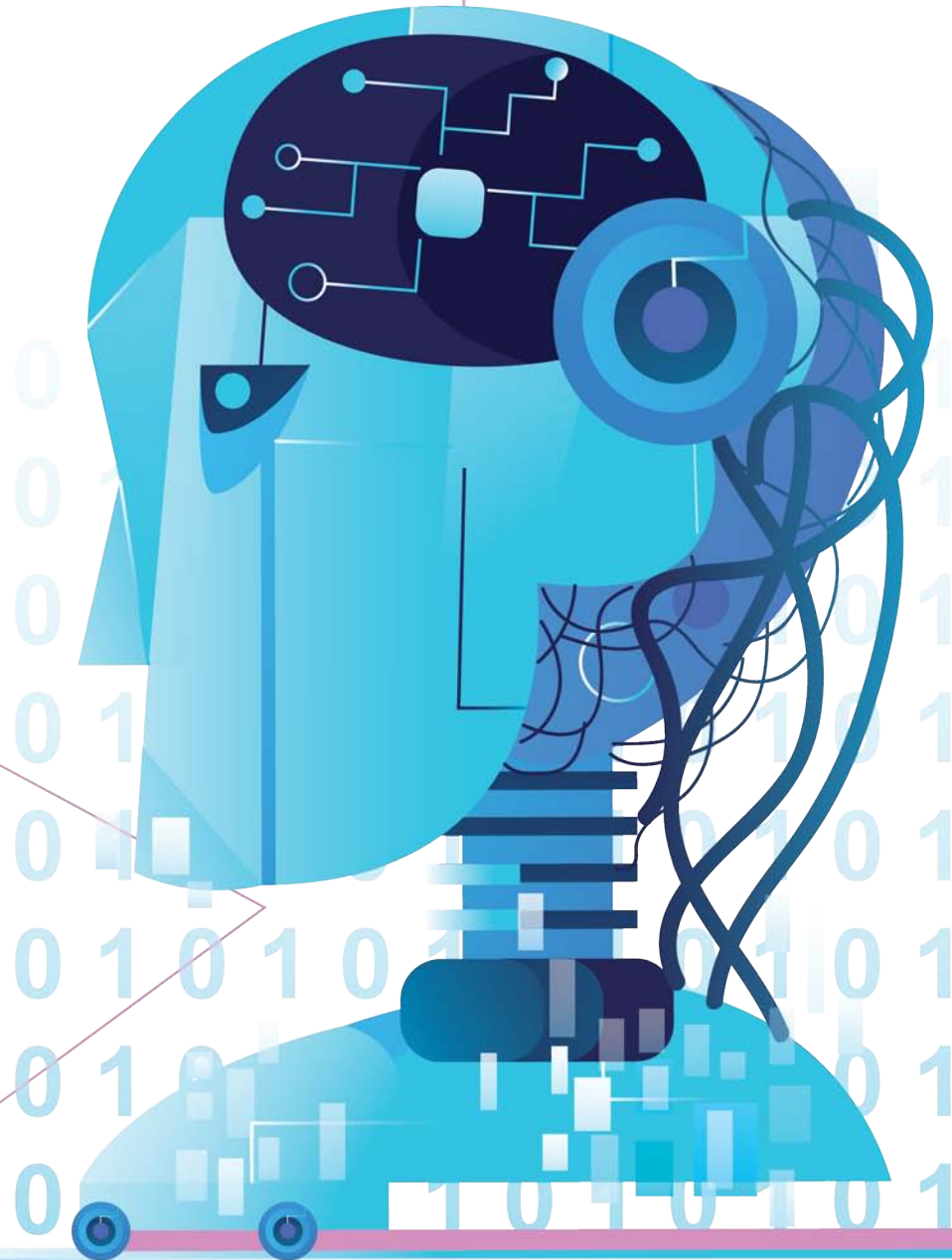


THE PARTICLE

Syed Babar Ali School of Science and Engineering's Magazine

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- **BEYOND BARRIERS
IN EDUCATION**
- **ARTIFICIAL
INTELLIGENCE
OUR NEED**
- **CANCER
TREATMENT
GETS A BOOST**



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شعاعِ اولیں

آپ کے ہاتھوں میں (یا رُو برو) ”دی پارٹیکل“ کا اولین شمارہ ہے، جو سید بابر علی سکول برائے سائنس اور انجینئرنگ، لمز سے وابستہ خبروں، دریافتوں، ایجادوں اور خیالات کا عکس ہے۔ اس عکس کی ترجمانی کئی خوبصورت تصاویر، مضامین، شذرات، نظموں اور اداریوں سے کی گئی ہے۔

ہمارے ملک میں سائنسی ابلاغ اور سائنسی صحافت کے چند نہایت اعلیٰ نمونے پائے جاتے ہیں۔ ہماری کوشش ہے کہ ہم اس صحافتی ادب میں اپنا کچھ حصہ ڈال سکیں، اپنے دوستوں کو اپنے بارے بتا سکیں اور ہمارے طلبہ و طالبات کو سائنس اور ٹیکنالوجی کے میدانوں میں کہانیاں لکھنے کی ترغیب دلا سکیں۔ ہمیں آپ کی آرا کا انتظار رہے گا۔

محمد صبیح انور
ڈین، سید بابر علی سکول برائے سائنس اور انجینئرنگ

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THE COLLOID

Science & Public Policy

Sabieh Anwar and Naveed Iftikhar

Public policy is a complex field and requires expertise and engagement of diverse disciplines and stakeholders. Public policy in Pakistan is dominated by lawyers, politicians, journalists and economists, all of whom are central for devising strategy and policy; but there is very little involvement of scientists in the domain of public policy. In this article, we will discuss the reasons behind this phenomenon and how to reinvigorate the role of science in public policy discourse.

Some fields like health policy, environmental policy, or education policy may require considerable input from scientists in respective fields. However, other areas, such as industrial policy and agriculture policy can also benefit from the active involvement of scientists.

Unfortunately, the public sector does not engage scientists to work closely with them on such policies. Politicians are often in a hurry and do not want to wait for any serious research or advice by a scientist. Resultantly, they look towards non-specialist bureaucrats who can provide readymade solutions under chaotic circumstances. The outcomes are plans with little long-term impact.

On the other side, most scientists are not equipped in communicating their work to non-scientists, let alone taking part in a public dialogue. Some of these disconnects between scientists and policymakers are a result of flawed education and examination systems which we explain below.

At the school level, science pedagogy does not inculcate an understanding of basic concepts and critical inquiry, rather it encourages rote learning and memorization of facts. When one doesn't even understand, how can one explain? In fact, the litmus test of

conceptual understanding of subject material is the ability to communicate in simple language.

We also doubt if there has ever been any serious initiative to expose civil servants and parliamentarians to recent developments in global science. The civil services examination does indeed test interested individuals on basic sciences, but these exams are largely an extension of traditional syllabi.

Thus, the problem of disconnect between science and public policy often stems from the lack of training of policymakers in the scientific method and the cultivation of scientific thought.

The role of science in myriad of public and mass-scale initiatives that deal with the public good is crystal clear. For example, the global climate is a calamity that transcends national borders. Melting of our glacial plains and its impact on agriculture, irrigation, food security and mangroves is critical.

Geological prospection in order to meet the country's energy demands as well as the mining of lucrative precious metals requires deep scientific and technological acumen. International standards for measures (the kilogramme, the second, etc.) are no longer based on tangible artefacts kept at an isolated location, quantum mechanics has come to the fore in defining these standards.

These standards will soon become essential for trade and commerce. Similarly, both in the civil and military domains, many operations will soon exploit quantum effects, both for communication and cryptography. National disasters, monsoon rains, locust attacks, dengue fever, crime control, security and forensics all require progressive ideas from diverse disciplines in science and technology. A scientifically illiterate bureaucracy cannot possibly rise to these challenges if they remain unaware or are untrained.

The Covid-19 pandemic has not only exposed fault lines in our scientific enterprise but has also taught us

important lessons for the future, as did the 2005 earthquake. During the pandemic, we have been seeing public servants, politicians and doctors in the media limelight.

Economists were also actively hosting webinars and advisory work for the public sector. But we have not observed an independent narrative on this pandemic being shaped by scientists in the country. We have also observed that people have not been paying serious attention to this pandemic. This may, in part, be due to confused, half-hearted messaging by governments but can also be attributed to the absence of credible voices of scientists who know how to talk to the public.

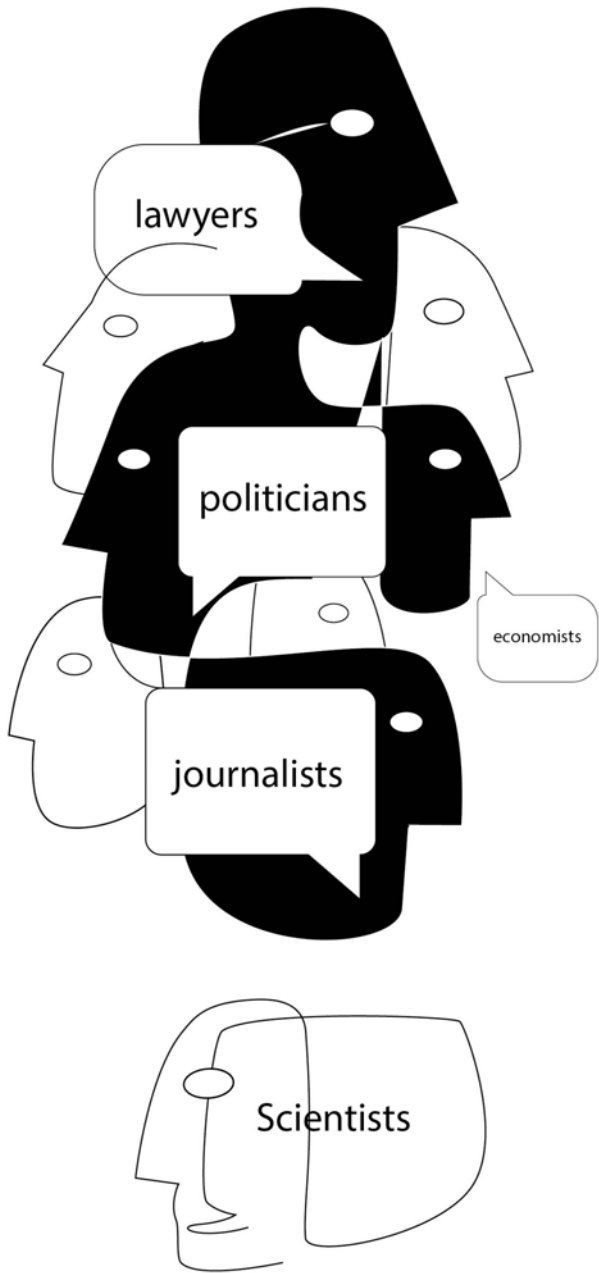
We propose a three-level process to engage scientists in the public policy landscape. We first need to reorient our education system from memorialisation to learning and interdisciplinary interactions. At the university level, efforts should be made towards establishing interdisciplinary graduate forums and events.

At the school level, we need to re-conceptualise science learning. Science fairs, science clubs and science awareness movements are now a well-established tradition in Pakistan, thanks to the numerous science organisations, such as one of the author’s Khwarizmi Science Society that organises the annual Lahore Science Mela, one of the country’s biggest citizen science event.

Secondly, the National School of Public Policy and Pakistan Institute of Parliamentary Studies should organise sessions and dialogue among scientists, public servants and parliamentarians on the latest scientific discoveries and frontiers. Civil Service training institutions also need to examine the content of their programmes on scientific developments. Lastly, our universities and scientific research centres should also expose scientists to public policy processes and challenges in Pakistan. We should provide cross-pollination of ideas from economics, public policy, and organisational management to be accessible to students of scientific and technological disciplines.

Sabieh Anwar is an experimental physicist and dean at the Syed Babar Ali School of Science and Engineering at LUMS.

Naveed Iftikhar is an entrepreneur, teacher and economic/urban policy professional.



The Future of Applied Mathematics in Pakistan

Dr. Ali Ashher Zaidi

The direction of mathematics in general and applied mathematics in particular seems to have gone adrift in Pakistan.

Although the country has successfully developed a large pool of scientists and applied mathematicians, they have been unable to contribute effectively to a knowledge-based economy. Various academics and thinkers have frequently identified the problems keeping us from achieving this goal but solutions have been rare. With a few concrete steps, which would not cost the national exchequer any hefty amount, a purposeful direction can be attained.

A major hurdle in creating a knowledge-based economy is the lack of academia-industry collaboration. Mathematicians and industry representatives hardly talk to each other and do not recognise each other’s importance in this mutually beneficial relationship. To overcome this, we could do what the world has already done, i.e., to start Math-in-industry study groups (MISGs) in Pakistan. These study groups first originated in the UK in 1968 at Oxford University and have now spread to almost all countries of Europe, Asia Pacific and America. These groups have been instrumental in tackling technical problems of industries. The idea is to organise a four to five days MISG where applied mathematicians, statisticians, physical scientists and engineers from universities and research centres gather and solve problems brought by the industries. The MISG workshop aims to provide practical, working solutions to real-life problems using methods from the mathematical sciences. This could be seen as a way forward for applied and industrial mathematics in Pakistan. The local industry would also tremendously benefit from this exercise. This would not only help us in establishing industry-academia links, but it would also create job opportunities for maths graduates. There will be saturation in academic jobs in Pakistan in future and a major chunk of our math graduates would have to go and work in industries. MISGs would enable us to go in that direction and could prove to be vital for mathematics led economic growth.

Once the industry realises the benefits of collaborating with academia through MISGs, they could be convinced to provide graduate scholarships to students who would work on industry-related problems in their research proj-

ects. At the moment, most of the research carried out by graduate students is based on theoretical science which has no direct relevance to the issues and problems faced by the industry. The graduate studentships sponsored by the industry will not only lessen the financial burden on students or national exchequer, but it will also create a skilled workforce that would be ready for industry-based jobs once they graduate. This will also ensure a focus on specific areas of Pakistan’s economy since if more money is invested in the form of studentships in e.g., agriculture-related projects, it would enable a greater number of scientists and mathematicians working in that sector. Agriculture and livestock certainly are important sectors of Pakistan’s economy and more mathematics should be used to address local problems of these sectors. Mathematics can help produce better yields, ensure healthy livestock and forests and reduce water pollution.

The main challenge, however, is to initiate the whole process. All over the world, such initiatives come from national mathematical associations and societies. Unfortunately, there is no truly “national” mathematical society in Pakistan. There are a lot of societies that claim to be national but these are mostly run by math departments of various universities. A national mathematical society would be a true representative of Pakistani mathematicians, one with members from all over Pakistan and democratically elected office-bearers.

The decisions of such a mathematical society need to be taken democratically. The Higher Education Commission (HEC) being the apex body responsible for steering higher education and research in Pakistan could provide a platform and make a national level society of mathematics and facilitate mathematicians to take the lead role in determining the future direction of mathematics in Pakistan.

Dr. Ali Ashher Zaidi is an Assistant Professor in the Department of Mathematics, Syed Babar Ali School of Science and Engineering, LUMS.

