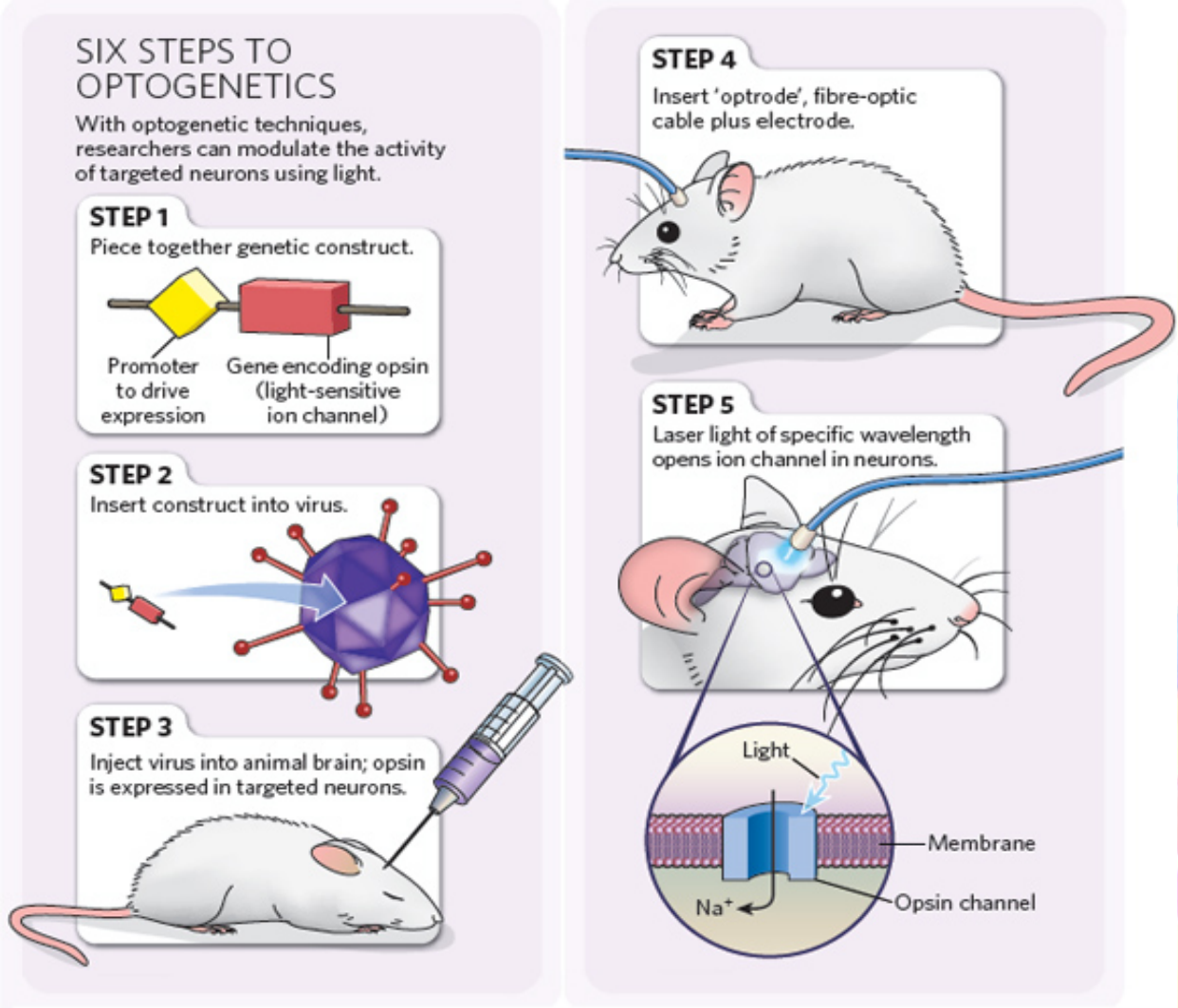
The gene of chR2 is constructed in to a viral vector like lentiviruses with a cell-type specific promoter and a recombinant virus is made. The recombinant virus is microinjected into the animal brain. This virus infects certain neurons to express the protein. An optogenetic effector tool called optorode is inserted in to the sub thalamus of the animal brain by making a small incision on the Dura using a fine needle. The optorode is used to send laser beam of particular wavelength which activates the chR2 expressing neuron. ChR2 acts as an inwardly rectifying cation channel, thus depolarizing the cells.

