DeNovo
THE BIOTECH SOCIETY

Ramaiah University
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CATALYST

A DENOVO:THE BIOTECH SOCIETY INITIATIVE

Vaccine Hesitancy

A phenomenon

Understanding this bizarre reluctance to get vaccinatedd

A new form of DNA discovered in human cells

By Dr.Debasish Kar

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Where do we stand today?

CATALYST

DENOVO: THE BIOTECH SOCIETY NEWSLETTER

ISSUE NO. 01

DECEMBER 2021

FROM THE EDITOR'S DESK

Sujanaa Sai, Editor-in-Chief

In one of the empty classrooms, in the newly constructed third floor of the FLAHS building, a few of us sat, huddled over a desk, furiously scribbling down ideas, as we tried to get our opinions across each other's increasingly excited and loud vociferations of viewpoints - ideas that would later become the blueprint for DeNovo: The Biotech Society. Fresh out of a severe lockdown and the prospects of the future beckoning us, we thought to ourselves, what exactly have we contributed to the betterment of our university? How can we leave behind a legacy that would benefit not only the present and future students but also something that we could look back on fondly? We wanted to lay the foundation for something that would eventually impact a larger change, as little as our experience is. With nothing but our ambitions and the endless encouragement and support from our respected faculty, DeNovo: The Biotech Society was born. It is the beginning of a new journey of learning and growth and as we proceed, we hope the tiny seeds of experience that we sow, would grow into a lush forest of knowledge and opportunities that would provide solace to many.

At DeNovo, apart from academic engagements, we hope to cultivate various soft skills, boost the confidence and inquisitiveness of the students and provide a platform for reliable intercommunication. This will shape the students to be well-rounded individuals, with the ability to tackle key issues in their professional as well as personal lives.

The core committees at Denovo consist of the Editorial, Outreach, Event Management, Treasury and Tech and E-Resources. These core committees function as interconnected and dynamic parts of a whole, headed by the President who is elected by the members of the core committee. We also seek to establish healthy communications with the alumni and encourage networking among the students within their niche as well as without.

If DeNovo is your metaphorical Hogwarts Express to the magical future that lies ahead, surely, the newsletter, aptly titled Catalyst, is the engine that drives it forward. This newsletter, initiated by the students, will feature articles and pieces from students across all the semesters and valuable contributions by the faculty. Catalyst will bring to you exciting scientific news and articles, fun facts, crosswords and quizzes, upcoming events, and keep you updated with everything science!

If communication is your strong suit, then outreach will be the perfect platform for you to hone them even further. Members of the outreach committee are involved in communicating vital information about the Society to everyone and recruiting students to participate in the activities. Event Management will organize and manage academic and extra-curricular activities of DeNovo, where you will gain wonderful insights into the world of science via academic webinars, workshops, and fun activities. And last but not the least, Treasury will manage all the finances of DeNovo and ensure we run smoothly and effectively.

No small feat, but made possible with an amazing team of like-minded and passionate individuals and an extraordinary faculty, who has encouraged us at every step of this endeavor. Going forward, I wish nothing but good luck and success to DeNovo -The Biotech Society!

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DeNovo
THE BIOTECH SOCIETY

In 1998, a paper titled “Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and persuasive developmental disorder in children” was published in renowned medical journal, the Lancet, and this paper would go on to make history as one of the most sensational papers in recent medical history while also setting the snowball rolling on modern vaccine hesitancy. From variolation against small pox using cowpox virus to the ongoing pandemic of the century, vaccine hesitancy has a history as long as that of vaccines themselves. The modern anti-vaccine movement and talking points, however, can be traced back to the 1998 paper, authored by then British gastroenterologist Andrew Wakefield.

Wakefield and 12 colleagues suggested in an early report in the Lancet that the measles, mumps and rubella (MMR) vaccine may be inducing behavioral regression and pervasive developmental disorder in children. The team studied a small sample of 12 children and analyzed the observed onset of symptoms of autism in them in relation to their MMR vaccination timeline to identify a temporal link between the two. In the conclusion, they speculated that the MMR vaccine could be causing regressive autism. Despite the small sample size, the uncontrolled design and the speculative conclusion, the paper received wide publicity. Epidemiological studies were conducted with hundreds to thousands of autistic children, refuting the posited link between MMR vaccines and autism. Since the administration of the MMR vaccination and the first observed signs of autism tend to occur in the same period of early childhood, a coincidental link is inevitable. Further investigation by independent journalist Brian Deer into the study itself revealed that not one of the 12 cases reported in the 1998 paper was free of misrepresentation or undisclosed alteration. Wakefield’s monetary bias was also thrown into the spotlight as it was discovered that he was funded by lawyers engaged in lawsuits against vaccine-manufacturers. When Wakefield was offered funding to conduct a bigger study with a wider reach, he refused to take the opportunity. From not elaborating on the risk involved in the various invasive procedures to administering experimental drugs without approval from an ethics committee, Wakefield et al also breached multiple consent guidelines