کورونا وائرس

کی روک تھام کے لیے جراثیم کش گزر گاہیں کتنی مفید ہیں؟

صحت پر ان کے کیا مضر اثرات ہو سکتے ہیں۔

کورونا وائرس کے پھیلاؤ کا واحد ذریعہ مریض کے منہ یا ناک سے ، چھینکنے یا کھانسنے کو صورت میں نکلنے والے باریک قطرے ہیں۔ یہ رطوبتی پھوار زمین پر گرنے سے پہلے کم از کم بھی چھ فٹ فاصلہ طے کر سکتی ہے۔ یہی وجہ ہے کہ روزمرہ میل جول میں ۶ فٹ فاصلہ رکھنا تجویز کیا جاتا ہے ان قطروں میں موجود وائرس سطحوں پر پڑنے کے بعد کئی دنوں تک متحرک رہ سکتا ہے۔ مثال کے طور پر کرنسی نوٹوں پر چار دن ، لکڑی اور کپڑے پر دو دن جبکہ اسٹیل، پلاسٹک اور سرجیکل ماسک پر سات دن متحرک رہ سکتا ہے۔ یہی وجہ ہے کہ روزمرہ زندگی میں متواتر مَس ہونے والی سطحوں کی جراثیم کش محال کے ساتھ صفائی بھی کووڈ-۱۹ کی روک تھام مدد دے سکتی ہے۔ مزید برآں، منہ، ناک اور آنکھوں کو نہ چھونے اور باقاعدگی سے صابن سے ہاتھ دھونے سے ہی اس مرض کا پھیلاؤ روکا جا سکتا ہے۔ لہذا مساجد یا بازاروں میں جراثیم کش گزر گاہوں کی تنصیب بے معنی ہے۔ ایسے دروازوں سے گزرنے کے بعد بھی ایک متاثرہ فرد ، چھینک اور کھانسی سے دوسروں تک وائرس منتقل کر سکتا ہے۔ جہاں تک کپڑوں پر وائرس کی ممکنہ موجودگی کی بات ہے تو گھر جانے پر فوراً ہی ان کو اتار کر صابونی یا غیر صابونی مصفی (ڈیٹرجنٹس) اور گرم پانی کے ساتھ دھونا کافی ہے۔

اب آتے ہیں جراثیم کش کیمیائی مرکبات کے ایک اور پہلو کی طرف۔ عمومی استعمال کے جراثیم کش کیمیائی مرکبات میں کلورین (اور اس کے مرکبات جیسا کہ گھریلو بلچ)، ہائیڈروجن پر آکسائیڈ، فینوئکس اور الکوحل (انتھانول اور آئسو پروپانول) اور کچھ ایلڈی ہائیڈز (فارم ایلڈی ہائیڈ، گلوٹرایلڈی ہائیڈ) شامل ہیں۔ جراثیم کش

کے لیے ان مرکبات کی مجوزہ مقدار پانی میں حل کر کے سطحوں پر لگائی جاتی ہے۔ ان محال کی افادیت کے لیے ضروری ہے کہ انہیں سطحوں پر ۱۰ منٹ تک لگا رہنے دیا جائے اور پانی سے صاف کرنے کے بجائے ہوا سے خشک ہونے دیا جائے۔ مزید برآں، ان کیمیکلز کی مجوزہ مقدار ہی جراثیم کے خلاف مفید ہے اس لیے استعمال کے پہلے لیبل پر دی گئی ہدایات کے مطابق کی محال بنانے چاہئیں۔ الکوحل مریضوں کی نگہداشت کے اوزاروں کی جراثیم کشی کے لیے بھی استعمال کیے جاتے ہیں۔

امریکی ادارہ برائے تدارک امراض کے مطابق، ایلڈی ہائیڈز اور کلورین ہپتالوں میں صفائی پر متعین عملے میں پیشہ ورانہ بیماریوں کا سبب بنتے رہے ہیں۔ لہذا حفاظتی تدابیر جیسا کہ دستانوں کا استعمال اور اچھی ہواداری (وینٹیلیشن) نہایت ضروری ہیں۔ یہ کیمیکلز دمہ اور سانس کی دوسری بیماریوں میں مبتلا مریضوں کے لیے بھی بہت خطرناک ہو سکتے ہیں۔ اسی طرح سوڈیم ہائیپوکلورائیٹ (گھریلو بلچ) میں موجود مقدار پانچ سے چھ فیصد) جو کہ سطحوں کی صفائی کے لیے نہایت مفید ہے، کا پھوار کی صورت میں جراثیم کش گزر گاہوں میں استعمال نہایت خطرناک ہو سکتا ہے کیونکہ یہ کیمیکل آنکھوں جلد اور پھیپھڑوں کو نقصان پہنچا سکتا ہے۔ تاہم سطحوں کی جراثیم کشی کے لیے یہ مرکب مفید ہے اور امریکی ادارہ برائے تحفظ ماحول کے مطابق ماحول کے لیے نقصان دہ نہیں۔

ہائیڈروجن پر آکسائیڈ کا پانی میں محلول (تین سے چھ فیصد) وائرس ، بیکٹیریا اور فنجائی کے خاتمے کے لیے زود اثر ہے۔ اس کے علاوہ یہ اینڈوسکوپ، وینٹیلیٹر، کنٹیکٹ لیئز کی جراثیم کشی کے لیے بھی استعمال کیا جاتا ہے۔ تاہم جراثیم کش گزر گاہوں میں اس کیمیکل کا استعمال آنکھوں اور جلد کو نقصان پہنچا سکتا ہے۔ علاوہ ازیں ہائیڈروجن پر آکسائیڈ کے محلول کا پھوار کی صورت میں استعمال دمہ یا الرجی کے مریضوں کے لیے مہلک ہو سکتا ہے۔

فینول اور اس سے بننے والے مرکبات (فینوئکس) بھی ماحولیاتی سطحوں (ٹیل، فرش ، مشینیں وغیرہ) کی جراثیم کشی کے لیے ، ادارہ برائے تحفظ ماحول کے منظور کردہ ہیں۔ ایک بہت ہی مشہور جراثیم کش محلول (ڈیٹول) کا متحرک جزو بھی فینوئکس ہی ہیں۔ تاہم ایک تحقیق کے مطابق نو مولود بچوں میں یہ ایک طرح کے یرقان کا باعث بنتے رہے ہیں۔

کھلی جگہوں پر متواتر جراثیم کشی ماحولیاتی آلودگی کا باعث بھی بن سکتی ہے۔ علاوہ ازیں جراثیم کش مرکبات کو اس پیمانے پر استعمال کرنا روپے کا بے جا اصراف ہے۔ دنیا بھر میں جراثیم کش کیمیائی مرکبات کی کمی بھی ہے اور ضرورت اس امر کی ہے کہ انہیں وہاں استعمال میں لایا جائے جہاں ان کی صحیح معنوں میں ضرورت ہے، جیسا کہ اسپتال۔

کسی بھی طرح کے جراثیم کش کیمیکل کا پھوار کی صورت میں گزرگاہوں میں استعمال صحت کے لیے نقصان دہ ہے۔ مزید یہ کہ کورونا وائرس کے پھیلاؤ کی روک تھام میں بھی مددگار نہیں اور عالمی ادارہ صحت بھی اپنی ویب سائٹ پر پورے جسم پر جراثیم کش سپرے کی حوصلہ شکنی کرتا ہے۔ یہ جراثیم کش گزر گاہیں گزرنے والوں کو جراثیم سے پاک ہونے کی ایک جھوٹی امید بھی دلاتی ہیں جس کی وجہ سے وہ صابن سے ہاتھ دھونے کو نظر انداز کرتے ہوئے وائرس سے متاثر ہو سکتے ہیں۔

تحریر: ڈاکٹر محمد ظہیر، اسٹنٹ پروفیسر،

شعبہ کیمیا و کیمیائی انجنئرنگ

HIDDEN IN PLAIN SIGHT

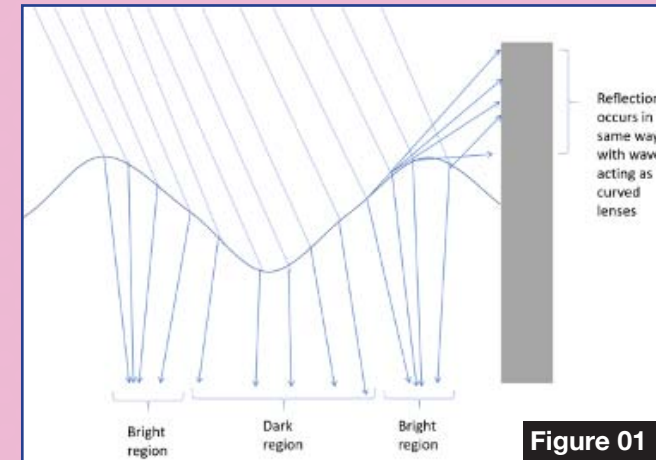
Fariha Hassan

Physics and Mathematics are two fields that are often perceived as highly complex. They seem to require a lot of background context to understand even some of the more basic concepts. However, I think treating these subjects as something profound and unreachable is a disservice. More often than not, we can see these complex concepts everywhere, not only in the way we move and the working of machines but more purely in the aesthetics around us. Take a look at some of the patterns below that appear at the bottom of a swimming pool or in a mug that you probably look at every day. While these patterns may look wildly different from each other, they are indeed connected.

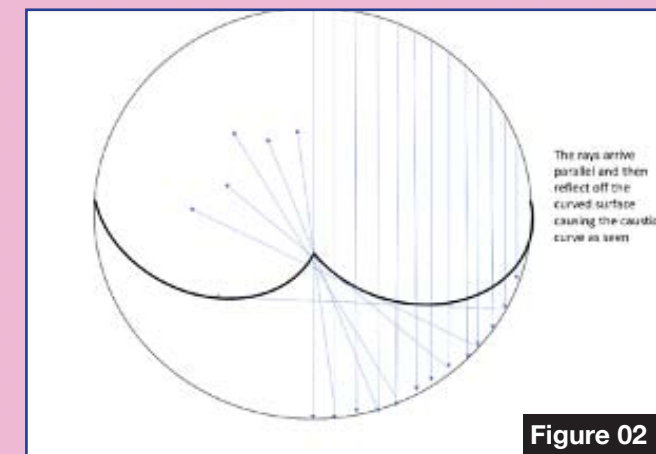
Usually, when we talk about optics or optical phenomenon, we discuss reflection, refraction, and diffraction, but these two images are connected by something a little different that utilises these concepts. These patterns are called caustic networks. The word caustic itself has fascinating origins; it comes from the Greek word *kaustikos*, which means capable of burning. The term is used here because the formation of these networks is a result of many rays coming together

and concentrating at one point. As any student who has ever played around with a magnifying glass can tell you, when too many light rays are focused together, they can generate enough heat to cause a fire.

So how can the coming together of rays of light lead to the patterns we see in these images? Well, each surface is different. In the case of the pool, the waves act as lenses that bend the light in different ways in different locations, as can be seen in the diagram below (Figure 1). Regions, where the light is spread out, are out of focus and so seem darker, and regions where all the light is concentrated at one point below the surface, are in focus and seem brighter. A similar pattern can be seen on the sides of ships as well, and it comes from the same concept. The waves act as varying lenses that reflect different amounts of light.



The pattern in the cup is a little different, but the same phenomenon causes it. The shape in the cup is called a caustic curve. It occurs because the side of the mug acts as a spherical lens that leads to light bouncing off to approximately the same point but not quite. The more curved part that the light falls on the further away it is from the centre as can be seen in the diagram (Figure 2).



Another exciting area where caustics play a role is rainbows. Usually, rainbows are explained using only total internal reflection; however, the brightness of rainbows is because the rays form a caustic near the raindrop. The cluster on one side causes the intensity of light, and on the other side is shaped like a cone with a half angle of about 42 degrees. This angle does not depend on the droplet size hence why we see it from a number of droplets, and when we look at the sky from this direction, we see glints from many raindrops leading to the image of the rainbow arc. This is why the ideal place to look at a rainbow is from a 42-degree angle.

As you can see, caustics are all around us. In fact, the example of the cup is something that Leonardo Da Vinci discovered back in 1508, and yet the concept continues to be relevant. Research on caustics is still ongoing for a myriad of compelling reasons. Mathematically, predicting the shape and geometry of caustics is done through multivariable calculus. In physics, caustics are not only important in optics but are also studied in the context of nanoscale structures since ferromagnetic materials possess a property essential to the idea of caustics. Additionally, the study of caustics has helped with understanding gravitational lensing and it is often studied in the field of computer graphics. It is fascinating how something extreme complex can be hidden behind something we see every day, only if we were willing to explore further.

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Beyond The Barriers In Education

Sabieh Anwar and Naveed Iftikhar

In this op-ed, we are not even scratching the surface of a highly insulated iron curtain between the exact and the social sciences, between humanities and business studies or the wide chasms between our mainstream educational institutions and madaaris. We are only looking at the schisms within science education itself and how these barriers stultify creativity and innovation.

Fences within our science education systems are deep-rooted and remind us of our propensity to court mediocrity and the perceived notion of the glory of 'specialisation'. For example, a distinction between matriculation in science or in arts bifurcates our body of students into two distinct pools.

Subsequently, the FSc stream further trifurcates into the archaic divisions of pre-engineering, pre-medicine and computer science. These distinctions ren-

der biological, physical, computational and mathematical sciences as distinct entities. Hence, a pre-medical student cannot study mathematics and appreciate its ubiquitous reach in all walks of life, while a pre-engineering student cannot decipher the wonders of the biological world and will remain aloof to the most notable advances revolving around the human genome, the proteome or the metabolome.

An excessive focus on specialisation in the various disciplines within science and engineering has purportedly hindered scientific progress in Pakistan.

It is seen that many engineering disciplines are now infused with science.

The photon now competes with the electron as the lifeline of devices, and a physicist is capable of bridging this gap between electronics and photonics. Batteries are revolutionising global energy demands; a chemist helps understand these power banks. Understanding complex systems ranging from human societies to human consciousness, and global climatic patterns to the spread and control of disease necessitates an intermixing of ideas from various fields. Any modern engineering curriculum should aim to nurture these interdisciplinary skills.

A few days ago, the Higher Education Commission (HEC) floated the idea that admission to a PhD programme does not require an undergraduate degree in the same discipline. Under the revised scheme, a microbiology student, for example, goes directly into a mathematics programme and carries out research in systems biology, enabling them to view biochemical systems as dynamical spatiotemporal networks. This proposal has met severe resistance.

Ironically, one of the authors of this piece Dr. Anwar is an engineer from Pakistan's oldest engineering university but could not get admission into a physics programme in the same institution. Eventually, he made his way to a foreign university without any paper-based evidence of formal training in physics.

Subsequently, his hiring into a public university here was next to impossible due to the arcane hiring criteria. Consider geology, astronomy, oceanography, climatology, archaeology, bio-engineering which draw upon multiple streams of thought. These areas remain neglected in Pakistan, and their growth can be deemed stunted, because we haven't been able to rise above the math-chemistry-physics-biology divide and the traditional boxes of engineering.

The strong barriers within science disciplines lead to observing interesting patterns in the country's academic community, so while organic chemistry flourishes in the country, the area of physical chemistry is relatively weak since chemists pursuing traditional botany, zoology and chemistry combos in their BSc or the four-year undergraduate chemistry programmes find little opportunity to interact with mathematically-minded chemists or chemically trained physicists. Similarly, clinicians have no recourse to statistical tools for analysing epidemiological data or even data generated on the workbench. Just analyse the hundreds of MPhil theses coming out of medical universities each year for their demonstrated skills in quantitative reasoning.