Potential Benefits

Regulation Of Parkinsons Motor:

Parkinson disease (PD) can be treated by Deep Brain Stimulation (DBS) by the application of a metallic bipolar or quadrupole electrode to the nucleus subthalamicus within the brain. With help of the electrodes an oscillating electric field is applied stimulating the neuronal cell. The extracellular

stimulation by the electrodes induces the required depolarization of cells & also partially a hyperpolarization, which inactivates cells with unwanted side effects.



Courtesy: http://www.etudogentemorta.com/wp-content/uploads/2010/05/optogenetics.jpg

Recovery Of Vision:

Experiments on photoreceptor deficient mice have shown that light evokes potentials in the visual cortex after the transduction of bipolar cells with ChR2 in the retina. This indicates that the retina of the animals regained photosensitivity, which is transmitted via the optic nerve to the brain. Trajectories of the movement of the animals in the dark and in the light show clearly an increased activity in the light as it is obtained for wild type animals.

In Neural Network Analysis:

The optogenetic method provides new opportunities to analyze neural networks. This can be achieved by growing cultured nerve cells on micro or nano patterned substrates. Cells can be stimulated or silenced simply by a light-beam with up to now unknown spatial precision. Only for registration of the

light evoked signals electrodes devices are necessary. Results from these experiments are expected to be used for theoretical work on neural nets.

IN CANCER:

Harald Janovjak & Michael Grusch "remote-controlled" the behavior of cancer cells with light, as reported in *EMBO Journal*. They re-engineered receptor tyrosine kinases (RTKs), essential cell surface receptors that sense growth factors and hormones, to be under the control of light. In the engineered receptors, the dimerization step and subsequently cell signaling can now be turned on and off by light as the algal proteins sense light and bind to each other.

CONCLUSIONS

Optogenetics is a fast growing field and find its application in almost all research areas; more than 800 laboratories around the world are now engaged in optogenetic research (Deisseroth, 2011). Despite copious amounts of research over the past 5 years, a consistent flow of new discoveries is being produced, both in neural circuitry research and in improving current optogenetic methods. Optogenetic effectors have increased our ability to manipulate neural circuits while optogenetic sensors are increasing our ability to observe such circuits. It will be exciting to see if further developments will increase their ability to complement one another, which would cause further acceleration to the already fast pace of neural research.

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Gene Manipulation In Foetuses

Glancis Luzeena Raja, 1st Year, B.Tech. (Biotech.)

INTRODUCTION

Gene manipulation is a field that involves any method of manipulation of genes. It uses techniques such as gene splicing and recombinant DNA technology to change or manipulate the characteristics of a particular organism.

So far, geneticists have restricted themselves to plants and certain species of animals. However, more recently, scientists are venturing into the unknown territory of gene manipulation in human beings, more particularly, foetuses.

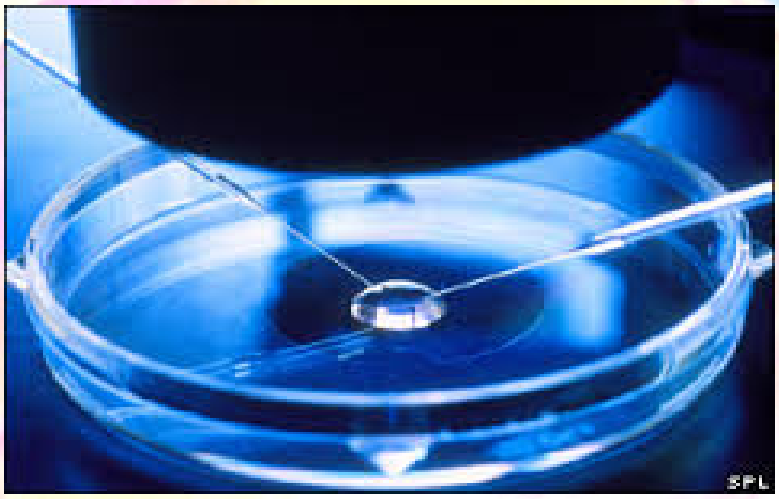
The idea may seem sinister, but this avenue of study does hold several advantages. Think about the possibilities if one can actually change genes in the foetus level. Deadly genetic diseases can be detected and measures can be taken to prevent it from manifesting itself, through gene manipulation. We all know that change and development is inevitable. Research has made venturing into new avenues of science just as inevitable.

“It’s not a question of ‘if’, but ‘when’ and ‘how’ this will occur," says Gregory Stock, head of the Program on Medicine, Technology and Society at UCLA's School of Medicine, about gene manipulation.