Ten of the twelve co-authors retracted from the paper in 2004 and twelve years after publishing the landmark study, The Lancet retracted the paper in 2010. The British Medical Council found that Wakefield had acted unethically and had shown “callous disregard” for the children in his study and he was stripped off his medical licence.

The damage to public health, however, was already done. Despite scientists and organizations across the world spending a lot of time and money refuting the results of a minor paper, vaccine hesitancy sky-rocketed causing multiple measles outbreaks. The snowball has since grown into an avalanche and has now resulted in vaccine hesitancy being one of the primary factors for the prolonged COVID-19 pandemic.

During a study conducted with 1638 individuals in India, it was reported that more than a third (37%) of participants were either not sure about or refused to obtain the COVID-19 vaccines. This rate of vaccine hesitancy is highly concerning given the threat of emerging variants around the world and a healthcare system in India that can be quickly overwhelmed with future outbreaks. Rumours about the vaccine causing disruptions in the menstrual cycle, reduced fertility, autism and various other unsubstantiated side effects have resulted in vaccine wastage as only 41% of India’s 944 million adults have been fully vaccinated. It is also fueled by many factors such as lack of technical knowledge in providers, patriarchal societal norms, critical view of medicine by naturopaths and homeopaths and the influence of media.

In 2021, with social media being more prevalent than ever before, misinformation is rampant and easily accessible to everyone with little to no prior verification. Fear mongering has become the key tool used by anti-vaccine advocacy groups, similar to the case in 1998 when the barrage of polarising and sensationalised media content used fear as the primary tactic.

Scientists who publish their data have an ethical responsibility to ensure the highest standards of research design, data collection, analysis, reporting and interpretation. More awareness and transparency are required to combat misinformation. Individual responsibility before passing on unfiltered media, training and education programs such as soft skills for health care providers are also essential to combat vaccine hesitancy.

Vaccines are some of, if not the most, successful public health endeavours ever put into practice. Countless lives have been saved and the occurrences of vaccine preventable diseases are a fraction of the rate prior to wide-spread vaccine campaigns and initiative. In this age where societal change and simultaneously, its demise can all happen in the blink of an eye, it is our responsibility to eliminate the epidemic that is vaccine hesitancy. Get vaccinated!

New Form of DNA Discovered in Human Cells

Dr. DEBASISH KAR, Ph.D

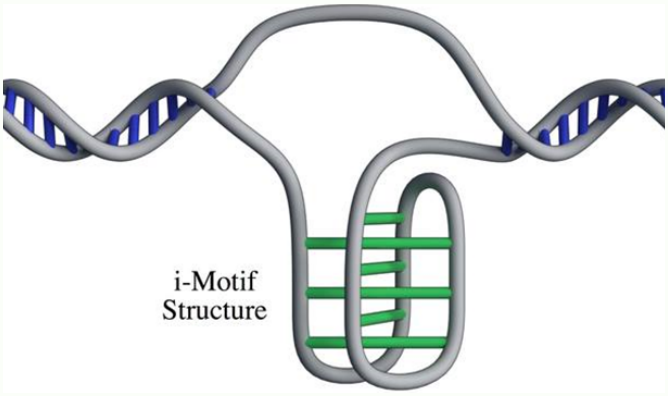


Figure: The proposed i-Motif structure of DNA

A new form of DNA has been discovered inside living human cells for the first time. Named i-motif, the form looks like a twisted knot of DNA rather than the well-known double helix. According to media reports, the discovery was made by scientists from the Garvan Institute of Medical Research in Sydney. A twisted 'knot' of DNA, the i-motif has never before been directly seen inside living cells.

The new findings, from the Garvan Institute of Medical Research, are published in the leading journal Nature Chemistry.