In order to understand how modern scientific intellectual thought is progressing, and to which our higher education must be attuned to, a brief story of the evolution of modern biology would be interesting. Evolving from butterfly-collection and classification of the flora and fauna, the DNA-centred dogma of biology was established, thanks to the physicist Francis Crick, and led to the mapping of the complete human genome. Eric Lander, a trained mathematician was one of the pioneers of cracking the human genome.

The postmodern picture of biology that has now emerged in the post-genomic world is a highly complex, interconnected system which cannot be deciphered without the sharp chisel of quantitative, analytic and numerical techniques. There are several exceptions proving the rule. Let's celebrate them. Engineering students are welcome into Masters and PhD programmes in basic sciences in LUMS; an electrical engineering department can hire a chemical engineer versed in microfluidics, a physics department can open its arms for an electrical engineer who broods over fundamental principles of how blackholes form and accomplished computer scientists and statisticians are surrounded by molecular biologists in the Department of Biology. Engineering students also flock to this university for relishing their first love in basic sciences, which has been denied by the straight-jacketed diversion of our best students into engineering and medicine.

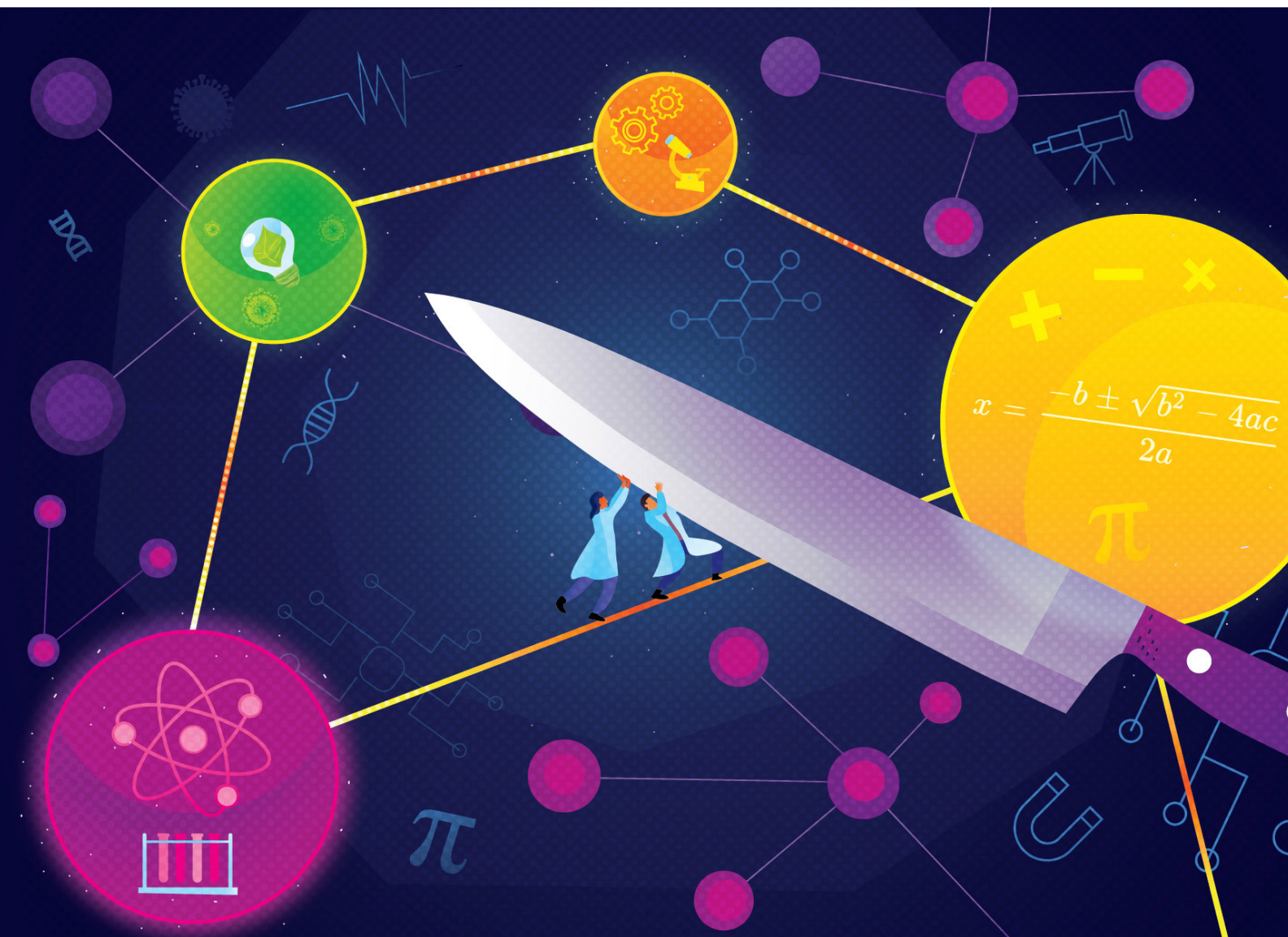
Similarly, COMSATS University's Interdisciplinary Research Centre in Biomedical Materials has a team of more than 25 chemists, physicists, pharmacists, engineers, materials scientists and dentists who converge for creating artificial skin, bone and other forms of human tissue. The Panjwani Centre for Molecular Medicine and Drug Design is a confluence of clinicians, pharmacologists, chemists, life scientists and neuroscientists.

In short, we need to create an atmosphere of academic freedom and flexible rules inside our universities, but the process really needs to begin from bottom up. Introducing an honours stream in grades eleven and twelve allowing a student to take multiple subjects from disparate bins is essential, and thus breaking away from the beaten tracks of pre-engineering and pre-medical.

We indeed have a long way to go before we can even begin to break the divide between the science and the arts, between exactitude and complexity, and the secular and the sacred; but let's start with breaking the obvious barriers in science education itself.

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Pakistan's Moon Rock

Danyal Haroon

Museums around the world house many wonderful and strange artefacts. The Pitt Rivers Museum in Oxford, for instance, has a glass bottle which apparently has a witch trapped in it. Nobody has dared to open it.

Meanwhile, Philadelphia's Mutter Museum has microscope slides with sections of Albert Einstein's brain – 20 microns thick and stained with cresyl violet. And even though many of Pakistan's museums are in a state of dilapidation, they too have collections of rare and interesting objects.

One such object is an actual piece of the Moon. Sealed in an acrylic sphere, it is kept hidden from the general public in the reserves of the National Museum of Pakistan in Karachi. It was brought to Earth by astronauts of NASA's Apollo 17, the last manned mission to land on the Moon. Other lunar rocks which can be found in different parts of the world have been brought by the Apollo missions, the Soviet Luna Programme's space probes and lunar meteorites which have landed on Earth. The Moon rock was presented as a gift to President Zulfikar Ali Bhutto by Apollo 17 astronauts Eugene A. Cernan (Commander), Ronald E. Evans (Command Module Pilot) and Harrison H. Schmitt (Lunar Module Pilot) on their visit to Pakistan in June 1973. The astronauts were touring the world to spread awareness about NASA's space missions and the United States' closest allies at the time were presented with Moon rocks as a goodwill gesture.

The astronauts told audiences that the first lunar mission in which human beings set foot on to the Moon was Apollo 11. Neil Armstrong was its Mission Commander and Buzz Aldrin, the Lunar Module Pilot. Subsequently, seven more manned missions were sent to the Moon by NASA. All were successful bar Apollo 13, which could not perform a lunar landing due to an oxygen tank explosion, forcing the

crew to loop their spacecraft around the Moon and safely land back on Earth.

Apollo 17 was launched at 12:33 am Eastern Standard Time on December 7, 1972 and was the last time humans set foot on the Moon. The astronauts spent three days on the lunar surface during which they used a Lunar Roving Vehicle (LRV) – popularly known as the Moon Buggy – to traverse the surface and collect samples.

The Apollo 17 astronauts were heartily welcomed when they arrived at Karachi airport as part of their world tour. During their trip they paid respects at the Mazar-e-Quaid and engaged in an interactive discussion with students and faculty at the Karachi University. They also met with scientists working at SUPARCO. NASA and SUPARCO closely collaborated on space research at the time and even conducted joint rocket launches from Pakistan.

Pakistan's Moon rock originates from the Taurus-Littrow



Photo Source: <https://www.youngpakistan.org/you-never-knew-these-people-visited-pakistan/>



Valley which was the lunar landing site for Apollo 17. The rock is mounted on a wooden plaque along with a small flag of Pakistan which was carried to the Moon and back aboard the spacecraft.

Many of the similar plaques which were presented to other countries as well as each of the US states have been misplaced, stolen or sold on the black market for massive sums of money.

It was suspected that Pakistan's rock has also met a similar fate. After all, it was no longer being exhibited the way it used to be in the past at venues like Karachi's Frere Hall. However, following Neil Armstrong's death eight years ago, writer Muhammad Adil Mulki successfully traced the whereabouts of the rock and described his quest in an article titled "Diary of a 'Luna'tic". In 2014, the rock was finally displayed after a gap of twelve years at an exhibition in Karachi organised with the help of NASA engineer Zainab Nagin Cox.

The Moon rock is reminiscent of an era where Pakistan's scientists and researchers were engaging in world-class space research. It also serves as a reminder that there are many more artefacts stowed away in Pakistan's museums, waiting to be rediscovered and appreciated as they once were.

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EUTHANASIA

A BIOLOGICAL AND MORAL CONUNDRUM

Zainab Azhar

Although euthanasia has gained a lot of media attention as of late, this controversial issue has been discussed for many centuries.

Greek philosophers, such as Socrates and Plato, and some more recent intellectuals have mulled over this issue extensively. Euthanasia is the optional termination of one's life with the aid of a doctor (**Oxford English Dictionary**). Those suffering from terminal illnesses, extreme depression, and various severe mental illnesses are likely to want to be euthanised. Active euthanasia is when a doctor is directly involved in the process, while passive euthanasia is when a physician refuses to provide treatment to a patient believing the patient's condition cannot be improved. Mercy is the main incentive in aiding in the suicide of a patient believed to be at death's door (**Barry 149**).

However, mercy and compassion lie in encouraging and working to ensure that each human life is protected. Many people believe that if they are not euthanised, they will have to live a meaningless, painful life (**Cramer; Sherwood**). However, in many of these cases, adequate therapy can help these people recover their will to live. Many organisations actively work towards the prevention of suicide (**Presley**). Just like suicide is to be prevented, euthanasia should be prevented as well. Right to life is a fundamental human right. Everyone has the right to have their life protected, even if it is from themselves. That is why strict laws preventing euthanasia should be upheld and more mental health support organisations, established.

Euthanasia because of severe mental illness is often equivalent to suicide, and with the right form of treatment, individuals could find the will to continue living. Patients diagnosed with severe depression and various psychological illnesses may want to opt for euthanasia because they feel as though their suffering will never end

even if they receive treatment (**Presley**).

For example, the BBC spoke to a man who was diagnosed with Borderline Personality Disorder and chronic depression. He was a victim of cruel harassment and bullying in school because of his sexual orientation. This man had attempted suicide numerous times following the death of his father (**Raglugon**). Despite his unstable psychological state, he sought treatment. In an attempt to relate with others suffering from illnesses similar to his, he joined a mental support group that would take walks around the neighbourhood. He was able to have heartfelt discussions with the other members and this helped him begin to handle his suppressed emotions.

Eventually, he became the leader of the mental support group and an inspiration to others like him (**Raglugon**). Just like this man, other patients could also recover their will to live following effective treatment (**Presley**). For many patients, depression can be treated, and mental illnesses handled, so euthanasia in cases like this is a suicide, not a mercy-killing because it is not certain that they would have continued suffering their entire lives.

Many patients may feel compelled to commit suicide or opt for euthanasia, even after multiple treatments and psychiatric counselling sessions because their condition has not improved. This may be because they believe that their conditions are untreatable and that it is an exercise of their free will to end their lives (**Barry 162**). A young woman in the Netherlands, named Auralia, decided to end her life for this very reason (**Presley**). She and her doctor both believed that her current state was beyond treatment, like a terminal illness. Her doctor stated that there is "no reasonable alternative in the patient's situation" (**Presley**). She did not want to be forced to live in such pain until the "bitter end" (**Presley**). Advocates of euthanasia in such cases may argue that it is rational to end one's life if it becomes unbearable because what matters are the moments that one has experienced, not the length of life (**Presley**).

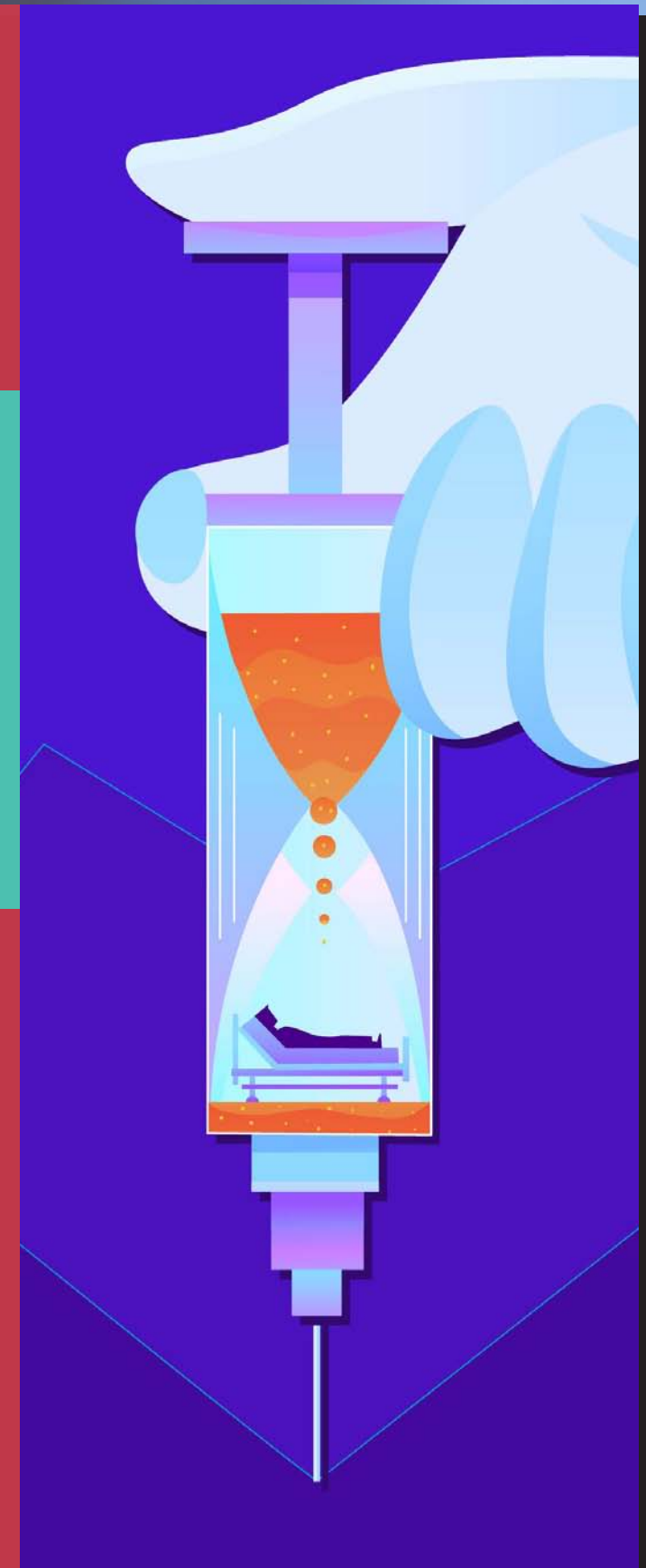
That is why it is irrational to purposely prolong one's lifespan when all that lies ahead is more suffering.