ASPECTS OF GENE MANIPULATION

By using basic techniques of genomics and biotechnology, scientists can now map the entire genome of any living organism. This method helps scientists understand the structure and functioning of the organism. They can also detect and study abnormalities and how to correct them.

Using this technique, the positive features of a given organism can also be amplified and passed on to the progeny. The genes responsible for desirable characters can be identified and isolated. These genes are then multiplied and then inserted back into the nucleus of that particular organism.



What if the same principles can be used to alter genes in human beings? When are human genes most susceptible to change? At what stage in a human being's life and development can change be easily accepted?

Humans have been evolving constantly and hence our bodies can accept change, if applied at the earliest stage possible. This is where gene manipulation in foetuses comes into play. This area of study is not only revolutionary, but also controversial. We are talking about modifying the genetic makeup of a human being. The principles and techniques could be used for less than noble purposes.

"The reason people are fascinated by this whole area is that it will challenge our fundamental thinking about who we are and what it means to be human," says Stock. "We are talking about remaking human biology."

Consider this hypothesis: A new set of genes that can boost the immunity of human beings is developed from our existing set of genes responsible for the same. This set of genes can be inserted into a freshly fertilized egg. The cell becomes two, and then four. Each version carries the extra set of genes. In nine months, a baby is born. Every cell in the child's body contains the replaced set of genes that increases his or her immunity.

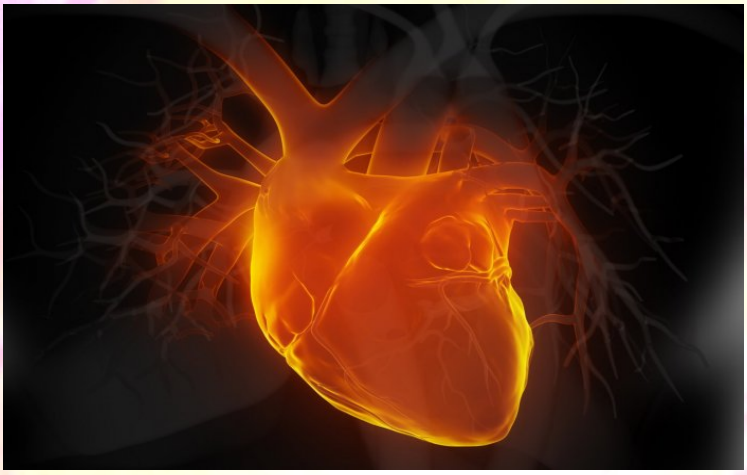
It's like producing a super human. And this is just one hypothesis. There are several other applications of the same technique. When we talk about remaking the biological setup of human beings, we concentrate on eliminating our flaws. But what part of our biology do we remake first? Typically the answer is to reduce human tendency to fall sick. Let's look at a few hypotheses being researched.

CASE 1: ERADICATION OF HEART DISEASE

The risk of heart disease in human beings depends partly on the levels of HDL, i.e. good cholesterol, in the body. 'The more the better'-that's the basic idea.

In the human body, a gene called ap0-A1 makes a major piece of HDL. The same is true in mice, whose biology, as scientists don't fail to point out constantly, is not so different from ours.

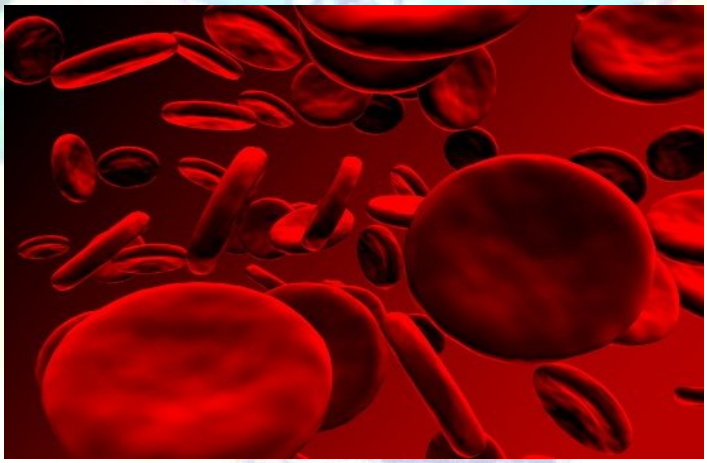
"It's possible in mice to dial in virtually any HDL level you want by introducing more copies of this gene," says Dr. R. Sanders Williams, a cardiologist at the University of Texas Southwestern Medical Center.



Is the same possible in humans as well? Can we 'dial in' the desired level of HDL in order to eliminate the risk of heart disease? Scientists have proposed introduction of apO-A1 genes to a foetus during the single cell stage in order to reduce the risk of heart disease, thus abolishing humanity's leading killer.