The iconic 'double helix' shape of DNA has captured the public imagination since 1953, when James Watson and Francis Crick famously uncovered the structure of DNA. However, it's now known that short stretches of DNA can exist in other shapes, in the laboratory at least - and scientists suspect that these different shapes might play an important role in how and when the DNA code is 'read'. The new shape looks entirely different to the double-stranded DNA double helix. When most of us think of DNA, we think of the double helix," says Associate Professor Daniel Christ (Head, Antibody Therapeutics Lab, Garvan) who co-led the research. "This new research reminds us that totally different DNA structures exist -- and could well be important for our cells."

"The i-motif is a four-stranded 'knot' of DNA," says Associate Professor Marcel Dinger (Head, Kinghorn Centre for Clinical Genomics, Garvan), who co-led the research with A/Prof Christ. "In the knot structure, C letters on the same strand of DNA bind to each other - so this is very different from a double helix, where 'letters' on opposite strands recognize each other, and where Cs bind to Gs [guanines]." Although researchers have seen the i-motif before and have studied it in detail, it has only been witnessed in vitro -that is, under artificial conditions in the laboratory, and not inside cells. In fact, scientists in the field have debated whether i-motif 'knots' would exist at all inside living things - a question that is resolved by the new findings. To detect the i-motifs inside cells, researchers

National news

Megha M

IISc. study identifies biomarkers to predict progression in brain tumour

Researchers at the Indian Institute of Science (IISc.) in Bengaluru, along with collaborators, have identified potential blood-based biomarkers to predict disease progression in those with advanced brain tumour.

The team collected blood and tumour samples from patients with Grade 3 and Grade 4 gliomas, and compared the numbers of monocytes and neutrophils in these samples. M2 monocytes, associated with suppression of immune responses were present in larger numbers in the samples from Grade 4 tumours. The researchers also found that levels of two surface proteins on neutrophils and monocytes, CD86 and CD63 which caused poor prognosis in other tumours, were closely related in both the blood and tumour samples. “Future studies could focus on developing therapies that reduce the numbers of M2 monocytes in the tumour microenvironment or alter their functionality,” the authors explained.

However, they also cautioned further testing and validation on a larger scale is necessary before this can be taken from the lab to the clinic.

International news

Shreya GM

Mouse study shows microplastics infiltrate blood brain barrier

In recent years, studies have revealed the kind of threat microplastics pose to marine creatures. This includes weakening the adhesive abilities of muscles, impairing the cognitive ability of hermit crabs and causing aneurysms and reproductive changes in fish.

Researchers at Daegu Gyeongbuk Institute of Science and Technology orally administered polystyrene microplastics two micrometers in size or smaller to mice over the course of seven days. Like humans, mice have a blood-brain barrier that prevents most foreign substances, and especially solids, from entering the organ, but the scientists found that the microplastics were able to make their way through.

The study shows that microplastics, especially microplastics with the size of 2 micrometers or less, start to be deposited in the brain even after short-term ingestion within seven days, resulting in apoptosis, and alterations in immune responses, and inflammatory responses.

developed a precise new tool - a fragment of an antibody molecule -- that could specifically recognise and attach to i-motifs with a very high affinity. Until now, the lack of an antibody that is specific for i-motifs has severely hampered the understanding of their role. Crucially, the antibody fragment didn't detect DNA in helical form, nor did it recognise 'G-quadruplex structures' (a structurally similar four-stranded DNA arrangement). With the new tool, researchers uncovered the location of 'i-motifs' in a range of human cell lines. Using fluorescence techniques to pinpoint where the i-motifs were located, they identified numerous spots of green within the nucleus, which indicate the position of i-motifs."What excited us most is that we could see the green spots -the i-motifs appearing

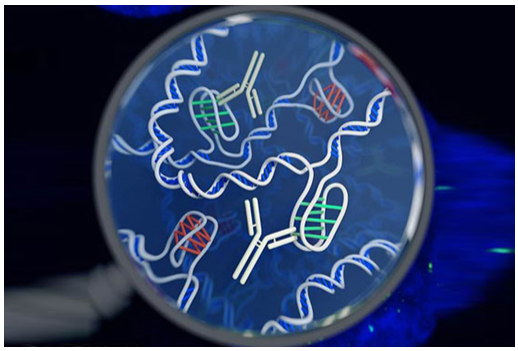


Figure: Scientists have previously debated whether i-motif 'knots' would exist at all inside living things.

and disappearing over time, so we know that they are forming, dissolving and forming again," says Dr Mahdi Zeraati, whose research underpins the study's findings. The researchers showed that i-motifs mostly form at a particular point in the cell's 'life cycle' - the late G1 phase, when DNA is being actively 'read'. They also showed that i-motifs appear in some promoter regions (areas of DNA that control whether genes are switched on or off) and in telomeres, 'end sections' of chromosomes that are important in the aging process.