They may also argue that because a doctor has declared the patient as being beyond treatment, such patients should not be compared to those who found meaning in life through therapy. Additionally, many argue that the patients themselves know better than anyone else about the intensity of their suffering, and whether or not they can bear it (**Cramer**).

However, it is difficult to determine whether a patient is still treatable or not. Doctors can make mistakes, and improvements in methods of treatment can bring about a positive change in the patient. Monique, a patient who was diagnosed with similar severe illnesses as Auralia, abandoned her wish to die and embraced life following effective, more personalised treatment. Her new doctor began by telling her that she wasn't crazy and that she was just traumatised. This helped her look at herself less as a lost cause (**Presley**). So, it may simply be that they are not being treated correctly and that more efficient treatment and therapy methods should be developed. Moreover, having suicidal tendencies is a symptom of many psychological illnesses such as Borderline Personality Disorder and chronic depression. Just because a patient believes they should be euthanised, should not mean that their belief is rational (**Presley**).

In addition to this, believing that ending one's life, whether it is by the aid of a doctor or one's own hand, is not an exercise of free will because of a few reasons. Humans are living beings and that is why they are freely able to determine their own actions. If a person kills themselves, that person destroys the means to their free will. If a person is dead, the person cannot make any choices and ceases to have any free will. Therefore, an action that destroys an individual's own means to free will is not an exercise of free will (**Barry 166**). It could be argued that patients may find the will to continue living through the right treatment and experiences.

Many believe people in a coma diagnosed as incurable should be euthanised. They may argue that these people cannot return to living normally. Moreover, supporters of euthanasia may believe that leaving them to exist in a vegetative state indefinitely, supported by a ventilator is cruel (**Aviv**). An English humanist, Thomas More, believed that if permanently comatose patients



are not euthanised, the resources of the hospitals will be wasted. Ventilators could be utilised to save patients who do have a chance of surviving and living a normal life. He argued that euthanasia of such patients could bring the world a step closer to “utopia” where resources are allocated and used efficiently **(Barry 165)**.

This view is supported by Utilitarians as well, who believe that it is everyone’s moral duty to carry out those actions which will result in the greatest possible overall well-being for the largest number of people (169). They believe that by allowing euthanasia, suffering will be minimised while well-being will be maximised because patients can die peacefully, and resources are not wasted. This would result in the net benefit of everyone. Moreover, a renowned physician, **Dr, Carl F. H. Marx**, believed that a physician is “not expected to have a remedy for death, but for the skillful alleviation of suffering.” **(Barry 169)**. Therefore, performing euthanasia on those suffering is part of the duty of a physician.

However, diagnoses can be incorrect, and it can be difficult to determine whether the patient is equivalent to being dead or not.

Moreover, if a person is alive and comatose, it is a breach of human rights **(Barry 160)** to proceed with euthanasia if the patient cannot provide consent. One such case is that of Jahi, an American child who was declared brain-dead after she had undergone surgery for sleep apnea. The doctors believed she was no longer in a state where she could be presumed alive and decided that her ventilator should be unplugged. However, her family resisted. They were devout Christians, and according to their beliefs, a person was still considered to be alive if the person is breathing. Soon after, Jahi began menstruating for the first time.

The brains of patients who are brain-dead start to decompose into a mush-like state after some time even if their bodies are supported by a ventilator. Some parts of Jahi’s brain were starting to decompose, but other parts were still intact **(Aviv)**. This implies that she was still alive and could possibly experience mental activity. Individual lives matter and people should not be allowed to euthanise patients such as Jahi when they cannot give consent, even if they believe it is for everyone’s overall well-being. It may be that she doesn’t mind being in this state, just like a normal person may enjoy their dreams at night when most of the brain is not functioning at its

usual capacity. Moreover, the doctor, in this case as well as others, had incorrectly diagnosed her as brain-dead when she was only partially brain-dead **(Chuck; Aviv)**. Jahi was still alive and as long as an individual is alive, they have full right to their life. Additionally, many religious individuals, such as devout Christians, Muslims, and Jews, have different beliefs regarding when a patient is to be considered dead **(Barry 163)**. The religious beliefs of every individual should be respected, and families should not be pushed towards letting their loved ones be euthanized against these beliefs.

Those afflicted with incurable diseases, such as cancer that is spreading uncontrollably, may seek euthanasia. Those who contend that they should be allowed to do so may argue that since these patients cannot be cured, they should not be forced to suffer until the bitter end **(Cramer)**. Doctors may withdraw their treatment because the patient cannot be cured, or they may inject the patient with a lethal substance **(Barry 150)**. However, this is a pessimistic way of viewing the situation. These patients should spend their remaining time optimistically, and not being as happy and content as before does not justify looking for means to their life. For example, consider the case of a man who has USD 50,000. Suddenly, a thief steals USD 40,000 away from that man. The man wouldn’t throw away the remaining USD 10,000 just because he was upset that some of it got stolen, or because USD 10,000 will buy fewer goods and services than USD 50,000.

Similarly, people afflicted with a terminal illness can make the most of their remaining time by doing something they enjoy or spending more time with loved ones. Most people are faced with a problem at one point or another in their life, which makes them unhappy. According to renowned philosopher Immanuel Kant, “misery gives no right to any man to take his own life, for then we should all be entitled to take our lives for lack of pleasure” **(Barry 167)**. He believed that people have a duty to uphold moral standards regarding self-love. Kant stressed the importance of self-love, and that such an act is not an act in self-love because individuals “can at all times go on living and doing our duty towards themselves without having to do violence to themselves” **(Barry 168)**. Even if living is painful, individuals shouldn’t be cruel to themselves by ending their life.

Whether euthanasia should be permitted or not is such an intricate issue that it may be easy for laws allowing euthanasia to be abused, and a patient’s consent to be misinterpreted. A best-selling author and columnist of The Washington Times, Tammy Bruce, has reported that

after a law that allows doctors to diagnose lethal medication to patients who have an estimated six months or less to live has been passed, some insurance companies have refused to provide the finance to cover the healthcare of many patients. In California, a woman was denied coverage of the cost of any more chemotherapy sessions by her insurance company due to this law. Another woman was sent a letter from her insurance company which said that the cost of lethal pills will be covered, but not the cost of the expensive medicine she requires to survive **(Bruce)**. These companies are attempting to use this law to save their costs and profits. The power to determine a patient’s treatment should be returned to doctors’ hands and those insurance companies should have no role in influencing this treatment.

People should always be encouraged to cherish their lives because it is their human right, and not nudged towards accepting death for the materialistic gains of others.

Moreover, in certain circumstances, euthanasia is likely to be misused even with impositions of legal restraints **(Sherwood)**. Another example is of a woman in Holland who is afflicted with dementia. She had stated in her medical directive that she will opt for euthanasia when she herself finds it to be the correct time to do so. However, after the nursing doctor perceived her to be “frightened and angry” **(Russel)** continuously for several weeks, the doctor believed that the patient’s request to be euthanised should be acted upon. Following the administration of a sedative laden coffee, the doctor began to inject her with a lethal substance, when she regained consciousness and resisted the procedure. The doctor instructed her family to pin her down while he finished injecting her. It has been reported that she had frequently told others in the few days before her death that she did not want to die. The doctor was not penalised **(Russel)**. She was not in a fully-rational state of mind and so could not give consent. However, it is clear from her resistance that she did not want to be euthanised. The doctor either abused his power or completely misinterpreted her consent, although the latter is much more unlikely.

Another, more extreme example of euthanasia laws being abused took place in Nazi Germany. Adolf Hitler, the lawyer Alfred Hoche, and psychiatrist Karl Binding believed that while important citizens of society, the soldiers, lost their lives in battle, society’s “least valued citizens” **(Koenigsberg)** should not be cared for. Hit-

ler ordered that all children below the age of three who had inherited severe disabilities and genetic diseases were to be euthanised **(Koenigsberg 104)**. Later this programme extended to disabled and mentally ill adults as well **(Koenigsberg 105)**. Physicians were to determine if a patient was incurable, and then proceed to euthanise them by means of starvation, lethal injection, and later, carbon monoxide. Although Hitler was responsible for allowing this programme to be carried out, the shocking fact is that it was largely due to the eagerness of physicians that many lives were lost. German physicians were the ones who had devised and proposed the programme to Hitler **(Koenigsberg 106-107)**. Although this is a very extreme example of how physicians abused their power, it does provide some grounds to believe that not all doctors are not as upright as some may believe euthanasia is too sensitive an issue to risk its misuse.

Everyone should encourage those ailed by illnesses such as the ones mentioned above towards acceptance and the will to make the most of the time they have left. Suffering and hardships exist in everyone’s lives to varying degrees. That is why communities should work towards the improvement of therapy programmes. As argued above, although the idea of euthanasia sprung from the incentive to provide those suffering from peace, there are better alternatives. Thus, strict laws banning euthanasia should be upheld.

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Since the beginning of civilisation, humans have been faced with practical problems of disease, hunger, and predators. The passage of time has only changed the form of the problems, not their nature. Life is short, so does it make sense to spend time and effort on ideas rather than on solving practical problems?

In 2001, the British mathematician Andrew Wiles solved one of the most famous problems in mathematics, Fermat's Last Theorem. It took him half a lifetime of intense intellectual effort to come up with a proof that mathematicians had been seeking for almost three hundred years.

Or consider Maxwell's Equations, in particular his idea of displacement current.

Not taking up more than a few square centimeters of space on a sheet of paper, these equations provide the theoretical foundation of every classical electrical and magnetic phenomenon ever observed. Like Ghalib's poetry or Monet's paintings, they are ageless classics.

covered by Charles Darwin. As Dr. Pervez Hoodbhoy put it in a recent article, "Without Darwinian selection one can't even begin to understand microbial-host interaction, the evolution of pathogens, or start developing drugs and vaccines." (Dawn, 4 April 2020). Evolution by random selection, which began as an idea in Darwin's mind, has made 21st-century medicine possible. Most people think of human history as a history of wars, conquests, victories and defeats. But the real history of human civilisation is the history of ideas. Writing about Maxwell's Equations, Richard Feynman said, "From a long view of the history of mankind, seen from, say, ten thousand years from now, there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics. The American Civil War will pale into provincial insignificance in comparison with this important scientific event of the same decade."

IDEAS

Dr. Kamran Ezdi

On a dark stormy night, if your car breaks down on a remote road, would you rather have as your travelling companion a theoretical physicist who knows his quantum mechanics or a car mechanic who can fix broken carburettors with rudimentary tools? The answer is obvious. And this leads to the next question: in a world full of mundane, practical problems, is there any place for ideas and their practitioners?

What distinguishes humans from other animals is a matter of some debate among sociologists and anthropologists. However, it is not too wrong to say that humans have the ability to self-reflect while animals do not. This means that humans can think about issues beyond the immediate concerns of survival and propagation. Put another way, we are perhaps the only species on Earth that have evolved to create ideas. It is in our genes.

Ideas usually start from issues of practical necessity.

Ideas usually start from issues of practical necessity. Lighting a fire to

keep predators away or using crow-bars to lift heavy logs started as ideas in someone's mind. Modern examples are the use of electromagnetic waves for communication or the use of semiconductor diodes as electric switches. The solution of every practical problem, it appears, starts with an idea. From horse-riding to trans-continental flights, and from dying of insect bites to modern life expectancy touching the 90s, humankind has solved a lot of problems with the power of ideas.

But what about ideas that seem to have no practical utility at all? Of what benefit is it to anyone if the Riemann Conjecture is correct?

Or why the ratio of a circle's diameter to its radius is an irrational number?

It is considered one of the greatest proofs in mathematics. And yet, Wiles' proof of Fermat's Last Theorem solved no human problem. It did not end any wars or reduce poverty anywhere. A smart entrepreneur could have made a fortune in the same time, creating thousands of jobs in the process. The practical utility of Wiles' proof, on the other hand, is zero. So, is it useless?

Maybe. But it is not worthless. In the world of ideas, worth comes not from the material or financial gains that may be made from an idea but from its intrinsic beauty. The beauty of an idea is like the beauty of a painting or a poem; impossible to describe but hard to ignore. Fermat's Last Theorem is beautiful because it expresses, in one sentence, a profound truth that no one was able to rebut for three hundred years.

Occasionally, abstract theoretical ideas find unexpected practical applications. Pioneers of quantum mechanics had no idea that the abstruse principles of the subject will one day lead to the advent of the electronic age and fundamentally change the world. They studied it as an idea that explains the working of the physical world at tiny distance scales. Practical applications were a by-product, not the inspiration, for doing quantum mechanics. Consider a different example. As a result of advances in pharmaceuticals, the treatment of diseases such as cancer and AIDS has made great progress in the last few decades. This has not only resulted in alleviating pain and prolonging the lives of those unfortunate to be afflicted by them but also considerably improved their quality of life. The development of these drugs would not have been possible without the principles of evolutionary biology dis-

Territories conquered by force can be lost. Buildings, roads, missiles, and tanks, however durable and tough, ultimately crumble before the ravages of time. The only thing that survives is ideas. Societies that encourage new ideas prosper and grow and contribute to the enrichment of human culture. Those that discourage new ideas disappear without a trace, unlamented and forgotten.

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BLACK HOLES

Tuba Zaidi

Black holes present in deep space have been mysterious since centuries and only now scientists are able to unveil their mystery

The concept of a sufficiently massive and compact star was first pointed out by an assumption made by Roemer, a Danish astronomer, that gravity might have an essential effect on light. This assumption led John Michell, a Cambridge don to write a paper in the “Royal Society of London” in 1783 in which he described a star which had a large mass and was dense enough, would have a large force of gravity.

This assumption led to the discovery of an important heavenly body known as “Black Hole” meaning “black voids in space”. The name “black hole” was given by John Archibald Wheeler, an American theoretical physicist in 1967. The black holes are most commonly produced after the death of massive stars called supernovae or hypernovae. After any nova incident, a singularity (a one-dimensional point present in the centre of a black hole) is formed that has a size smaller than that of subatomic particles and has an infinite density.

According to a theory given by Einstein, *“there exists a singularity inside every black hole”*. At this singularity, all the matter of a black hole is compressed at a point having an infinitely small volume. According to NASA (National Aeronautics and Space Administration), “It is a great amount of matter packed into a very small area”. The black holes are the captivating heavenly bodies present in the heart of all large galaxies. Edwin Powell Hubble also discovered that every large galaxy is revolving around a black hole. The supermassive black hole found in the Milky Way galaxy has “...a mass of 800 million times the mass of the Sun” which describes that a black hole has a huge mass present at a small volume. It has such a strong gravitational pull that even light cannot escape. The black holes help us in understanding the universe in a more appropriate way and they are the cause of equilibrium in the universe.

Black holes are so massive that they distort the fabric of space and time and this distortion curves space and time itself, much like a heavy weight put on a stretched rubber sheet would appear.

Space-time describes the four dimensions of our universe; three spatial (up/down, forward/backward and left/right) and one temporal i.e. time. Einstein first showed that space and time are related to each other. Substantially, all physical bodies warp space around them, depending upon their mass.

