NUCLEAR ENERGY THE BETTER ENERGY

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NOBEL LAUREATES 2020

MENTAL HEALTH

An In-Built Treasure

nUeBe
All you need to know about Nuclear Energy

Letter From The Founder

"Change is the only constant." Never before have I related to this phrase as much as I do now. With the entire world working from home and stuck in front of their laptop screens, adapting to the new norm has become crucial.

With that in mind, my team at nUeBe decided to do something different and instead of a feature article on nuclear science, we decided to dedicate this issue to young scientists and researchers who are struggling to maintain their work-life balance during this pandemic and in the process are often neglecting their mental health needs. Through this issue, my team hopes to connect with scientists in the making and help them realize that enriching mental health is as important as taking care of their physical health.

Okay, but we are the nUeBes and we couldn't resist a short article to introduce you all to some of the lesser known fun-facts about nuclear energy. Thanks to my member, Nilormi Das for compiling a list of nuclear fun-facts that will leave you amazed and craving to know more.

To end this issue on a hopeful note, my team members Dhaval Gadariya and Vivek Patel have written a short review of the 2020 Nobel Prizes awarded in Physics and Chemistry. As scientists, these awards motivate us and keep us hopeful for a better future for everyone.

As I sign off this letter, I recall my team's wonderful journey with this issue and I hope you all enjoy this one as much as we did.

Happy Reading

Nirupama Sensharma
(Founder)

Mental Health Issues within Young Scientists

Author: Nirupama Sensharma

Suppose one fine morning you wake up with a bad headache. What would you do? Probably drag yourself out of your bed, find your first-aid box and take an aspirin. But what if the headache didn't get better? What if it kept getting worse? Most people would respond by saying that they would ask for help, go to a doctor to try and find out the underlying cause and get it resolved. So far so good.

Now go back to the first question and replace ***headache*** with ***depression***. What would you do? As a next-step remedy, you would probably go out and hangout with friends, enjoy your favorite tequila shots to burst the stress. But what if it doesn't get better? What if it keeps getting worse with time? What if it got so bad that you could no longer drag yourself out of bed?
Most people would just go on repeating the first-hand remedy over and over again without trying to find the root cause of what is causing the depression in the first place. Most people would avoid getting professional help for as long as they possibly could.

Observing *Mental Illness Awareness Week* last month, we the nUeBes thought it's high time to address the ever-increasing concerns surrounding the mental health of young scientists. But before we proceed, we would like you to take a moment and focus on the words **depression** and **mental health**.
Now ask yourself, what feelings arise within you at this very moment - anger, resistance, shame, fear or something entirely different?
We are scientists. We are expected to be intelligent, smart, competitive and brilliant, all at the same time. But we are still human. We have a brain that weighs approximately 3.3 lbs and despite what most people would like to believe, our brain and the rest of our body organs are exactly the same as every other human. So are our feelings of anxiety, depression, loneliness and burnout.

Given the extremely stressful and competitive work environments that most scientists work in, it is absolutely normal for them to experience mental health issues. And even more so as we are in the midst of a global pandemic with everyone stuck in their own bubble.

To fulfill their dreams of pursuing a career in science, research and discovery, many students and young scientists enrol in doctoral and postdoctoral programs. Although these programs are enjoyable and significantly fulfilling, they take a long time for completion. For the majority of that duration, therefore, the students are forced to stay away from family and friends, in hostels or residential facilities. Little do we know and discuss about the burden these young students have to take on while juggling their research, academic duties, household chores and personal lives. It becomes more difficult if they have ailing parents back at home or newly-married partners from other fields.

Some of the most common issues faced by young students are:

- Home-sickness
- Difficulty adjusting to a new environment
- Difficulty handling work pressure and personal life simultaneously
- Bullying and poor cooperation at workplace
- Stress and performance anxiety
- Depression and suicidal ideation
- Substance abuse

Psychologists believe that in the initial years of their program, the first four factors are the most common. However with the passage of time, poor stress tolerance resulting in depression, suicidal ideation, substance abuse and reigning from work becomes more evident and thus, a matter of concern. Constant performance pressure and work towards substantial scientific findings within a stipulated time has led to increasing suicide rates among research scholars and scientists. Academicians also often resort to substance abuse (mostly alcohol, cannabis and tobacco) to ease out their stress as a poor form of coping.

Dr. Amanda Nowak has recently earned her doctorate in Developmental Psychology from the University of Notre Dame. She says that graduate students in the first year of their program face anxiety (often due to excessive workload) which then transitions into depression and loneliness in their second year and beyond. She further says that with the current COVID crises, depression is hitting graduate students sooner than expected and it's therefore vital that we try to raise awareness so students are not afraid to reach out and ask for the help they need.