Dr Zeraati says, "We think the coming and going of the i-motifs is a clue to what they do. It seems likely that they are there to help switch genes on or off, and to affect whether a gene is actively read or not.

"We also think the transient nature of the i-motifs explains why they have been so very difficult to track down in cells until now," adds Prof Christ. Prof Marcel Dinger says, "It's exciting to uncover a whole new form of DNA in cells -- and these findings will set the stage for a whole new push to understand what this new DNA shape is really for, and whether it will impact on health and disease."

CRISPR/Cas9-A PHENOMENAL DISCOVERY

ANANYA ANURAG ANAND

“Emmanuelle Charpentier and Jennifer A. Doudna win for technology that gives scientists unprecedented abilities to change the code of life” was a catchy headline I came across on October 7, 2020 while reading the Scientific American.

2020 was the year when Nobel Prize in Chemistry was awarded for the discovery of CRISPR (Clustered regularly interspaced short palindromic repeat)/Cas9, an editing system which has enabled scientists to edit the long stretches of DNA that codes the life for many organisms.

With this, Emmanuelle Charpentier, a microbiologist and director of Berlin-based Max Planck Unit for Science of Pathogens, and Jennifer A. Doudna, a professor and biochemist at University of California, Berkley, created history because this was the first time when Nobel Prize in chemistry was awarded to two women together!

In bacteria, Charpentier identified tracrRNA, a hitherto unknown molecule, about a decade ago. She discovered that this molecule is part of a microbe's immune system that aids in the battle against viruses by cleaving viral DNA.

Illustration of Doudna and Charpentier by David Parkins published in Nature

Doudna was mapping the cas proteins,a group of enzymes linked to CRISPR that snip DNA at specified locations, around the same time. The two scientists began working together in 2011 after meeting at a conference in Puerto Rico, where they went to a cafe in San Juan and discussed how their research overlapped. They were able to create these genetic scissors in the lab and reprogramme them to cut DNA at whatever location the scientists chose.

CRISPR's discovery and function

Francisco Mojica was the first to describe what is now known as a CRISPR locus. He worked on them and realised that what had been described as diverse repeat sequences actually shared a set of characteristics that are now known as CRISPR sequence hallmarks. He discovered that these sequences matched fragments from acteriophage genomes in 2005. He accurately hypothesised that CRISPR is an adaptive immune system.

Cas9 and PAM were discovered

Bolotin was researching Streptococcus thermophilus and revealed an uncommon CRISPR locus. Although the CRISPR array was similar to earlier systems, it lacked several cas genes and instead contained novel cas genes, including one producing

a large protein with nuclease activity that is now known as Cas9. They also discovered the spacers, which are related to viral genes. For target recognition, this sequence, known as the protospacer adjacent motif (PAM), is essential.

Spacer sequences are transcribed into guide RNAs

John van der Oost and colleagues demonstrated that spacer sequences originating from phage are translated into tiny RNAs called CRISPR RNAs (crRNAs) that direct Cas proteins to the target DNA in E. coli. Marraffini and Sontheimer demonstrated that the target molecule is DNA, not RNA. They noted in their paper that this system could be a powerful tool if it could be transferred to non-bacterial systems.

Cas9 cleaves target DNA

CRISPR-Cas9 generates double-stranded breaks in target DNA at exact places 3 nucleotides upstream of the PAM, according to Moineau and colleagues. Cas9 is the only protein necessary for cleavage. In Type II CRISPR systems, interference is mediated by a single big protein (in this case, Cas9) working in tandem with crRNAs.

Discovery of tracrRNA for Cas9 system

The group of Emmanuelle Charpentier provided the final piece to the puzzle in the process of natural CRISPR-Cas9-guided interference. They used Streptococcus pyogenes, which has a Cas9-containing CRISPR-Cas system, to do small RNA sequencing. They revealed that there is a second tiny RNA called trans-activating CRISPR RNA (tracrRNA) that exists in addition to the crRNA. They discovered that tracrRNA and crRNA form a duplex, and that this duplex is what directs Cas9 to its targets. CRISPR systems can function heterologously in other species

Siksnys and colleagues cloned the whole CRISPR-Cas locus from S. thermophilus (a Type II system) and expressed it in E. coli (a Type I system), demonstrating that it could provide plasmid resistance. This indicated that CRISPR systems are self-contained units and confirmed that all of the Type II system's essential components were known.