The massive they are, the more bent space is. “A massive object distorts or ‘curves’ space-time, like a bowling ball sitting on a canvas”. According to Einstein, our space is space-time. A massive body like black hole can cause a colossal curvature in it due to Earth, Sun, and other heavenly bodies which tend to fall towards it as though a more massive entity that is, a black hole is attracting them which is termed as “gravity”. “Space-time tells matter how to move; matter tells space-time how to curve”. Warped space guides all bodies how to move, and makes them travel along shortest possible paths called geodesics.

The curvature of space-time around mass explains gravity.

“Gravity is the curvature of the universe, caused by massive bodies, which determines the path that objects travel”.

According to Einstein, “gravity is the motion of bodies through curved space-time”. It means that gravity is not a pull that causes attraction between masses, in fact, it is a bend in space-time. Earth’s gravity is a strength that keeps you on the ground and makes objects fall. Gravity is a

pull that supports the planets around the Sun and keeps the Moon around the Earth. It is a force that gives you weight.

“It is gravity that shapes the large-scale structure of the universe”. A galaxy consists of billions of stars. Our galaxy is known as the Milky Way in which the Sun is one of the many stars. Every galaxy is revolving around a black hole, which is the main reason for the equilibrium of our universe. The moon orbits the Earth and the Earth orbits around the Sun with all other planets and Sun orbits around a central black hole with all other stars. The universe without these compact, organised circular motions of planets around stars, moons around their planets and stars around their black holes, would have a random motion in which everything would have been colliding with each other.

According to John Taylor, “Gravity is an intrinsic property of space”. Space is affected by the heavy stars embedded in it to such an extent that it becomes curved. So, therefore, the planets do not move in a straight line, or randomly rather they orbit around the Sun in the curved lines around it. The black holes help in the formation of the systematic universe and its shape, and they make Earth stay in orbit so we can survive. “All that is needed is the description of gravity as an intrinsic distortion of space”. Thus, the black holes help in predicting the motion of the heavenly bodies and help us in understanding the concept of gravity. If there were no black holes, then there would be no space-time curve. If there were no space-time curve, then there would be no gravity. If there were no gravity, then there would be no stability.

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انج کی سائنس

کچھ لوگ یہ دعویٰ کرتے ہیں کہ انھیں مرچیں کم لگتی ہیں۔ مجھے یاد پڑتا ہے ہمارے تایا جان، تیز سے تیز مرچ بھی، نہ صرف یہ کہ بغیر سی سی کیے کھا جاتے تھے بلکہ یہ بھی کہتے کہ "پھکی ہے!" کیا ایسا ہو سکتا ہے کہ کچھ لوگوں پر مرچوں کا اثر واقعی کم ہوتا ہو؟ سائنس کے مطابق ایسا ممکن ہے۔ کیپسین اگر جسم میں بار بار جذب ہوتا رہے تو یہ مذکورہ بالا ریسپٹر کے خاتمے کا باعث بنتا ہے۔ یوں جلن کے احساس کے خلاف جسم میں برداشت پیدا ہو جاتی ہے۔ یہی وجہ ہے کہ ہری مرچوں کے عادی آہستہ آہستہ جلن کے احساس سے عاری ہو جاتے ہیں۔

مرچوں سے پیدا جلن کیسے کم کی جائے؟ کیپسین، اپنی چکنائی پسند دم کی وجہ سے پانی میں حل پذیر نہیں۔ یہی وجہ ہے کہ پانی پینے سے یہ جلن کم نہیں ہوتی۔ تاہم دودھ میں موجود ایک پروٹین "کائی سن"، کیپسینو نیڈز کو حل کر کے جلن سے نجات دلا سکتا ہے۔ لہذا مرچوں کی حدت کم کرنے کے لیے دودھ پینا چاہیے۔

تحریر: ڈاکٹر محمد ظہیر، اسٹنٹ پروفیسر،
شعبہ کیمیا و کیمیائی انجینئرنگ

لڑکپن میں ہر کھانے کے ساتھ ہری مرچ کتر کتر کھانے کی لت پڑ گئی تھی۔ کھانے کے بعد حالت غیر ہو جاتی، ناک اور آنکھوں سے سیلابی ریلے بہنے لگتے اور منہ میں جیسے کسی نے انگارے رکھ دیے ہوں۔ ہم اس آگ کو پانی سے بجھانے کی کوشش میں ناکام ہونے کے بعد دو زانوں ہو کر کسی سگ تشنہ لب کی مانند زبان باہر نکال کر ہانپنے لگ جاتے۔ لعاب دہن کی اچھی خاصی مقدار نکلنے پر منہ میں لگی آگ کی حدت کہیں کم ہوتی۔ آئیے دیکھتے ہیں کہ مرچوں میں، جلن کے احساس کی وجہ بننے والے مرکبات کون سے ہیں، یہ احساس کیوں پیدا ہوتا ہے اور اس کی شدت کو کیسے ختم کیا جا سکتا ہے؟

مرچ کا پودا، خاندان کیپسی کم سے تعلق رکھتا ہے۔ ان پودوں میں کیمیائی مرکبات کا ایک گروہ کیپسینو نیڈز پانا جاتا ہے جس کے دو رکن زیادہ عام ہیں۔ ایک "کیپسین" اور دوسرا ڈائی ہائیڈرو کیپسین (اشکال دکھئے)۔ یہی دو اجزا مرچوں کی خاصیت کی وجہ ہیں۔ کیپسینو نیڈز، جذب ہونے کے بعد، منہ کی رطوبتی جھلی میں موجود ایک ریسپٹر سے جڑتے ہیں۔ یہ ریسپٹر چونکہ حرارت سے پیدا ہونے والی جلن کے احساس سے وابستہ ہے، اس لیے یہ جلن پیدا کرتا ہے۔ اس تکلیف کے رد عمل میں جسم سے قدرتی درد کش مرکبات "اینڈورفنز" خارج ہو کر مسرت اور طمانیت کا احساس دیتے ہیں۔

Experimental

Scientists

Prisoners of a Process

Sabieh Anwar and Naveed Iftikhar



Lab-work is an important component of the scientific process and is a manifestation of human ingenuity. The experimental endeavour is similar to the romance an artist professes with their artwork.

Over the centuries, scientific experiments have also changed in their role from mere fact-collection routines to fundamental probes into the biological and physical universes creating the most useful inventions of our times.

In Pakistan’s universities, backwardness in the field of experimental science owes a great deal to the archaic, complex and bureaucratic processes, which may sound well-meaning, but start with the premise that practitioners of science are untrustworthy. This premise has led to multiple layers of checks to ensure prudence and fiscal discipline. The outcome is the exact opposite and the process itself mars the spirit of scientific curiosity.

Scientific instruments are the tools for research and discovery and come in various kinds. Telescopes probe deeper into the universe, microscopes tear open viruses, pathogens, medical scanners help identify and treat diseases, and DNA sequencers enable modern forensics. The scientific march forward is shaped by the wedlock between tools and ideas.

Acquisition of resources for experimental research is governed by the Public Procurement Regulatory Authority (PPRA) rules in the case of public financing. The procurement processes result in inefficiency, wastage, promote extravagance and set up a recipe for failure by frustration. These rules may work slightly better for construction of dams or roads but are a dread for the inventor who works in her lab making ventilators, the physicist who counts feeble clicks of single photons on her photodetectors in long sleepless nights, or the drug designer who carefully pipettes nanoliters of molecules into a petri dish.

Let’s be specific. Scientific tools are routed through local vendors who cause delays in delivery of equipment and also add a layer of insane profiteering. In the next stage, the installation and operationalisation of equipment face

numerous challenges. Scientists remain unable to tinker with the instrument for the dread of converting malfunctioning apparatus to complete write-offs. This aggravates due to the lack of appetite and resources for hiring, grooming, and training technicians who usually act as a lynchpin in the experimental process.

It is astonishing how the purchase of small technical supplies costing only a few thousands of rupees is so difficult. These spares could potentially resurrect abandoned equipment which are worth millions. Indeed, penny wise pound foolish, we end up in a vicious cycle of replacing old apparatuses with new ones continually spending more and more money. We eventually build empires of scientific wreckage.

One of the fascinations of lab-work is that the route for scientific inquiry is adaptive and does not follow a pre-ordained pattern. There are surprises along the way. Consider the example of some synthetic organic chemists whose work depends on synthetic chemicals not produced in the country.

What if during the course of an experiment she feels to replace one chemical with another? For this surprising twist, she will immediately require the new chemical for the other ingredients are perishable and are already set up. She quickly scrambles through online catalogues, writes to her department head, who writes to the dean, who relays this to the Office of Research and then to the Vice Chancellor who repeat-sanctions an already approved budget and finally a clerk will prepare a request for purchase.

An advertisement may then need to be floated in the newspaper and a certain time period must lapse before bids are accepted and can be challenged by competitors. In case of no-shows, a second-round is required. The time duration from demand to procurement can easily take anywhere from several months to more than a year. No wonder we see many scientists already giving up on experimental investigations, resorting to mediocrity and lacklustre teaching, or bid adieu and leave.

Our scientific investigators have become prisoners of this very process. Some fixes are needed. First, the use of credit cards and online purchases should be allowed. Secondly, scientists should be permitted to purchase used equipment which is nominally at a fraction of the cost of new. Third, allowing universities to establish business-to-business (B2B) relationships with original equipment manufacturers will lead to financial savings and expediency. At times, scientific equipment manufacturers are co-discoverers in the experiment and a crucial rapport

between the end-user and the manufacturer of the customised instrument becomes useful.

The fourth solution is liberalising the procedure of ‘off-the-shelf purchases’, allowing the scientific community to build their own hardware, rejuvenate old equipment and participate in the global democratising do-it-yourself movement of constructing hardware that is accessible to everyone. Fifth, advance payments should be allowed in lieu of a letter of credits, which are considered outdated. Ironically, the current procurement rules systematically curtail the spirit of competition and also discriminate against an indigenous product developer.

In summary, we should devise a process that is customised for laboratory life instilling the confidence, joy, and fascination among our scientific community towards the intellectual endeavour. Only then can we expect to see some public good coming out of our universities.

We suggest that the Higher Education Commission (HEC) take up this matter with the PPRA, the State Bank of Pakistan (SBP), Pakistan Customs and the postal authorities and resolve the issues faced in enabling a liberal culture of creating or buying tools for experimental science.

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Naveed Iftikhar is an entrepreneur, teacher and economic/urban policy professional.

Artificial Intelligence OUR NEED

Muhammad Adnan Anwar

Alan Turing, a great mathematician who cracked the Enigma machine in World War II was the first to bring up the idea of Artificial Intelligence (AI) by asking a single question, 'can a machine think?'.

Although the term AI was first used by John McCarthy, an American computer scientist, in a conference held in Dartmouth college in the summer of 1956. The participant in this conference became the pioneer leaders of AI. But they underestimated the difficulty of modelling and digitising the human brain. As a response global powers never supported this idea.

Not a single definition of AI is universally accepted or not a single definition compactly describes the AI. Every definition has some limitations i.e. "building machines that are intelligent" does not state what makes a machine intelligent.

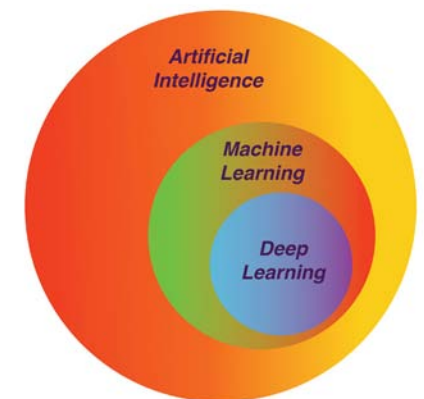
AI is generally divided into 3 categories:

- Artificial Narrow Intelligence (*weak AI*)
- Artificial General Intelligence (*strong AI*)
- Artificial Super Intelligence (*strong AI*)

Weak AI is task-based; it is good at performing a specific task. IBM developed the first chess-playing computer named, "Deep Blue" it defeated the Russian grandmaster Garry Kasparov in 1997. Deep Blue could generate 200 million chess moves per second. It is considered one of the earliest examples of weak AI. Self-driving car is also an example of weak AI. In contrast to weak AI, artificial general intelligence systems could perform any task that a human is capable of. Many researchers are ambiguous if strong AI is possible and there are also many who question whether it would be desirable. Stephen

Hawking, for example, warned: "It [*strong AI*] would take off on its own, and re-design itself at an ever-increasing rate. Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded."

By now we are all surrounded by AI. Either it is an automatic grading system in education or autonomous vehicles, from the business management system to space exploration, from health care to climate change and so on. AI becomes a part and parcel of the modern era. It reduces human effort and makes life very easy and accurate. In the context of Pakistan, we have yet to answer a couple of fundamental questions regarding AI; which areas are to be considered for research and development and which field of AI can be useful to create human-computer interaction. As we have a very high ratio of young people to engage in such fields, we need to think locally first and then explore the international prospects.



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PHILOSOPHY

Tuba Zaidi

I turned on my laptop at 01:20 pm, checked for the internet connection, and its battery. My online exam was scheduled from 01:30 pm to 02:30 pm. Time lapsed as slowly as it could. At 01:29 pm, it seemed to me as if I were travelling with a speed of light since time was lingering. After so much wait, it turned out to be 01:30 pm. But as soon as it was 01:30 pm, the very next moment it became 02:30 pm. I was so surprised by what had happened to me.

“The feeling of time” varies from person to person and events to events. Time moves faster when we are happy and busy. Especially during a lengthy and challenging exam, it passes quickly (in case you know all the answers).

Time moves slowly when we are free and sad. Especially when we are waiting for someone and giving an exam not knowing how to solve that, it feels like it is as slow as a turtle.



Time is very complicated to understand. We cannot mark its starting and ending points. According to Aristotle, time is nothing but only related to the people and incidents or events. Contrarily, Plato and Newton thought that time is like a vessel or a pot in which we put our incidents and life; but besides this, it exists independently.

In ancient cultures, like Maya, Inca, Hinduism, Greeks, Buddhists, and others, people think that time travels in a circular path like a wheel. But Muslims, Jews, Christians, and other religious people believe that time moves in a straight line. They believe that time began when God ordered and will end according to His orders. People come and go, but time does not change.

Time is independent of everything we physically know of so far at the macroscopic level. In his marvelous novel named “RAKH”, Mustanser Hussain Tarer

wrote: “Time passes, but we don’t have sensations. You stand there, and it passes away, or probably you pass away, and it stands there.”

We cannot stop time. Better or worse, it passes. It does not care for anyone. Time does not stop. It changes. Sometimes, it changes people, and sometimes it changes the circumstances of the people. Time is a teacher. It educates people and gives some remarkable lessons that no one can give. Time makes a person grow. It enables a person to think more and learn more. Time is like a river current that makes everyone swim with its flow.

Life is precious since, once lost, can never ever come back. Very similarly, time is precious.

Once lost, then we cannot reverse it. Our small mistake, if stretched in only some seconds, can ruin someone’s life. We can say every person has his or her own frame of time. His or her time is associated with life. It starts when we get our consciousness and ends when we lose that. We have to ‘live’ life, which is ultimately time. Thus, we have to consume our time and not waste it.