Dr. Amanda Nowak

Various leading educational institutions have started establishing facilities to help sustain a positive mental health among their force of young scientists and researchers. Every year, more and more schools, colleges and institutes of professional education and training are initiating mental health and well being facilities to deal with the increasing rates of suicide, depression and substance abuse among their students.

Sudarshana Sen Gupta is a Clinical & Rehabilitation Psychologist and currently works as a visiting psychologist at the National Institute of Technology in Durgapur, India. Having worked with students in higher education, she has realized that although many of them experience symptoms of severe depression, they do not report it to their co-workers or authorities due to the fear of being stigmatized, tagged and bullied. She further says that oftentimes, these students do not seek any help, even if it is easily accessible (maintaining confidentiality) and free of cost. As a psychologist, she has been involved with some institutions to regularly organize awareness and anti-bullying campaigns to make the students aware of ways to identify these issues, deal with them, seek help, provide support and inform them about the legal consequences of substance abuse

Sudarshana Sen Gupta

and bullying. As per requirement, support groups are also formed among the students and their family members to include them in the treatment process. She further told us that the students who seek help from these mental health facilities, become more equipped to deal with their life challenges, pessimistic thoughts, stress, anger outburst and work pressure, more effectively and positively.

It also needs to be clarified that the overall mental health issues are similar across different disciplines. While STEM students face issues like dealing with a micromanaging advisor or having to spend long hours in their laboratories, students from Arts and Letters often experience neglect from their advisors. Although the root cause might be different, students from different disciplines still experience the same outcome of negative mental health effects. That being said, we need to understand that well being is important for everyone irrespective of their field of study and more importantly accepting that there is nothing wrong with seeking professional help.

We cannot let shame and discrimination continue to stand in the way of students and young scientists seeking the help they need to enrich their mental health.