Biochemical characterization of Cas9-mediated cleavage

Using this heterologous system, Siksny and his colleagues isolated Cas9 in association with crRNA from an E. coli strain designed to carry the S. thermophilus CRISPR locus and conducted a series of biochemical studies to describe Cas9's mechanism of action. They confirmed the cleavage location and PAM requirement, and they demonstrated that the RuvC domain cleaves the non-complimentary strand while the HNH domain cleaves the complementary site using point mutations. They also discovered that the crRNA could be shortened to a 20-nt stretch, which would allow for efficient cleavage. They demonstrated that by altering the crRNA sequence, they could reprogram Cas9 to target a specific location.

Emmanuelle Charpentier, in cooperation with Jennifer Doudna, published similar findings to those of Gasiunas et al. at almost the same time.

CRISPR-Cas9 harnessed for genome editing

Zhang was the first to successfully adapt CRISPR-Cas9 for genome editing in eukaryotic cells. He had previously worked TALENs. Zhang and his collaborators created two Cas9 orthologs (from S. thermophilus and S. pyogenes) and demonstrated targeted genome cleavage in human and mouse cells. They also demonstrated that the system could be programmed to target numerous genomic regions and perform homology-directed repair.

Thus, The RNA-guided nucleases from CRISPR-Cas systems are regarded as one of the most reliable tools being used for genome editing. CRISPR-Cas systems or "genetic scissors," are being utilised by plant scientists to generate pest-resistant and drought-resistant crops, and it has the potential to revolutionise agriculture. It is also used in clinical trials of new cancer medicines in medicine. Researchers are also attempting to use it to treat genetic disorders.

Lately, CRISPR-Cas system is also being investigated for diagnosis of COVID-19. The CRISPR-Cas-based methods diagnose the SARS-CoV-2 infections within an hour. Apart from its diagnostic ability, it is also being assessed for antiviral therapy; however, till date, no CRISPR-based therapy has been approved for human use. The Prophylactic Antiviral CRISPR in huMAN cells (PAC-MAN), which is Cas 13 based strategy, has been developed against coronavirus. CRISPR-Cas is a truly path-breaking discovery that can have wide-reaching applications in modern science.

ON THIS DAY IN SCIENCE

In 1938, the first U.S. patent was issued for casein fibre (No. 2,140,274). Earl Ovando Whittier and Stephen Philip Gould of Washington, D.C. had first produced casein fibre in December 1935 which they dedicated "to the free use of the people of the United States of America." Casein is the main protein found in milk. Their aim was to produce dispersions of casein (mixed usually with plasticizers and salts), which could be extruded into fibres having the requisite characteristics of strength, water resistance, flexibility, and softness. The fibres could be used as substitutes for wool and other fibres. Some of the plasticizers experimented with were fat acids to give the fibres flexibility, softness and water repellancy. Sodium aluminate improved the fibre's strength. They are used in interlock outerwear, T-shirts, cardigans, jumpers, knitted berets etc.

December is celebrated as AIDS awareness month

HIV is a major global public health issue, having claimed 36.3 million [27.2–47.8 million] lives so far. According to global estimates by the WHO, 680 000 [480 000–1.0 million] people died from HIV-related causes and 1.5 million [1.0–2.0 million] people acquired HIV in 2020.

HIV progressively destroys certain types of white blood cells called CD4+ lymphocytes. Lymphocytes help defend the body against foreign cells, infectious organisms, and cancer. Thus, when HIV destroys CD4+ lymphocytes, people become susceptible to attack by many other infectious organisms.The most advanced stage of HIV infection is acquired immunodeficiency syndrome (AIDS). HIV infection is considered to be AIDS when at least one serious complicating illness develops or the count of CD4+ lymphocytes decreases substantially.