CASE 2: SICKLE CELL ANEMIA

Sickle Cell Anemia is a hereditary disease, characterized by the presence of abnormal sickle shaped red blood cells. This phenomenon occurs due to a mutation in the hemoglobin gene. The life expectancy of the affected person is reduced drastically.



During pregnancy, a small amount of foetal DNA enters the mother's bloodstream. A blood sample is drawn from the mother's arm and the foetal blood is also extracted, from which the foetuses' genetic structure can be sequenced. This is a common technique used for the detection of various diseases.

A recent hypothesis states that the foetal haemoglobin can be turned on once the mechanism of hemoglobin switching is understood. This technique has been experimented on mice and has shown promising results.

Not long after birth, human babies transition from producing blood containing oxygen-rich foetal haemoglobin to blood bearing the adult haemoglobin protein. For children with sickle cell disease, the transition from the foetal to adult form of haemoglobin—the oxygen-carrying protein in blood—marks the onset of anaemia and painful symptoms of the disorder.

Now, new research led by Howard Hughes Medical Institute (HHMI) investigator Stuart H. Orkin of Children's Hospital Boston, Dana Farber Cancer Institute, and Harvard Medical School shows that silencing a protein known as BCL11A can reactivate foetal haemoglobin production in adult mice and effectively reverses sickle cell disease. The new finding, reported October 13, 2011, in *Science Express*, reveals that BCL11A is one of the primary factors involved in turning off foetal haemoglobin production. The paper's first author is Jian Xu, an HHMI-Helen Hay Whitney fellow.

BCL11A is likely one of a suite of up to a dozen factors that influence foetal haemoglobin levels, Orkin says, but the new study provides hard evidence that it is one of the key players in regulating the production of foetal haemoglobin. BCL11A works as a repressor by binding to DNA and regulating gene expression.

CASE 3: REPROGENETICS

Reprogenetics is an offshoot of an established medical procedure called preimplantation genetic diagnosis (PGD).It isn't a new area of study, but uses several techniques associated with gene manipulation. PGD allows couples at risk of transmitting a genetic disease to ensure their future children are unaffected by the disease without going through the process of prenatal diagnosis (i.e., testing of foetal tissue for the presence of disease genes) and being forced to make the difficult decision regarding pregnancy termination.

Basically, PGD involves extracting a single cell from an eight-cell embryo (created via in vitro fertilization) and analyzing the DNA of that single cell for the presence of one or more disease-associated genetic alterations. Then, only those embryos without the disease mutation are implanted in the mother's uterus.

Introduced in the 1990s, PGD was first used for determining the sex of embryos to minimize the likelihood of transmitting fatal sex-linked disease genes to offspring. Clinical use of PGD has expanded from embryo sexing to single-gene diagnostic testing, such as for Huntington's disease. Today, reproductive clinicians regularly use PGD to diagnose some 170 different conditions, with two of the more common being cystic fibrosis and hemoglobin disorders (e.g., Cooley's anaemia).

ADVANTAGES AND DISADVANTAGES OF GENE MANIPULATION

There are always two sides to any issue. Any field in science has its own set of boons and banes. While gene manipulation can benefit society, it also raises several questions on ethics.Currently genome sequencing and manipulation is restricted to detection of genetic diseases. Ashkenazi Jews, for instance, are carriers of a rare but terrible childhood disease, Tay-Sachs, and Jewish couples planning

to have a family commonly get tested for it. Tests also show if a child will have Down syndrome or cystic fibrosis. Parents then can make a reproductive choice: They can prepare for the child or elect to terminate the pregnancy. The potential of abortion however, makes this field of study highly controversial.

Understanding our genes may actually increase our freedom by helping us understand the biological obstacles—and opportunities—we have to work with. Soon, scientific understanding of the genetics of obesity, for example, will be so advanced and our technology so sophisticated that, eventually, without discarding embryos at all, we could use gene-targeting techniques to tweak foetal DNA sequences.

However, there are several disadvantages to consider as well. This concept brings up ethical issues that need to be addressed. What if the research and progress made in this field is used for purposes other than the ones it was intended for?

Could this area of research lead to the field of eugenics? Eugenics was a concept embraced by the Nazis. It involved selective breeding in order to obtain a population having desirable characters.

While most parents care about promoting the health of their children, some may give more importance to their talents. They may use this technique to enhance their child's cosmetic features or their skills such as athletics or intelligence.