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TIME

Distinct

پانی میں چھپی کامیابی

لکی مروت کے پی-ایچ-ڈی سائنسدان کی کہانی

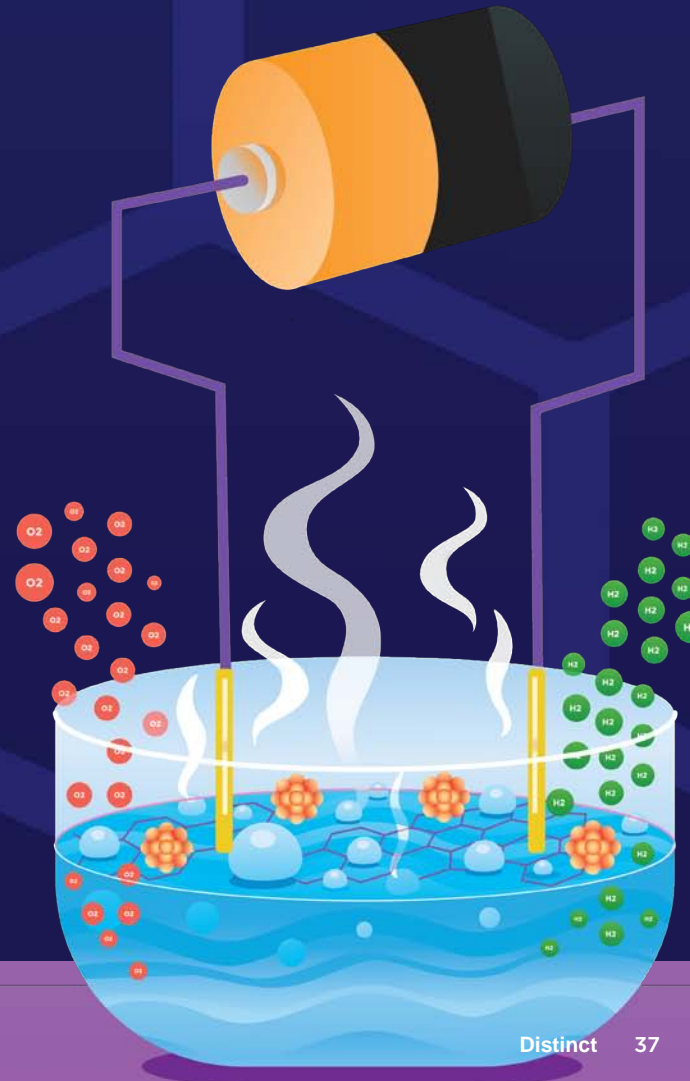
آئیے ملتے ہیں ایک ایسے ہی شخص سے، جس کا آبائی شہر تو لکی مروت ہے مگر علم کی طلب اسے پشاور، اسلام آباد اور -لاہور لے چلی اور آج وہ شخص اپنے آبائی علاقے کا پہلا پی ایچ-ڈی اسکالر بن چکا ہے۔ یہ ہے ڈاکٹر اختر منیر۔

دراصل ڈاکٹر اختر کا کیمیا سے عشق ایف ایس سی مکمل ہونے کے فوراً بعد ہی شروع ہو گیا تھا۔ انھیں لگا کہ قدرت کی جانب سے ان کے لیے فیصلہ ہو چکا ہے کہ وہ کیمسٹری کو بطور مضمون اپنائیں گے۔ لہذا، انہوں نے لمز میں اپنے سفر کو شروع کرنے سے قبل قائد اعظم یونیورسٹی سے غیر نامیاتی اور تجزیاتی کیمسٹری میں ایم ایس سی اور ایم فل کی ڈگری حاصل کی۔

لیکن مفت میں مشورہ کون نہیں دیتا؟ یہ کتنی عام سی بات ہے کہ آپ اپنے کیریئر سے متعلقہ کوئی بھی قدم اٹھانے کا سوچیں تو کبھی دائیں کبھی بائیں سے آواز آتی ہے ”ارے ایسے کرلو، ارے ویسے کرلو!“۔ قائد اعظم یونیورسٹی سے ایم ایس سی کے بعد بہت سے لوگوں نے ڈاکٹر اختر کو بھی کچھ ایسے ہی کہا؛ ”لمز کیوں جانا چاہتے ہو؟ باہر کی یونیورسٹی جانا بہتر ہوگا، اچھا چلو قائد اعظم یونیورسٹی ہی چلے جاؤ۔“ لیکن ڈاکٹر اختر نے صرف اپنے دل کی سنی اور لمز میں پی-ایچ-ڈی میں داخلہ لیا۔ ڈاکٹر صاحب کے مطابق یہ ان کی تعلیمی اور پیشہ ورانہ زندگی کا سب سے اچھا فیصلہ تھا۔

دنیاوی مقصد تو انسان کو خود ہی بنانا پڑتا ہے۔ تو کیوں نہ

پیدا ہونے سے لے کر زندگی کے اختتام تک کے اس لازمان سلسلے میں انسان کچھ برس کا سفر زمین کے سرسبز میدان، آسمان سے باتیں کرتے پہاڑوں اور پتے ریگستانوں کے دامن میں گزارتا ہے اور سوچتا ہے کہ کیا اسکی زندگی کا کوئی مقصد ہے بھی یا نہیں۔ ہم میں سے اکثر لوگ کسی ایسے انسان کو ضرور جانتے ہوں گے جو اس مقصد کی تلاش میں اپنے گھر، دوست اور رشتہ داروں سے دور جا کر علم سے دوستی کے سفر کا آغاز کرنا چاہتا ہو یا کر چکا ہو۔



ایسا مقصد بنا لیا جائے جس کی کاوش کے نتائج نہ صرف ذاتی بلکہ عوامی اور ملکی سطح پر بھی مرتب ہوں! ڈاکٹر اختر نے یہاں بھی ایک اچھا فیصلہ کیا اور انسانی فلاح و بہبود کو مد نظر رکھتے ہوئے پانی سے توانائی حاصل کرنے کا ایک انوکھا اور موثر طریقہ ایجاد کیا جس کے نتیجے میں بننے والی ہائیڈروجن گیس کو بطور ایندھن استعمال کیا جاسکے گا۔ ڈاکٹر اختر نے بتایا کہ اس تجربے میں پانی سے ہائیڈروجن الگ کرنے کے لیے انہوں نے کوبالٹ اور نیکل جیسی دھاتوں سمیت گرافین آکسائیڈ اور انتہائی چھوٹے سوراخوں پر مبنی کاربن بھی استعمال کی۔ اس طرح انھوں نے ایک نئی قسم کے نینو عمل انگ کی دریافت کی جس سے روایتی طریقہ کار کی نسبت کئی گنا زیادہ ہائیڈروجن گیس بنائی جاسکتی ہے۔

یہ مٹیریل انسانی آنکھ براہ راست دیکھ تو نہیں سکتی لیکن عقل کا سہارا لے کر انسان آسمان و زمین کی حدیں چھو سکتا ہے اور خود بھی اپنی قابلیت پر حیران ہو جاتا ہے۔

ڈاکٹر اختر کا ماننا ہے کہ آج کل کے دور میں نینو ٹیکنالوجی پر زیادہ کام صحت اور توانائی کے شعبے میں ہو رہا ہے۔ یہ دونوں ہی انسان کی سب سے بڑی اور نمایاں ضروریات زندگی بن چکے ہیں۔ ٹرک، گاڑی اور ہوائی جہاز، یہ سب پٹرولیم مصنوعات کو جلا کر چلائے جاتے ہیں اور اس کے نتیجے میں خارج ہونے والا خطرناک اور مضر صحت فضلہ ہوا میں بکھر جاتا ہے۔ کیا ہم اپنے بچوں کے لیے آلودگی سے بھری دنیا چھوڑ کر جانا چاہتے ہیں؟ کیا ہم اس نظام میں کوئی تبدیلی نہیں لانا چاہتے؟ کیا اس آلودہ ماحول سے نکلنے کی لیے کوئی تیار نہیں؟ آلودگی سے نجات حاصل کرنے کے لیے

ہمیں ہائیڈروجن گیس جیسے قابل تجدید توانائی کے وسائل تلاش کرنے ہوں گے، جو کہ ڈاکٹر اختر کی تحقیق کا مرکزی مضمون ہے۔

شاید ڈاکٹر اختر کے آبائی علاقے کی کم حالی اور پسماندگی ہی انکی کامیابی کی وجہ بنی کیونکہ انھوں نے کبھی اپنے حوصلے پست نہ ہونے دیے اور یہی وجہ ہے کہ آج ان کا نام انکے علاقے کے لوگوں کے لیے باعثِ فخر ہے۔

انسان اس کرہ ارض پہ چند دیہاتیوں کے لیے قدم رکھتا ہے۔ اس مختصر وقت میں اپنا مقصد کھوجنا، اس پر محنت سے کام کرنا اور کامیابیاں سمیٹنا، یہ شرف حاصل کرنا ہر ایک کے بس میں ہے۔ ڈاکٹر صاحب کے مطابق انہیں یہ کامیابی والدین کی دعا کے بعد لمز کی وجہ سے ملی جہاں انھیں ملے ہم خیال ساتھی، مخلص دوست اور بہترین اساتذہ بالخصوص وہ اپنے تعلیمی مربی ڈاکٹر ارشاد حسین کے تہ دل سے ممنون ہیں۔ ان کا کہنا ہے کہ حقیقی طور پر لمز طلبہ میں میرٹ اور خوش آئند مسابقت کو فروغ دیتا ہے اور پھر طلبہ میں استقامت، دیانتداری اور تندرہی کا مزاج بھی پیدا کرتا ہے۔ چنانچہ اس زمانہ طالب علمی کے دوران ان کی شخصیت کی خوبصورت تشکیل ہوئی۔ انہوں نے خاص طور پر ادارے کے ڈین ڈاکٹر صبیح انور کے انقلابی اقدامات کی تعریف کی۔

تحریر: روشن بخاری



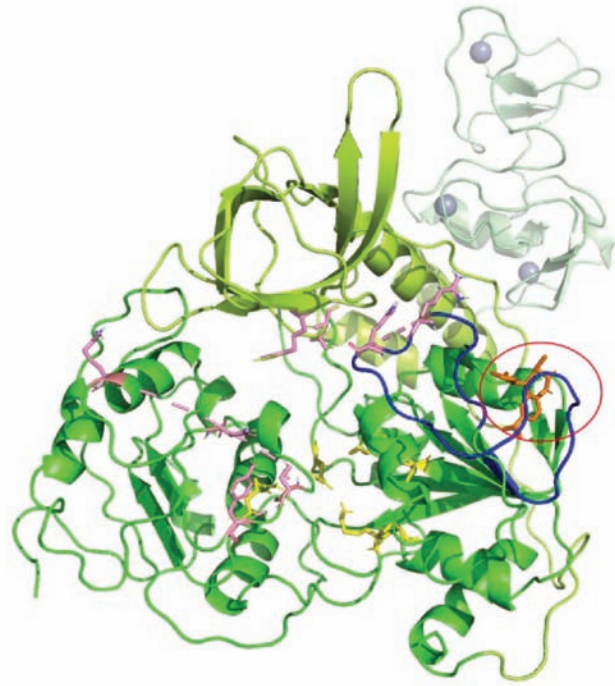




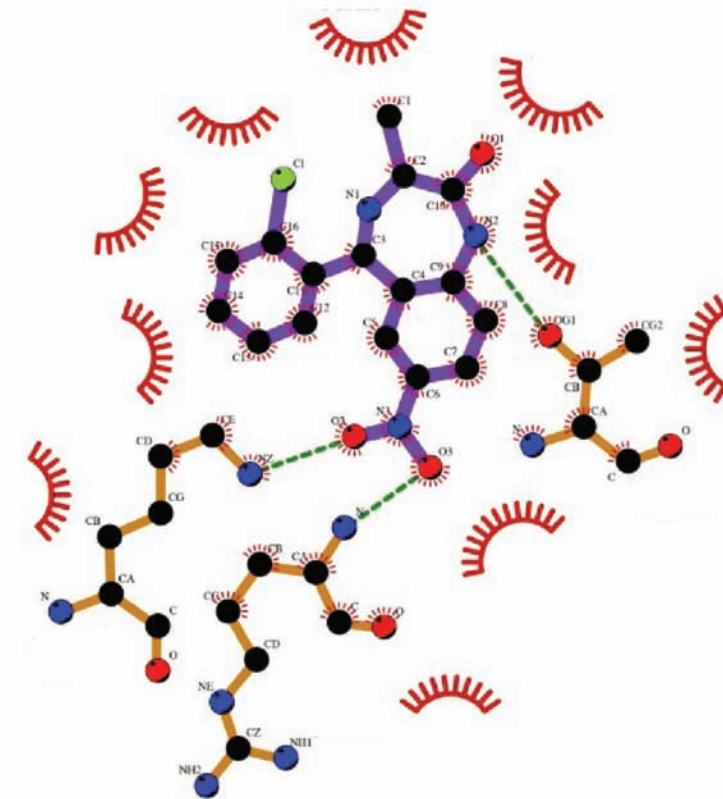
DISCOVER.Y

Zeroing Down on Drug-like Molecules for Inhibiting the Coronavirus

Coronavirus disease-19 (COVID-19) has drastically affected healthcare all over the world. LUMS Faculty and students are responding to the crisis in multiple ways. Graduate students **Hafsa Iftikhar** and **Nayer Ali** in the Biochemistry and Structural Biology Lab led by **Shahzad ul Hussan** have exploited tools in artificial intelligence to identify potential drugs or drug-like molecules specifically targeting the SARS-CoV-2 virus.



Three enzymes of the coronavirus are crucial for its replication inside the human cell. The group modeled three-dimensional structures of these enzymes and screened a library of around 5000 already known drugs and drug-like molecules, purely using cutting-edge computational techniques to identify three promising molecules that can potentially inhibit the replication of the virus.



This work was hailed as an important step forward in the global challenge to cure the pandemic. The research group's next step is to verify the efficacy of these drugs by doing standard experiments.

Publication: Computers in Medicine and Biology (volume 122, July 2020).

Glucose Sensing with Machine Learning

Dr. Wala Saadeh's Contributions to Non-invasive Glucose Monitoring

As of 2020, according to the International Diabetes Federation, 17.1% of the adult population of Pakistan, which means about 19 million out of 113 million adults, suffers from diabetes. According to the Institute for Health Metrics and Evaluation (IHME), an independent global health research center at the University of Washington USA, diabetes was ranked in the top ten causes of deaths in Pakistan in 2017.

Diabetes is a disease which impairs the body's ability to produce insulin or hinders the effective use of insulin in the human body. Insulin is a hormone that regulates our blood glucose levels by allowing our bodies to either use or store the sugar (glucose) from carbohydrate enriched foods that we consume. This disease spares no one, it is prevalent in children, the youth, adults, and pregnant women. Untreated, it could lead to multiple organ failure eventually resulting in death.

Untreated, it could lead to multiple organ failure eventually resulting in death.

Dr. Wala Saadeh in SSE's Electrical Engineering Department came up with the idea of developing an affordable and non-invasive blood glucose level monitoring device. The idea was triggered after she met a lady and her diabetic child at the airport, Dr. Saadeh recalls. The mother had to check her son's blood glucose levels multiple times daily using the conventional finger-prick method and administer daily insulin injections.