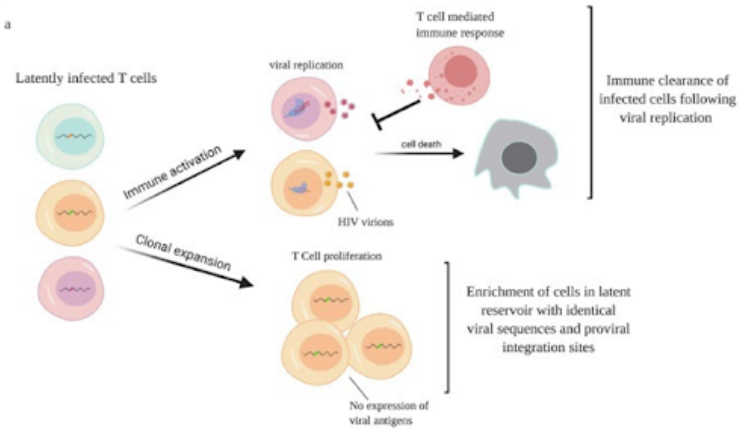
Treatment with antiretroviral drugs (antiretroviral therapy or ART) is essential, because without treatment, the CD4+ count begins to fall and increase in HIV infection can lead to serious complications.Thus, people need to take antiretroviral drugs for their lifetime.

Antiretroviral therapy is the term used to describe the treatment of HIV, this involves a combination of two or more drugs that are used to stop the virus from multiplying within the blood and reduce the viral load whilst increasing the number of CD4+ T cells which helps in preventing transmission and slowing down or preventing the development of AIDS. However this treatment comes with a significant downside in the form of side effects such as loss of appetite, Lipodystrophy, Diarrhea, and several other physical and possibly mental side effects which makes it increasingly hard to adhere to the treatment regimen.

In the fight against HIV, a major breakthrough study led by Dr. Xu Yu by studying rare patients called 'HIV controllers' discovered a mechanism to find a cure for HIV and decrease patient's dependence on ART.

A small subset of HIV patients who are able to control HIV replication in the absence of antiretroviral treatment for an unusually long period of time are commonly called HIV controllers. They serve as templates for a functioning cure. Many of these patients are subjected to infection with replication-competent viruses. A significant percentage of these patients have Human Leukocyte Antigen Alleles (HLA alleles) that protect them. These patients have peripheral CD4+ T cells that have small reservoirs and a low frequency of intact proviruses.

Recent studies suggest that a disproportionate integration of these proviruses at sites that possess a limited transcriptional activity escalates the possibility that the replication-competent viruses do not replicate due to the fact that they are trapped in a "blocked and locked" state.



Effect of clonal expansion on the viral reservoir: A) Activation of latently infected T cells will lead to viral transcription and replication. The synthesis of viral protein will lead to immune recognition and elimination of these cells by the immune system. Clonal expansion will lead to enrichment of cells with identical viral sequences and proviral integration sites

On the basis of "degree of control" with respect to the control of the HIV infection in these subjects' bodies, the subjects are classified into two categories, Namely, Elite Controllers (EC's) and Viremic Controllers (VC's).

Subjects that are able to maintain a viral load that is below the limit of detection of any commercial viral load assays are called Elite controllers and subjects who maintain viral loads that are detectable but less than 2000 copies/ml are called Viremic controllers.

A better understanding of the viral reservoir in these subjects is needed if a functional cure is to be achieved in patients with progressive disease who are on suppressive antiretroviral (ART) regimens (chronic progressors, CPs). To this end, scientists sequenced 1,385 and 2,388 full length proviral genomes from 64 ECs and 41 CPs respectively and also found significantly lower levels of intact and total DNA in ECs. They also showed that there was clonal expansion of genome-intact viruses in EC and the frequency of these presumed replication-competent clonally expanded viruses was higher in EC than in subjects on ART. It is possible that this enrichment of clonally expanded proviruses in ECs may be due to the fact that while viral replication results in the synthesis of viral proteins that can be identified by the immune system, clonal expansion can take place without antigen expression or virus production.

Thus, HIV-specific immune responses are more likely to eradicate CD4+ T cells containing actively replicating viruses than infected CD4+ T cells that have undergone clonal expansion.

These studies show that elite controllers keep HIV in control by inducing a potent T-cell response which attacks and destroys viral infected cells. Based on these findings, researchers are trying to develop a therapeutic vaccine that would 'teach' the immune system of a patient to destroy the HIV virus.

Bizarre Science

Pallavi, Madhulika

Genetically engineered mosquitoes

The Aedes aegypti mosquito that is infamous for carrying diseases like Zika virus, Dengue, Yellow fever, etc grew resistant to insecticides due to overuse.