There is a thin line between genetic enhancement and people seeking to simply improve their physical attributes. This makes genetic manipulation in the foetus level seem more sinister and intrusive. It is an invasion of a person's privacy. They are robbed of their chance to choose for themselves.

Having information about the genetic makeup of their child could cause anxiety in parents as well. While most parents hope for 'normal' children, the results of genetic sequencing could change their perception of what 'normal' is.

One cannot account for the unpredictable nature of would-be parents. The results also could affect parenting. If, for instance, genes associated with intelligence could be located and the parents know the child will not have the genetic variations associated with high IQ, would that affect how they raise the child or their expectations? What if genes for athletic ability were discovered but a foetus lacked favourable versions of those genes? Would parents who want an athletic child be disappointed or even terminate the pregnancy?

Parents who act on the information make decisions for another human being, and not for themselves. Do they have the right to do so? Such ethical issues have been raised against the concept of gene manipulation.

CONCLUSION

"I see nothing wrong ethically in the correction of single gene defects. But I am concerned of any other kind of intervention, for anything else would be an experiment, which would impose our will on future generations and take unreasonable chances on their welfare. Such intervention is beyond the scope of consideration." –Ian Wilmut

Society may not be ready for such a radical change either. Diseases that were perceived as incurable could now be cured. This may be hard to process for many and hence there will be resistance. But change and progress in inevitable and as humans, we will always adapt to change. Gene manipulation is an effective was to protect the future generation from various deadly diseases.

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Student Interview

-As told to **Shonima Menon, 3rd Year, B.Tech. (Biotech.)**

Interviewing a junior is always fun because they come into our department with so much confidence, enthusiasm and of course, armed with ideas .So, we have here, a fantastic interview with **D.S. Mukilan** of 2nd year C.

Q. What hypothesis are you interested in testing?

Ans. I would like to implement human biology and mechanical components for advancements and enhancements.

Q. What existing scientific knowledge are you challenging?

Ans. I am challenging enhancement of human life, its longevity, aging, physical power enhancement. I want to work on a whole lot of ideas like biome chips, disease resistance, space exploration and of course mainly adaptability.

Q. Phew! That's a lot of ideas to work on. So what is the basic outline of your idea? How do you plan on executing it?

Ans. Actually, what I am planning is against nature but what I really wish to do is to work with nature side by side and enhance our own life too. I want to eco balance and control our own cycle of life. So, I want to start by studying the human body, the fundamentals, and hormones, etc. I want to find a simplistic solution which is realistic and not riddled with scientific jargon. I want to make a breakthrough.

Q. Feels good just hearing the idea out! So what is the basis of your work? What already existing work are you planning to use as your reference?

Ans. This is a restricted and sensitive topic. This type of research is carried out in secretive manner in military areas. (Secretly). Actually, I have heard that Finland and Norway are researching jelly fish for its immortality and other researchers are researching animal genes, to incorporate them in plants.

Q. How will your research benefit the wider community?

Ans. (confidently) Find it yourself when you read about it. My strategy is to implement in smaller populations first, then proceed with wider applications. After all "complication is what makes humans".

Q. Now you are actually putting forward a plan of action which has to cross many parameters and borders. So how do you want the panel to judge you?