Most of us who grew up with diabetic parents, grandparents, siblings, or friends are familiar with repeated finger pricking to check sugar levels which could be painful and also leave the patient vulnerable to various kinds of infections. In a research paper co-authored with her student Aminah Hina, titled, "Non-Invasive Glucose Monitoring SoC Based on Single Wavelength Photoplethysmography" (published in IEEE Transactions on Biomedical Circuits and

Systems, vol. 14, no. 3, pp. 504-515, June 2020), the research team proposes a device such as the ones used in hospitals to monitor the oxygen concentration level and heart rate. The patient basically places his or her finger in a clip-like device, which measures the blood glucose level.

The method involves sending a light wave through the body and detecting it is using a sensor on the other side. Since there is no direct relationship among the incident light, resultant light, and blood glucose level, they have used a machine learning algorithm trained to map specific light features with certain blood glucose values.

The machine learning algorithm allows to detect and quantify glucose levels and is based on a highly sensitive technique for measuring blood volumes using near-infrared optical pulses, called photoplethysmography.

While conducting their research, Dr. Saadeh's team tested the device on 200 students from LUMS. However, they could not find a sufficient number of diabetic patients on campus. The machine learning algorithm used was therefore, calibrated for normal blood glucose levels. They are now working with a local clinic that treats diabetic patients for recalibrating the algorithm accordingly. The team first demonstrated the first prototype of the device at the IEEE International Symposium on Circuits and

Systems organised in Japan in 2019.

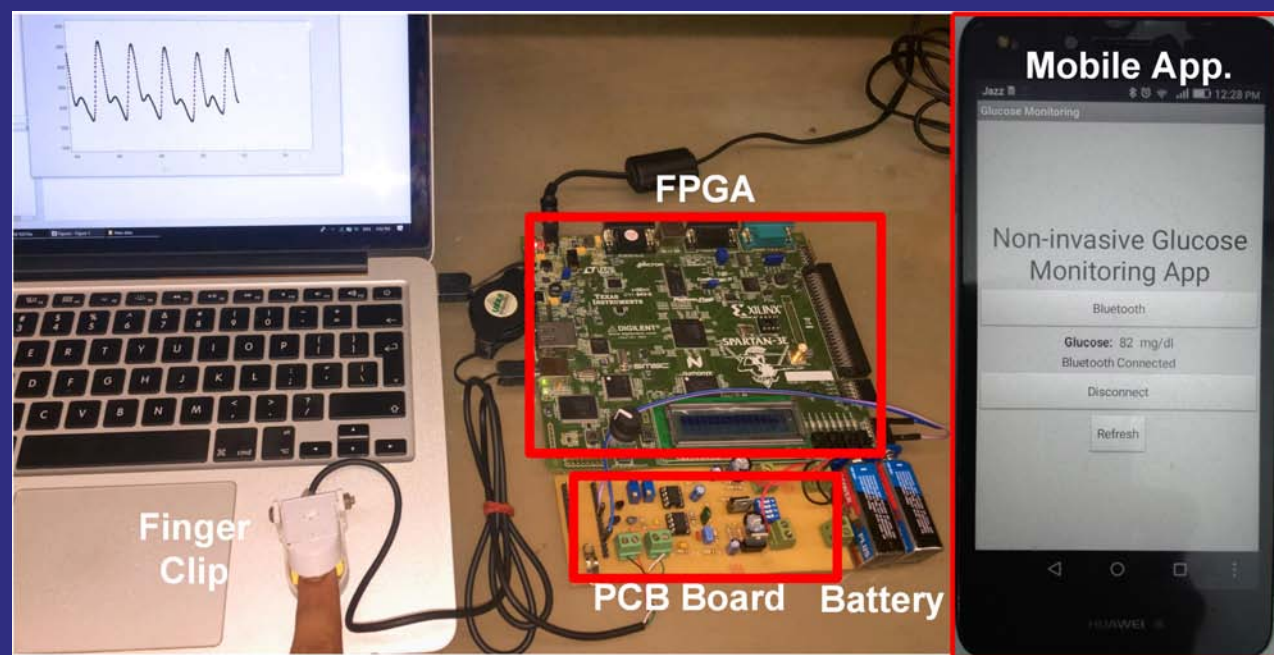
The research team is now working on the second prototype of the device, with the aim of making the circuit smaller to fit onto a single chip and making the measurements even more accurate via extensive testing on diabetic patients.

It is important to note that a few non-invasive blood glucose level monitoring devices such as the GlucoTrack© are available in the market, but are extremely expensive. For example, the one-time cost of GlucoTrack© is approximately PKR 3.4 lac with a recurring cost of PKR 30,000 every 6 months.

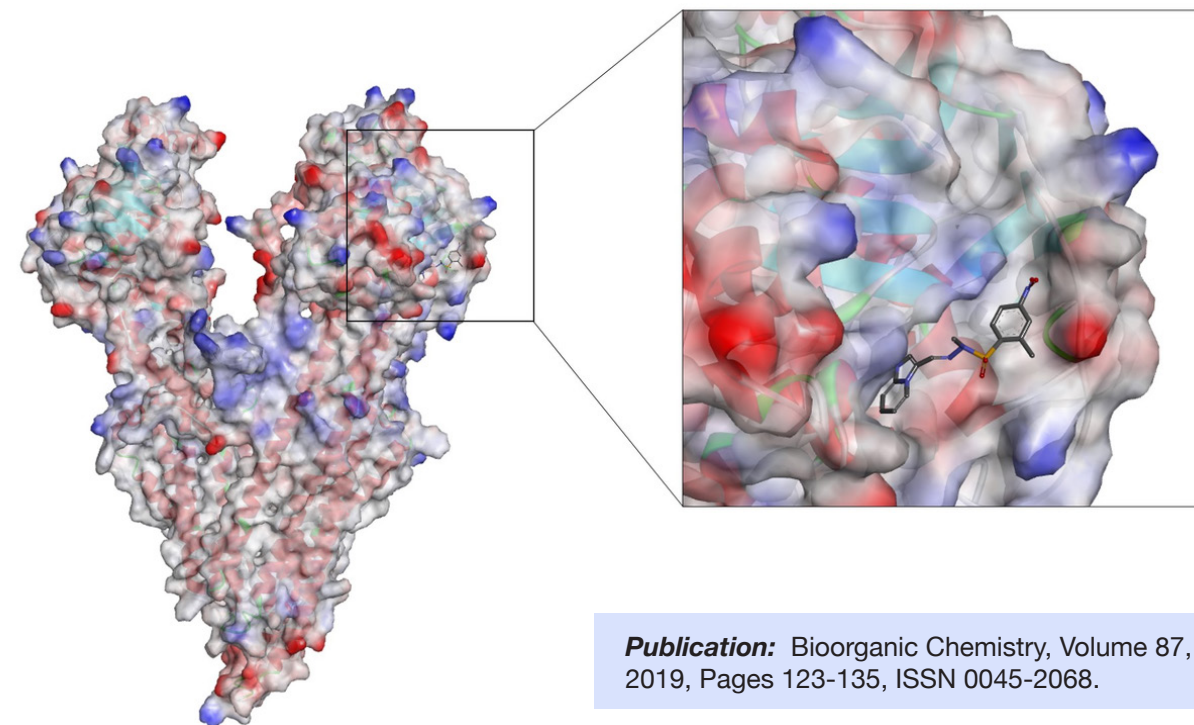
Once Dr. Saadeh and her team is ready, they aspire to work with companies that manufacture medical devices to make this non-invasive, blood glucose level monitoring device available to the public at affordable rates.

Dr. Safeeullah Chaudhry in SSE's Biology Department is also closely working with a startup called Byonyks on non-invasive glucose monitoring.

Publication: *IEEE Transactions on Biomedical Circuits and Systems*, vol. 14, no. 3, pp. 504-515, June 2020.



Interdisciplinary Work in the Field of Cancer Therapeutics



Publication: *Bioorganic Chemistry*, Volume 87, 2019, Pages 123-135, ISSN 0045-2068.

The faculty and students at SSE continue their exemplary interdisciplinary work in the field of cancer therapeutics.

Working in Dr. Amir Faisal's group in biology, MS student Rida Zahra's paper titled 'A cell-based high-throughput screen identifies inhibitors that overcome P-glycoprotein (Pgp)-mediated multidrug resistance' has been published in PLOS One. Co-authors include two PhD students and Dr. Aziz Mithani from Biology as well as Dr. Rahman Shah Zaib Saleem from Chemistry.

The research team used a cell-based high throughput screening approach to identify eight compounds with known biological targets that can overcome multidrug resistance in cancer. The work also spells out the underlying mechanisms of how these compounds overcome resistance.

This work represents an important step in enabling researchers to tackle one of the major challenges in cancer therapeutics.



Groundbreaking Research conducted on Cellular Networks

Led by **Dr. Zafar Ayyub Qazi** as the Project Lead, and **Dr. Zartash Uzmi** as Co-Advisor the next generation of cellular networks (5G and beyond) are expected to provide ultra-low latency and high reliability to support emerging and near real-time applications such as augmented and virtual reality, remote surgery, self-driving cars and multi-player online gaming.

In order to move the ‘control plane’ aka ‘brain’ closer to the edge (Edge Computing Paradigm); the LUMS research team created edge-based cellular control plane, which tries to keep cellular network control plane consistent (hence providing strong reliability), while providing user applications’ low latency. They implemented a high fidelity prototype of their design and demonstrated using real cellular traffic traces to find out how it significantly improves latency and reliability for applications over existing cellular design.

This important step towards realizing the promise 5G and 6G networks will be appearing in ACM SIGCOMM 2020 (<https://conferences.sigcomm.org/sigcomm/2020/>), a premier conference on computer networks.

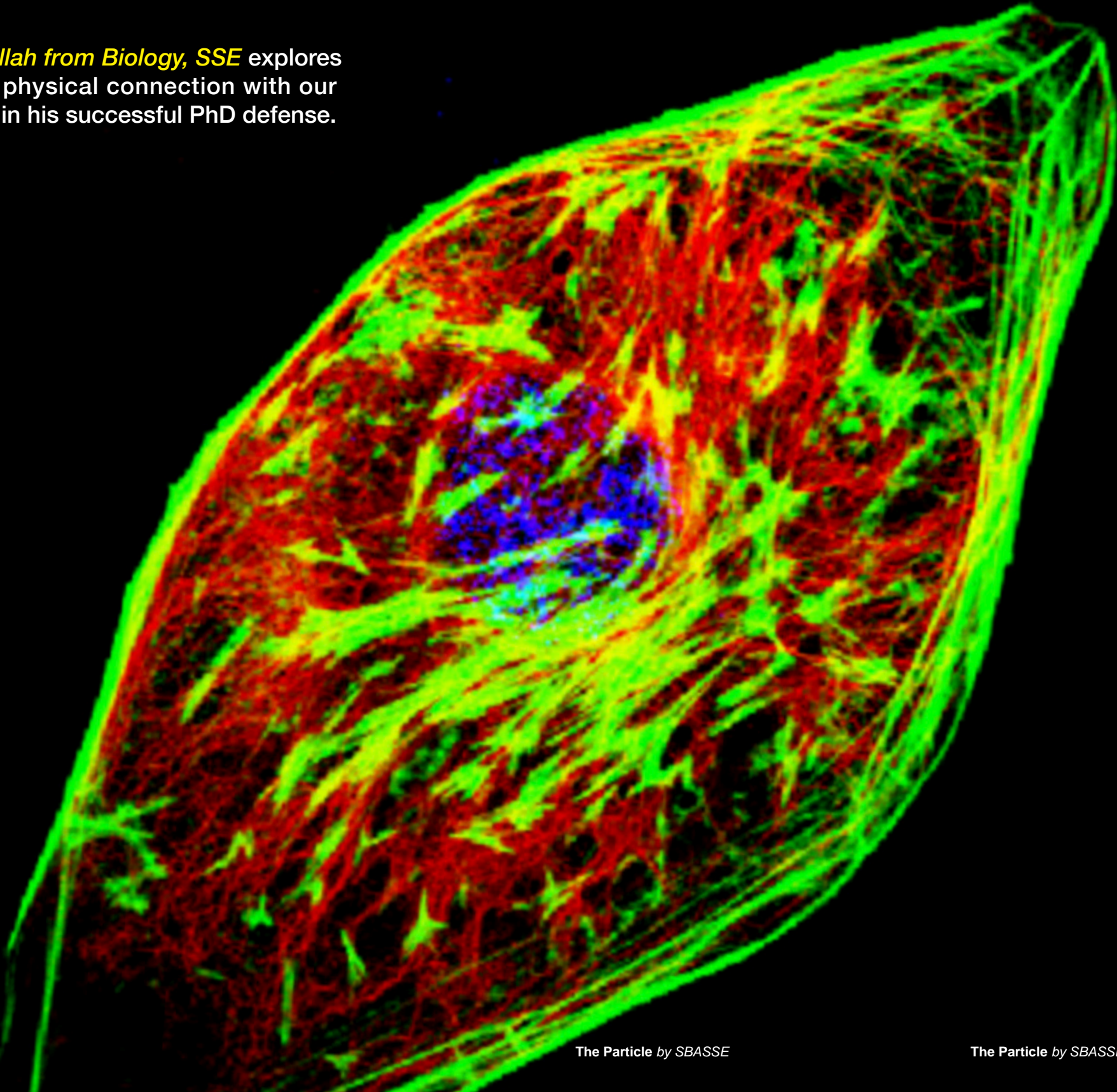
Publication: SIGCOMM ‘20: Proceedings of the Annual conference of the ACM Special Interest Group on Data Communication on the applications, technologies, architectures, and protocols for computer communication, July 2020, Pages 648–661.

The research team includes Mukhtiar Ahmad (SSE PhD student), Syed Usman Jafri (CS UG), Syed Ali Nawazish (CS MSc), Muhammad Azam Ikram, and Wasiq Ahmad Noorani.



First Physical Connection with Mothers

Rahim Ullah from Biology, SSE explores our first physical connection with our mothers in his successful PhD defense.