Nuclear Science Fun-facts

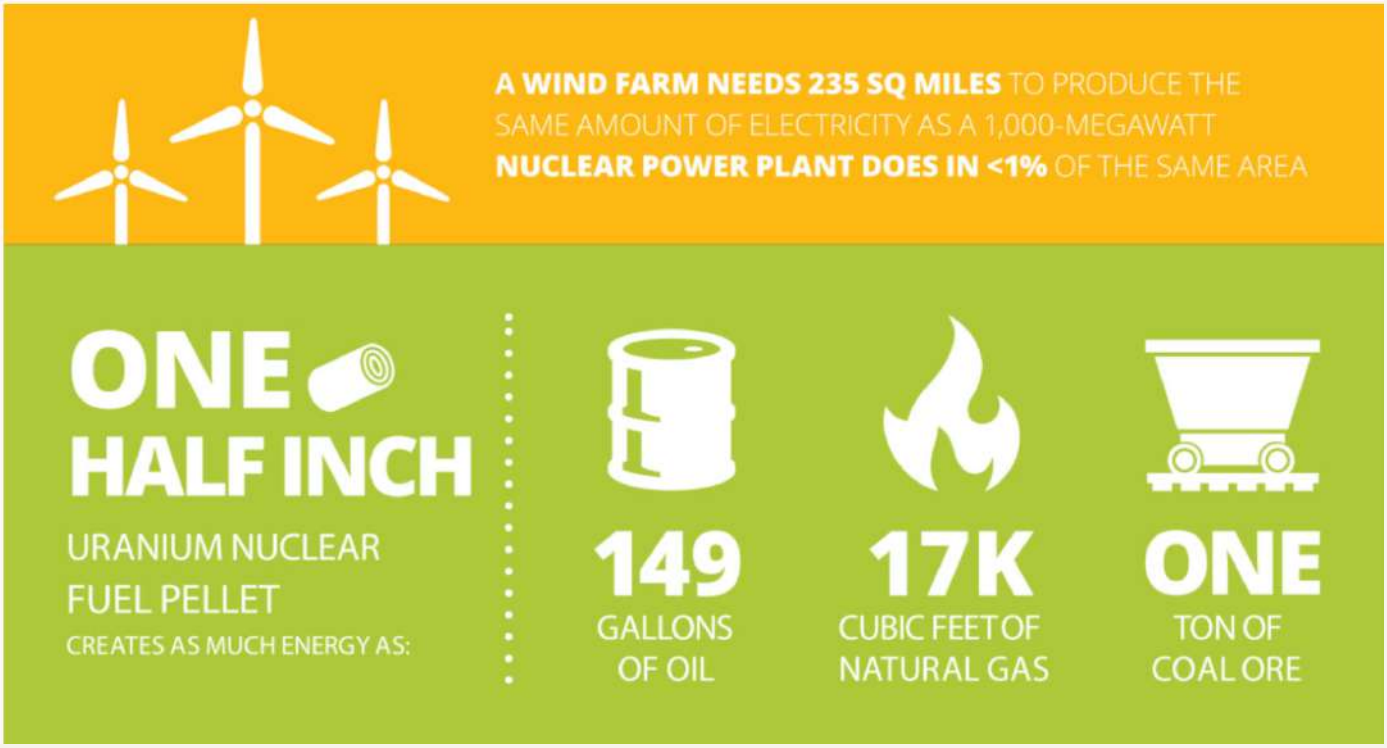
Author: Nilormi Das

“What?!! Nuclear!! No way, it is dangerous. Isn’t it related to bombs and radiation causing cancer?” This is how most people react to everything related to nuclear science. However, the reality is quite different. There is an associated risk with every aspect of life but that hardly restricts us from living our life.
Nuclear energy being a major contributor to zero emissions electricity, is much more beneficial if handled safely. It is eco-friendly and the ultimate solution to global warming. Let’s explore a few fun facts related to Nuclear Energy:

- **Moly Cow.** Wait, it isn't related to *Holy Cow* in any way! Instead, this is a generator used to extract the metastable isotope 99mTc of the element Technetium from a decaying sample of Molybdenum-99 by the technique of column chromatography. It is colloquially termed as *Moly Cow* as the device *milks* 99mTc from Mo-99. Tc-99 has a very important application in the field of nuclear medicine. It has a very short half-life of 6 hours. However it’s parent nuclide Mo-99 with a comparatively longer half-life of 66 hours is supplied to hospitals and the daughter isotope is thereafter extracted. Tc-99 is used as a medical tracer to examine organ structure and function of the brain, kidney, heart, bone, liver and lung. It is also used for whole-body imaging which helps in the detection of bone metastases. As it is used for sentinel node imaging prior surgery, it has also found great importance in treating cancer.

- "**Coal is abundant on Earth."** This phrase will soon be outdated unless we stop exploiting fossil fuels. Being the age-old stereotypical source of energy, coal has gained a lot of popularity. Remember the days when “koo jhik jhik koo” used to be the signature alarm for an approaching train? Those steam locomotives were mostly fuelled by burning coal.

Now, those have been replaced by electricity. But where does this electricity come from? In most cases, we depend on thermal energy that is produced mostly from fossil fuels especially coal.



As we know it requires thousands and thousands of years for fossils to form, it is high time we cut down our usage. Moreover, the consumption rate of coal is much higher as compared to uranium. 1 g of uranium is capable of producing about 1 MW which is the energy equivalent of 3 tons of coal. So why not adapt to this profitable energy resource? We have enough uranium to produce energy for the next 500 years and it can be increased through the reprocessing of spent fuel. Besides, nuclear energy does not contribute to pollution. Adapting nuclear energy will help build a cleaner and greener future.

- **Radioactive Queen**. As we all know, the Nobel Prize being the supreme reward is awarded to those who during the preceding year have conferred the greatest benefit to humankind. It is awarded in the fields of Physics, Chemistry, Physiology or Medicine, Literature and Peace. It is one of the rarest of the rare cases that a person has been awarded the Nobel Prize

twice in a lifetime in two different fields and created history. It is none other than our *Radioactive Queen*, Marie Sklodowska Curie. Madame Curie is the only person who has been awarded the Nobel Prize in Physics in 1903 followed by the Nobel Prize in Chemistry in the year 1911 for her pioneering research on radioactivity and for discovering two radioactive elements namely Polonium and Radium. These cutting edge researches which created a revolution were part of the nuclear science genre.

NOBEL LAUREATES 2020

On 27 November 1895, Alfred Nobel signed his last will and testament, giving the largest share of his fortune to a series of prizes in Physics, Chemistry, Physiology or Medicine, Literature and Peace – the Nobel Prizes. Here is a list of the 2020 Nobel Prizes:

- The 2020 Nobel Prize in Physiology or Medicine was jointly awarded to Harvey J. Alter, Michael Houghton and Charles M. Rice *"for the discovery of Hepatitis C virus"*.