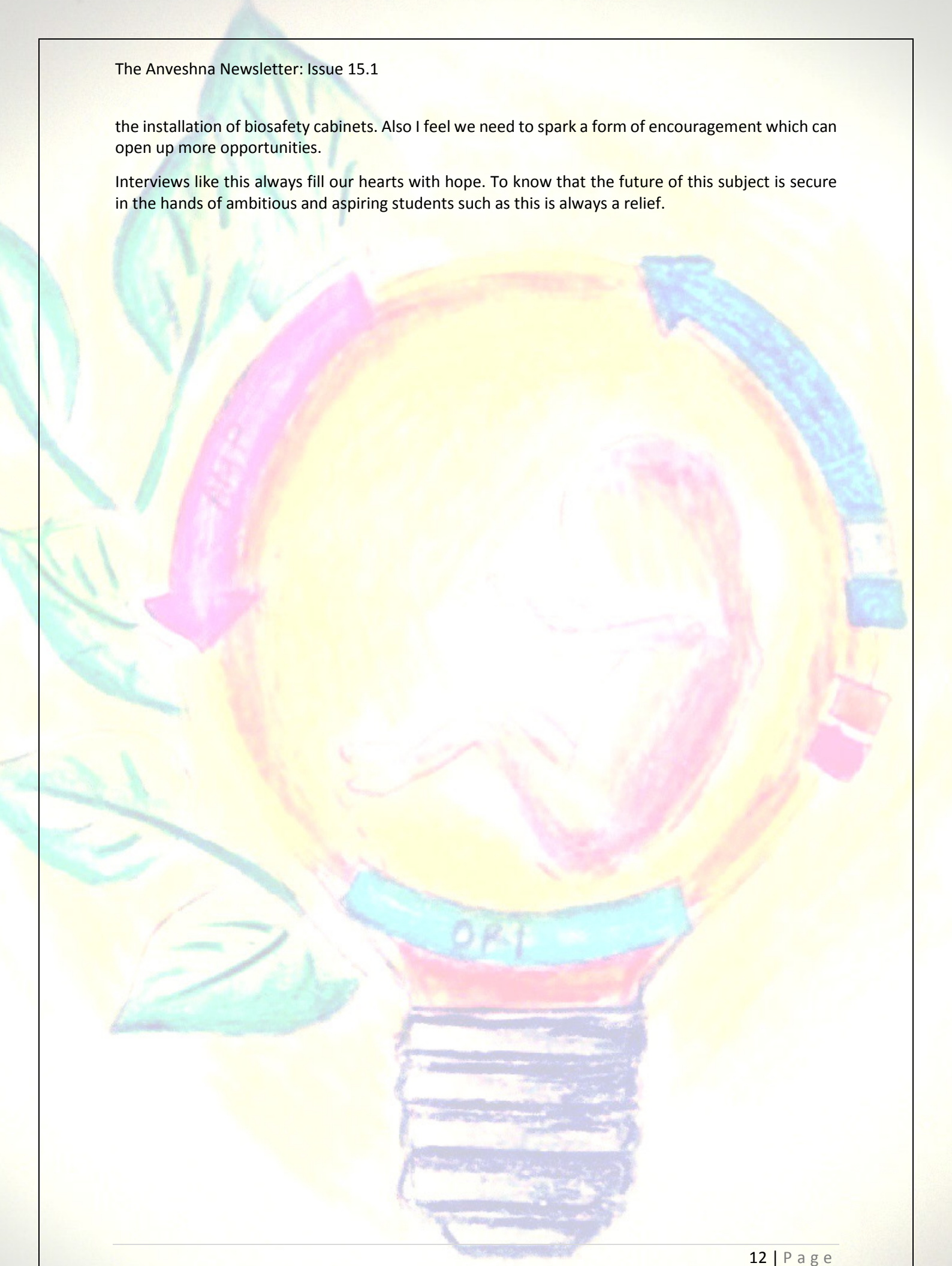
Ans. I want best of both artificial intelligence and humans. The panel should not be emotionally corrupted yet be rational in its approach and my main aim is to explore the beauty of nature and is one lifetime enough for it?

Q. Now the most important question. How do you find the department and what more should be done to encourage research?

Ans. (Ahem ahem) It is currently very much developing accessibility in technological aspects, equipment and labs are pretty good. I feel it is currently partially restricted. I am looking forward to

the installation of biosafety cabinets. Also I feel we need to spark a form of encouragement which can open up more opportunities.

Interviews like this always fill our hearts with hope. To know that the future of this subject is secure in the hands of ambitious and aspiring students such as this is always a relief.



RARIORA – The Technical Symposium

Akshaya Keerthi SJ, 3rd year, B.Tech. (Biotech.)

After a long haul of hard work, the most awaited technical symposium – "RARIORA" took place in the Department of Biotechnology, School of Bioengineering, SRM University from 22nd August – 23rd August, 2014. Now, let me present you an insight behind this novel approach – including the happenings during the D-day and 'behind-the-scenes'.

Five months before the technical symposium, Anveshna (The Biotech Association) members – Aravind Kannan, Vignesh Srinivas and Jahnavi Bhaskaran approached with this novel idea of conducting a symposium that primarily specializes on Biotechnological ideas. The term 'Rariora' was chosen unanimously (as we all know) by all the members of the association as the meaning fit perfectly to the motive of the symposium. Derived from the Latin word, Rariora means "rare collector's item", this emphasized their motive towards finding the hidden talent and knowledge of young intellectuals.

Concurrently, Rariora targeted the general public on Environmental Awareness and they conducted the 'GREEN DRIVE', where students of SRM Biotechnology walked the Besant Nagar Beach path on 16th August, 2014 caring placards on Environmental Awareness and to create an Eco-friendly surrounding.

DAY 1

The symposium started with a short Inaugural Function with the HOD address to the gathering followed by two seminars given by the guest lecturers – Dr. Ghiridaran Appaswamy from Life Cell Pvt. Ltd presented his seminar on 'Application of Stem cell on Regenerative Medicine and Dr. Rajeshwari, K. from Bioklone presented a seminar on 'Bio-entrepreneurship'.