Oxitec, A firm based in Abington worked with the Florida Keys Mosquito Control District and came up with a solution that involved releasing bioengineered male Aedes aegypti mosquitoes that didn't bite and mated with the female Aedes aegypti that were responsible for the biting.

The released males carried a gene that forced their female offspring to die in the early larval stage and hence only the males survived, causing the population of disease causing female mosquitoes to steadily decline.

The CRISPR Baby scandal

In 2018 a team of scientists from the southern university of science and technology led by Chinese scientist He Jiankui had created the first gene-edited babies using the revolutionary CRISPR-cas9, a unique technology that enables scientists to edit parts of the genome.

The project's goal was to create humans resistant to HIV. According to the main results, the team was "successfully" able to "reproduce" a known mutation in a gene called CCR5. This mutation occurs within a very small percentage of people and is known to give the individual resistance to HIV infection.

However, the team hadn't managed to reproduce the target mutation as per what the unpublished manuscripts suggest. Instead, they had created new mutations, which may or may not lead to HIV resistance, and never actually checked to confirm.

This project received international backlash and criticism for not just the pursuit of germline editing but also the neglect in following adequate safety testing and failure to follow standard procedures in acquiring participants.

Scientist of the month

Joel M, Rachana Joshi

"If you think you know it, then you do not know it, and if you know that you cannot know it, then you know it".

~ Dr. Ramachandran

Professor Gopalasamudram Narayanan Ramachandran born on October 8, 1922. A small-town boy from Ernakulum, Kerala, he went on to complete his master's in Madras University and received his Ph.D. from Cambridge, London.

Ramachandran's career began with the study of crystal physics and optics but slowly shifted to biological macromolecules which led him to discover the famous Ramachandran plot in 1963, which has two diverse applications for conformations and distributions. He was a co-researcher under Nobel Laureate Sir C.V. Raman at IISC, Bangalore. Although he dabbled around in many fields, his main ambition was to supplement the experimental side of biopolymer conformation.

Professor Ramachandran deservedly received many awards and honours, the Shanti Swarup Bhatnagar Award for Physics in India (1961) and the Fellowship of the Royal Society of London. In 1999, the International Union of Crystallography honoured him with the Ewald Prize for his 'outstanding contributions to crystallography'. He was nominated for the Nobel Prize as well for his fundamental contributions to protein structure and function. Although Professor Ramachandran passed away in Chennai on April 7, 2001, he left indelible footprints in all his scientific ventures.

Quiz

Kavitha, Debashma

1.The phenomenon of an offspring of two inbred parents showing a greater level of physical fitness than their parents and a lot of times the general populace is known as _____.

2.What is the most common condition caused due to chromosomal abnormalities?

3.Mini – Brains can be grown from _____.

4.Researchers have succeeded in creating a 3D-printed human heart from _____.

5.When do humans first acquire bacteria?

6.Some of the genetic material that makes up your DNA is not of human origin; viruses and bacteria have inserted some of it in a process known as _____.

ANSWERS - Click here or scan the QR code!