- The 2020 Nobel Prize in Physics was awarded one half to Roger Penrose, from University of Oxford, UK *“for the discovery that black hole formation is a robust prediction of the general theory of relativity”* and the other half jointly to Reinhard Genzel form Max Planck Institute for Extraterrestrial Physics, Germany and University of California, USA and Andrea Ghezfrom from University of California, USA *“for the discovery of a supermassive compact object at the centre of our galaxy”*.

- The 2020 Nobel Prize in Chemistry was awarded to Emmanuelle Charpentier from Max Planck Unit for the Science of Pathogens, Germany and Jennifer A. Doudna from University of California, USA *“for the development of a method for genome editing”*.

- The 2020 Nobel Prize in Literature was awarded to the American poet Louise Glück *“for her unmistakable poetic voice that with austere beauty makes individual existence universal”*.

- The 2020 Nobel Peace Prize was awarded to the World Food Programme (WFP) for its efforts to combat hunger, for its contribution to bettering conditions for peace in conflict-affected areas and for acting as a driving force in efforts to prevent the use of hunger as a weapon of war and conflict.

Let's have a closer look at the Nobel Prizes in Physics and Chemistry ...

Nobel Prize in Physics 2020

Author: Dhaval Gadariya

Ill. Niklas Elmehed. © Nobel Media.
Roger Penrose
Prize share: 1/2

Ill. Niklas Elmehed. © Nobel Media.
Reinhard Genzel
Prize share: 1/4

Ill. Niklas Elmehed. © Nobel Media.
Andrea Ghez
Prize share: 1/4

This year´s Nobel Prize in Physics was shared by 3 scientists including Roger Penrose from UK, Reinhard Genzel from Germany and Andrea Ghez from USA. Roger Penrose was awarded one half of the prize for his outstanding work to show that black holes are a direct consequence of the general theory of relativity whereas the other half was shared by Reinhard Genzel and Andrea Ghez for their discovery of an invisible and extremely heavy object at the centre of our galaxy, governing the stars´orbit. In this article we will take a flyby look at what these discoveries are about and how they impact our lives.

The father of general relativity, the man Albert Einstein himself had thought of the existence of black holes. Yes, those infamous monsters in time and space' capturing everything that goes sufficiently close enough to them, enslaving them for eternity. Such is the capacity of those black holes that the fastest known entity in the universe- the Light itself, cannot escape from the crushing grip of a black hole. Not only Roger's, but Reinhard and Andrea's work is also related to black holes - at least at this moment because on the current state of understanding of Physics, there is no other explanation for a gravitational field so strong that it is capable of orchestrating the motion of all the stars in our Milky Way but a supermassive black hole. It would not be an exaggeration to say that the theme for this year's Nobel prize in Physics was black holes.

Nobel Prize in Chemistry 2020

Author: Vivek Patel

Emmanuelle Charpentier Max Planck Unit for the Science of Pathogens, Berlin, Germany (left) and Jennifer A. Doudna University of California, Berkeley, USA (right)
"For the development of a method for genome editing"

A body of any organism is made up of cells. From a small single-celled bacteria to human beings, every "living" organism is made up of cells. These cells contain the DNA of that specific organism which essentially has all the blueprint required to make that organism. The DNA is made of what we call chromosomes and chromosomes have genes. These genes have all the information about the living organism and can be vital in telling us the various aspects such as its evolution, underlying diseases etc.

With the advancement of technology in the field of microscopy, it was possible to investigate and understand the functioning of the genes much more efficiently than before. One such achievement is CRISPER, which is an abbreviation for *Clustered Regularly Interspaced Short Palindromic Repeats*. In simple terms, it is a genetic scissor. Before the discovery of CRISPER gene, editing/understanding was a complicated and painful process for scientists. CRISPER made this process simple and the credit goes to the two women who figured out how to make these "scissors."

In 2011, Emmanuelle Charpentier found that a bacteria called Streptococcus pyogenes naturally develops a method to protect itself from certain viruses when these bacteria face any viral infection. The bacteria, as a part of its immunity system "cuts" an RNA strain from viral DNA and stores it as a record. When it is infected by a similar virus again, this information stored from the previous encounter helps its immune system to fight the virus, similar to creating a vaccine in your own body.

COMING UP NEXT ...

NUCLEAR WASTE **DEC 1**

Guest article by *Aditya Chincholkar*

CLEAN WATER FROM NUCLEAR TECHNOLOGY **DEC 15**

Article by our member *Ashabari Majumdar*

PLASMA: A HOT MESS PART III **JAN 15**

Article by our member *Dhaval Gadariya.*
Final installment for our Plasma series

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