The events of Rariora started by 11:30 am after the inaugural. The two day symposium had 6 events namely: Poster presentation, Brain Chase, Clash of the Eloquent,Catechize, Think-a-Thesis and Abstr'Art , and 1 workshop on Forensics.

These events were however split between the two days, with Poster Presentation, Brain Chase and Clash of the Eloquent on the first day and Think-a Thesis, Abstr'Art and Catechize on the second day. Many participants from various colleges such as St. Joseph's, SSN, RMK and students from Kendriya Vidyalaya and SSV schools also took part in the events and the workshop.

HERE IS AN INSIGHT ON THE EVENTS:

- Poster Presentation: This is a forum where the participants can present their original research idea and present an abstract through a poster presentation. The participants were judged on originality, presentation and the reasoning for the questions posed by the judge. This concept helps the students to get a broader perspective on the idea.

- Brain Chase: On the lighter side, Brain Chase was the most sought-after event of all, as its primary concept was "TREASURE HUNT". As the name suggests, Brain Chase is about deciphering the clues hidden all over the campus grounds. And the judging was simple – Whoever finishes first – WINS! However, these riddles were not easy to find out and certainly

made the participants to think out of the box to break these clues. However this 45 minutes event was definitely the star event of the symposium.

- Clash of the Eloquent: This event tested on the oratorical skills of the participants. The event had 3 rounds held for on both the days of the symposium. The first day held round 1 and round 2 which was "Tag and Tackle" where individual participants were tested on an extempore for a selected topic. The qualified participants moved to the next round – Debate. The final round was on the second day, where an Asian Parliamentary styled Debate was conducted for the 2 teams qualified for the finals, the judges scored the participants based on confidence, flow of language, attention to details, factual accuracy and behavior.

DAY 2

The second day began with a seminar by Dr. Sri Bala Kameshwari, Senior Scientist of CLRI who presented a presentation on "Perspectives of Biological Treatment of Tannery Waste Water".

- **Catechize:** This is a 5 round quiz event that had covered all the aspects of science. These were the following rounds – Rapidata, Cluedo, Snooze and Lose, Hear Eye and Hands On. The qualifiers battled their way up to the finals, with hands on experiments to be done to obtain the answers. This helped the participants to gain knowledge both practically and theoretically.

- **Think-a-Thesis:** The primary idea was enabling the participants to think of a hypothesis however bizarre them maybe. This first round was tested on the individual's creativity and innovation. The qualifiers of this round would battle against their opponent in an adzap, where the participants need to act their resultant product of their hypothesis from the previous round. They were tested on their ability to convince their product to the judges and also the reasoning for questions posed. This event helps the students to pursue their novel ideas along with the ability to commercialize their products.

- **Abstr'Art:** As the name suggests, individuals would be tested on their creativity and imagination through their abstract art. The topic given to these participants were Environment Awareness.

- WORKSHOP – FORENSIC: The two day workshop on Forensic was conducted by the guest lecturer – Ms. Joulyn Kenny, a forensic expert in the IFO Forensic Standard Research Pvt. Ltd. The workshop dealt with a basic criminology, case studies, and types of forensic pattern. The students got hands-on experience in finger-printing, blood splatter, shoe printing and a mock case to solve. The worship was certainly a different experience that pooled in almost 80 participants on both the days. This workshop gave an insight on how to deal with both chemical and psychological pathways of forensic studies.

The roaring 2 day symposium ended with a Valedictorian Ceremony where prizes and certificates were given to the winners of various events. The closing speech was given by the Secretary of Anveshna – Aravind Kannan.

-----Behind the Scenes-------

- Lunch time taken up by the Rariora Meetings.
- Facing the HOD for approval of events and ODs.
- Denial of ODs by the HOD (initially).
- Committed members seeking sponsorship during college hours.
- Never-ending list of college and school invitations sent through mails.
- Running around the campus (Brain Chase) to hid clues.
- Sarada ma'am staying back in college with the students after college hours.
- Innumerable climbing of stairs.

So, to sum it up, Rariora was a huge success that changed many students and teachers' perspective of thinking and the spirit of true harmony was shown throughout the process of this technical symposium.

ANVESHNA MEMBERS:

- Aravind Kannan: Secretary
- Vignesh Srinivas
- Jahnavi Bhaskaran

15 Coordinators and 50 Volunteers pulled this 2 day event together.

Internship at IIT-Madras during December 2013

Deepthi Mohan, 4th Year, B.Tech. (Biotech.)