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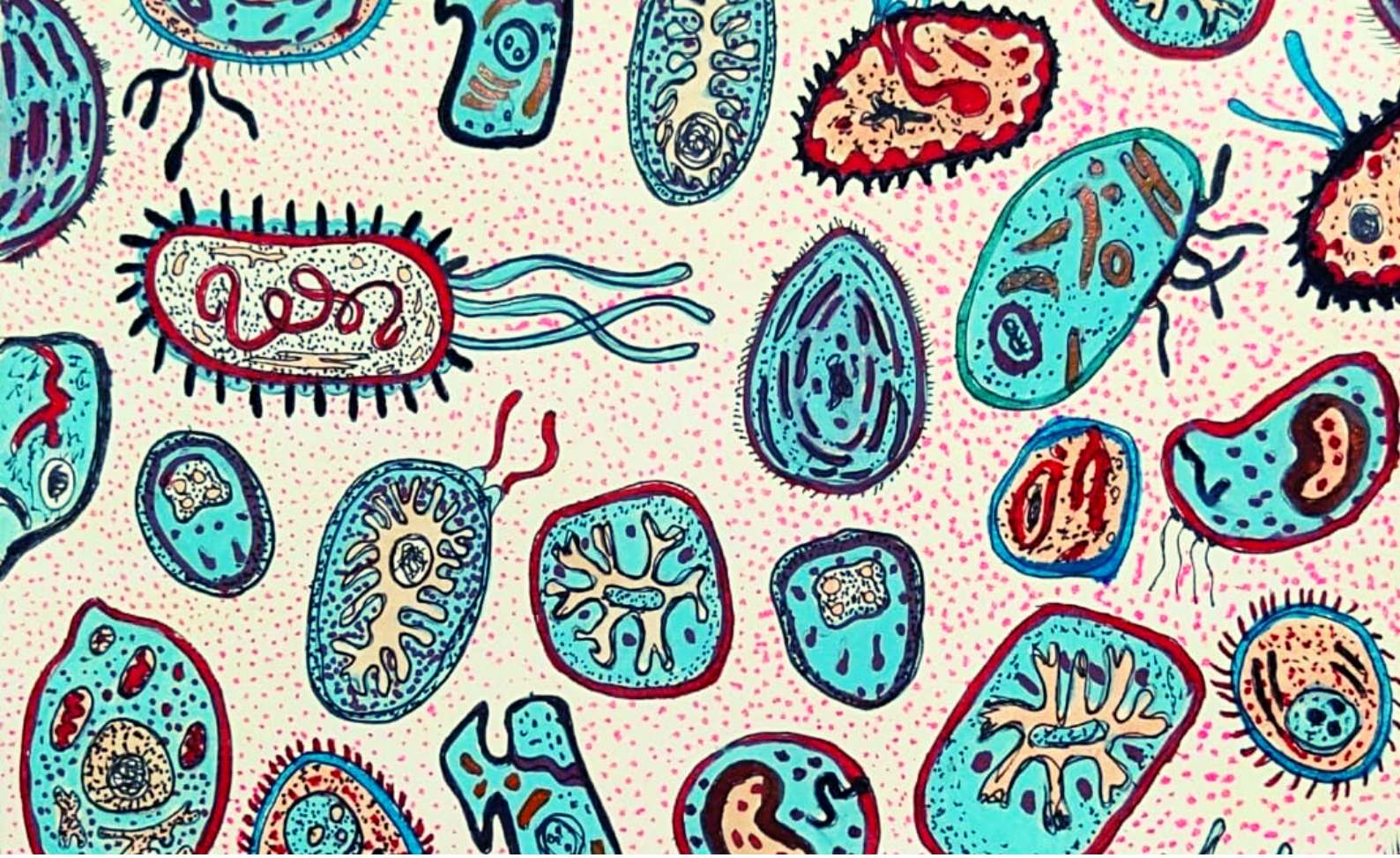

Afterword

This isn't the end but only a new beginning

ALDO EMANUEL

This issue has been a pleasure to work on, from all the new knowledge we gained to the experience in making sure to put out a newsletter that isn't inferior to any. However, this feat is not by our effort alone but the culmination of all the generous help we've received throughout this newsletters' making.

We would like to thank Dr. Debasish Kar, Dr. Ekta Tripathi, Dr. Swati Sinha, , and all the other faculty for their boundless insight, encouragement, and guidance over the course of making our first issue. Without them our inexperience would've probably gotten the better of us.

Next, we would like to thank all of the three authors, Sri Mathangi H, Ananya Anurag Anand and Shruthi, who have contributed their informative and thought provoking articles, the subcommittee members for all the work they've put into the making of this newsletter as well as the members of the Design team, namely, Nyaipriya, and Ananya. M for the wonderful illustrations which have given our newsletter an artistic tinge and helped make it livelier. We would also like to thank the rest of the committees of the DeNovo – The Biotech Society for taking over all the logistics that are involved in the publishing of this newsletter.

Lastly, we would like to thank our Editor in chief, Sujanaa Sai for editing every article personally to make sure it reaches a set standard of quality whilst helping with the illustrations and the template alongside all of the decision-making that goes into the making of an official newsletter.

Within the bounds of this issue, we tried to address and raise awareness with regards to viruses, vaccines, and other bits of interesting yet relevant information. Regardless of how strapped for time we were, we wanted to make sure the reader takes away an unbiased view of the current state of the world of biotech in these troubling times.

We hope to sink our talons into even more issues that are in desperate need of addressing and to help spread awareness of all the crucial things that are being buried under the numerous superficial developments in our coming issues.

Thank you very much for your patience, enthusiasm as well as all the support as we hope to build a strong foundation for Catalyst in the upcoming issues.