Internships offer students a period of practical experience in the industry/institute relating to their field of study. It gives exposure and hands-on-training in various aspects of one's course. The tutelage stint helps in better understanding of subject, building confidence, developing communication and interpersonal skills. In today's fiercely competitive world the training gives you an edge over others when it comes to higher studies or finding a job. The internship is the perfect chance to acquire professional skills and talents. Skills like responsibility and making professional connections can be valuable learning which an internship can offer.

My internship was at IIT-Madras during December 2013 (for one month) at the Bio-organic and Chemistry Lab in the area of bio-catalysis. IIT-Madras has the Department of Biotechnology where research in various fields of Biotechnology is being carried out. Cancer Biology, Plant Biotechnology, Systems Biology, Developmental Biology, Bioinformatics etc. are some of the areas of specialization. The laboratories here are very well equipped with state of the art equipment. The requirement for pursuing an internship is a reasonably good CGPA and a record of internships done earlier at reputed institutes. Another alternative is to apply for paid 'The Summer Research Fellowship' which also gives a good opportunity to work on academic projects for third year B.Tech or first year M. Tech. students.

Bio-catalysis, the use of live micro-organisms to carry out a chemical reaction is important tool in biological research. Bio-catalysis offers a practical solution to make the alcohol oxidation reaction a viable Green Chemistry process I worked on bioconversion of 1-Phenylethanol to Acetophenone which is a commercially important reaction and has widespread applications. Alcohol oxidation is commonly carried out with the help of chromium (VI) catalyst which is toxic, corrosive, and expensive and releases carcinogenic byproducts. Moreover, such reactions require severe conditions such as, high pressure or temperature, using strong mineral acids like sulphuric acid, yet provide only 42% efficiency.

This internship helped me to gain experience of working in a lab and also to hone my career skills. I learnt how to design an experiment and analyze the results obtained. As and when time permitted I got the chance to interact with research scholars, post-doctoral students and we discussed issues of mutual interest in biotechnology. This helped in widening my horizon on the scope of biotechnology research.

The Stem Cell Drive

A Blood Stem Cell Donation Camp was jointly organized by DATRI and Anveshna (Biotech Association) on the 4th and 5th of February this year. The camp involved a Seminar given by the members of DATRI on the 4th.The seminar covered topics such as various medical cases that were closed successfully due to Stem cell donations, and also about the risks involved in being a donor. The actual registration and swabbing procedure took place on the following day.

PROCEDURE

- The potential donor had to fill out a small registration form giving HIS/HER consent for the procedure. The form also had minor Donor profile questions such as name, age, address etc.
- A cotton swab of the registrant salivary sample was taken by volunteers and stored in sealed sample bags and tagged to the form. A copy of the form and a Donor ID was given to the potential donors so that they could be called forward as donors at a later period if there is a match
- The salivary samples are HLA typed and the data is stored in a registry. If and when a person requires a stem cell transplant, their HLA types are run against a registry compiled by these organizations.
- Upon having found a match, the donor is given NEUPOGEN injections that stimulate the release of blood stem cells into peripheral blood. This facilitates easy and harmless collection of stem cells from the donor.
- Till date these injections have not shown to have any major side effects apart from a few cases of mild headaches.

TURN OUT

On behalf of Anveshna, we would like to thank all the students of the Bioengineering Sciences Block for having thronged our quadrangle and responded so enthusiastically. The success of a camp is its turn out and this camp recorded over 400 registrants. We can be sure that we have contributed in a small way, to saving a person's life. We hope to organize many more camps of this nature and we also hope the response grows with each one. Keep the numbers coming!!! :D

COORDINATOR

- Dr. D.V.L. Sarada, Asst. Professor.

ORGANIZERS

- Datri Team.
- Anveshna Team

VOLUNTEERS

- Sanjay Narayanaswamy, 3rd Year, B.Tech. (Biotech.)
- Raghav Gururajan, 3rd Year, B.Tech. (Biotech.)
- Akshaya Keerthi, 3rd Year, B.Tech. (Biotech.)
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- Gayathri Sukumar, 3rd Year, B.Tech. (Biotech.)
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- Srividya Raja Gopal, 3rd Year, B.Tech. (Biotech.)
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About Anveshna

The goals of the association are to provide an in-depth knowledge about current trends in Biotechnology by inviting eminent speakers from both academic institutions and industries, enhance the interaction among the students, improve the learning atmosphere, increase the awareness about doing research, etc.

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