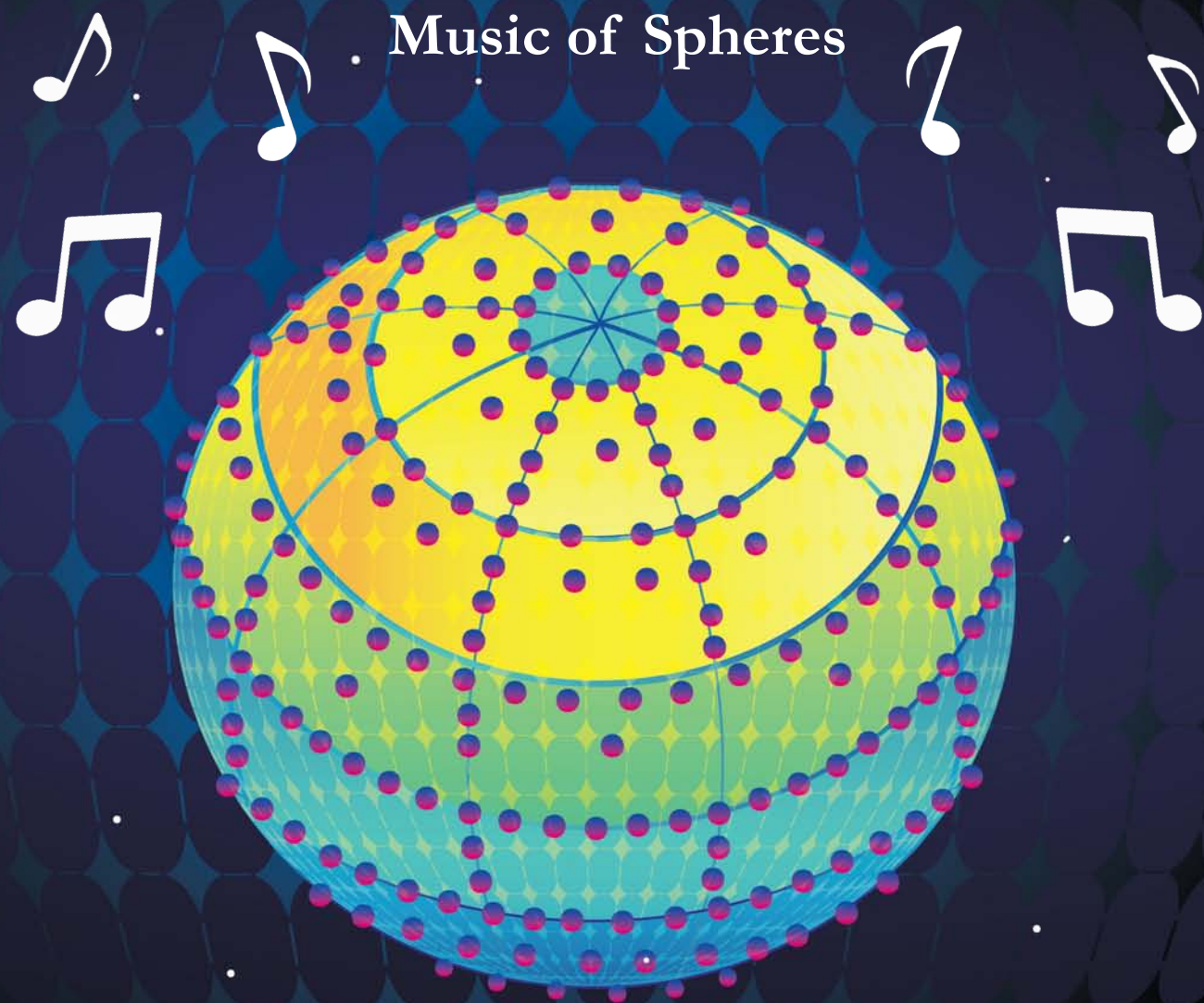
This work is an understanding of our first ever physical connection with our mothers.

Rahim has worked on specialised cells which help us connect with our mother’s womb when we are just a few days old, a simple clump of cells. These cells undergo specific changes at the level of switching on thousands of genes while an equal number is turned off which results in the formation of a chord (called the placenta). The placenta is our physical link with our loving mothers.

Rahim not only developed molecular tools to dissect changes in these cell types but more importantly, revealed changes at the level of genes while this transition is still taking place. Another aspect of Rahim’s work addressed why cells don’t die or become cancerous, proposing a novel mechanism defying cell death. Finally, an icing on the cake is the discovery of novel genes which we call splice variants.

This alternate splicing part was computed by Dr. Aziz Mithani and computational analysis has predicted many such novel exons which were previously never described. The work was experimentally validated by Rahim and his supervisor, Dr. Amir Faisal. Finally, the work has discovered possibilities to understand what may go wrong in abnormal pregnancies and premature births.

Publication: Stem Cell Research & Therapy volume 11, article number: 342 (2020).



Music of Spheres

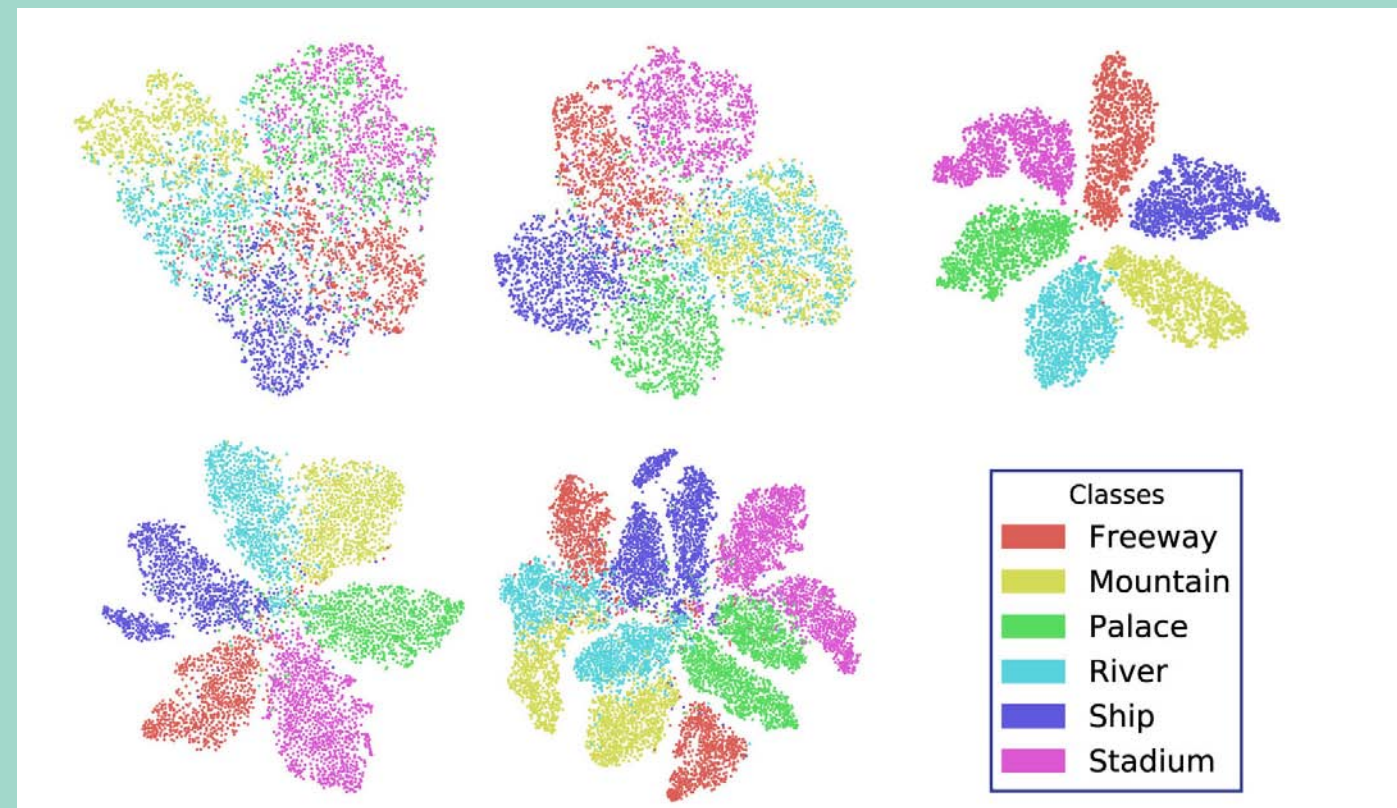
Working under the supervision of Dr. Zubair Khalid in SBASSE electrical engineering area, Wajeeha Nafees has discovered amazing mathematical structures for applications in medical imaging, cosmology, computer vision and many others.

We now know many new ways of listening and reconstructing signals emerging from spherical sources, thanks to this amazing body of work.

Publication: Ideas from the work have been published in IEEE Transactions on Signal Processing: (<https://ieeexplore.ieee.org/abstract/document/9052486>), ICASSP 2018 and ICASSP 2019, flagship conferences on signal processing.

Wajeeha Nafees from the Department of Electrical Engineering SBASSE, has successfully defended her PhD thesis on June 22, 2020.

Groundbreaking Thesis Cracked an Old Problem



Celebrating Dr. Numan Khurshid's PhD. defense from the Electrical Engineering department under the able supervision of Dr. Murtaza Taj.

Numan's groundbreaking thesis has cracked the problem of correlating images taken from an aerial view (e.g. using satellites, airplanes or drones) with images of the same object from the ground. While doing so, he has linked two seemingly disparate fields: remote sensing of Earth objects and algorithms for machine learning.

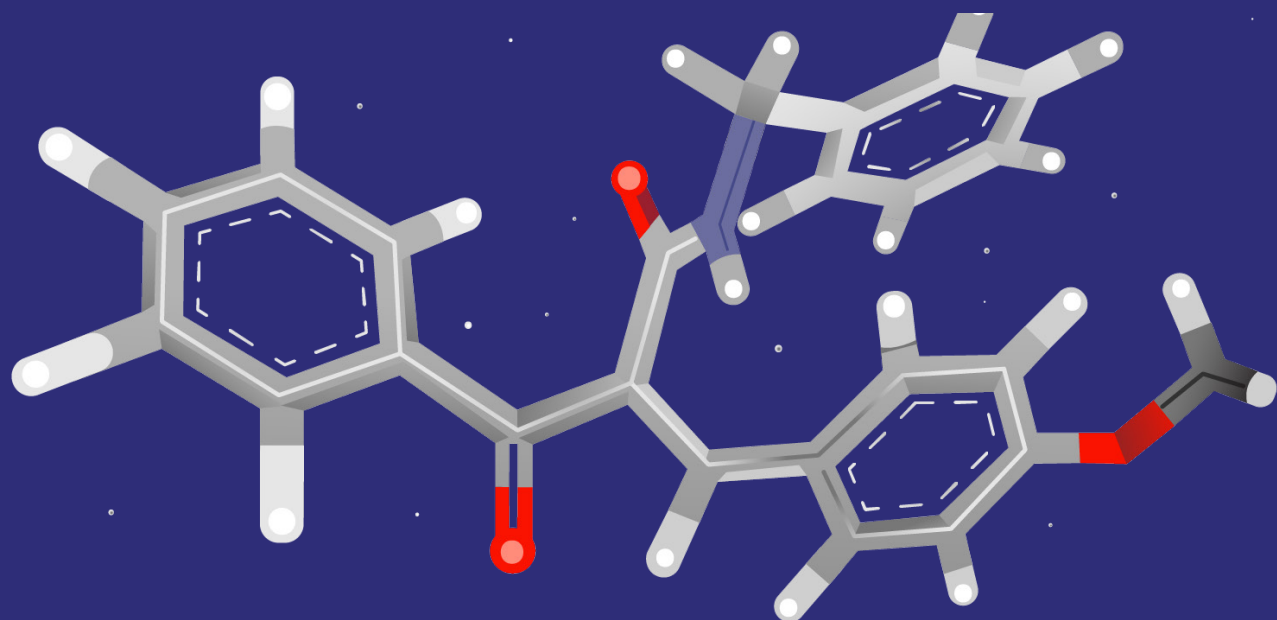
The gained ability to bridge the long view with close observations would allow many applications in space sciences, natural resource management, and monitoring of infrastructures. Indeed, Numan's framework has already found use by another student in Dr. Taj's group to detect Brick Kilns from volumes of satellite imagery.

What Numan's work demonstrates is a beautiful merger of perspectives that links the sky with the ground, CS with EE, and theory with practice. It has enabled the proverbial birds and frogs to view things together. Numan's work has been published in the top journals and conferences in geosciences and machine learning.

Publication: IEEE Transactions on Geoscience and Remote Sensing (Volume: 58 , Issue: 3 , March 2020 Page(s): 2001 - 2014).

Cancer Treatment gets a Boost

Next generation cancer treatment gets a boost with Sharon's PhD work at Department of Chemistry and Chemical Engineering, SBASSE.



Cancer is amongst the leading causes of mortality around the globe. The success of the current cancer therapeutics is often limited by the development of multidrug resistance and overall toxicity. The most common mechanism of drug resistance is the over-expression of P-glycoprotein (Pgp) efflux pumps.

In the current work, Sharon has worked on the discovery of the next generation cancer therapeutics. She discovered and synthesised a library of chalcones, whose biological evaluation revealed potency against not only normal cancer cells but also cancer cells that are resistant to current therapeutics due to the Pgp efflux pumps.

Publication: Sharon's PhD work has been published in Bioorganic Chemistry and the work was completed under the supervision of Dr. Rahman Saleem from the Department of Chemistry.

New Strides in Modeling the Onset and Treatment of Cancer

Dr. Safee Ullah Chaudhry and his team, working at the Biomedical Informatics Research Lab (BIRL) at SBASSE have made ground-breaking strides in modeling the onset and treatment of cancer.

Cancer, its aggravation and therapy, is a highly complex phenomenon that unfolds in space and in time and is controlled by a myriad of genetic and proteomic factors. The most modern approach to modeling the triggering and growth of cancer is using multi-scale models that implement cell signaling pathways and patient expression data.

BIRL's TISON platform which is an apt acronym for "Theatre for In-silico Systems Oncology" is a next-generation, user-friendly, software that provides teams of oncologists, drug designers, pharmacists, clinicians along with students of systems biology, a one-stop solution to modeling cancer.

The details of the software, which is available at <https://tison.lums.edu.pk/> are now ready for submission.



The Enigma of Silencing and Turning on Genes

Dr. Jawad Akhtar's PhD in the LUMS Epigenetics Lab

The process of human development is a very fascinating phenomenon which has also intrigued philosophers and scientists to think and discover the underlying intricacies. In other words, an average human body, that arises from a single fertilised egg, contains roughly 30 trillion cells which undergo about 10 quadrillion rounds of division throughout our lifetimes. To add to this intricacy, our body is not made up of identical cells but contains more than two hundred different highly specialised cell types that are responsible for the development of complex organs like heart, kidney, liver, eyes and brain.

Although each cell type contains the same basic genetic information (DNA), they inherit from the fertilised egg their identities and functions, which are drastically different from one another. Despite sharing the same set of genetic code, all the different cell types in a human body arise due to differences in their gene expression (decoding of gene) state. Such specific decoding of information gives each cell its identity which is maintained by two groups of highly specialised proteins, namely trithorax group (trxG) and Polycomb group (PcG).

The PcG proteins are known to maintain genes in an OFF state whereas trxG are known to antagonise PcG and maintain genes in an ON state, thus helping cells remember their fates. The maintenance of gene activation (ON state) by trxG is known as a constant struggle by proteins in the trxG against a default state of gene silencing maintained by the PcG.

During his PhD under Dr. Muhammad Tariq's supervision, Jawad Akhtar worked on PcG/trxG paradigm using fruit flies. He specifically worked on a gene named Enok in flies

which is known to modify fundamental building blocks of chromosomes and facilitate gene activation. Jawad's work has discovered a complex interplay between Enok and PcG factors which results in suppression of gene silencing by PcG and contributes to the anti-silencing act of the trxG. Using a functional genomics approach and employing molecular and biochemical tools, Jawad discovered that Enok physically associates with genes which are normally bound by trxG factors.

However, his work categorically established that while associating with chromatin, Enok actually inhibits the repressive effect of specific factors in PcG and consequently helps trxG. Jawad's work has certainly discovered a previously unknown role for Enok in maintenance of gene activation linked to the maintenance of cell fates and cellular memory. It also highlights a fact that dynamic and regulated cross-talk between PcG and trxG is quite complex and it will take time before we fully understand molecular mechanism of gene activation maintained by the trxG.



Publication: A recently published article in 'Epigenetics and Chromatin Journal' describes details of Jawad's work which was performed under supervision of Dr. Muhammad Tariq in Epigenetics lab. This work in Tariq lab was funded by grants from the Higher Education Commission (HEC) and LUMS.



EVENTS & FEATURES

Virtual Seminar Series

Talk on “Life in New Normal, Microorganisms and our Environment”

Center for Water Informatics and Technology (WIT), held a virtual talk on June 26, 2020, to debate on “Life in New Normal: Microorganisms and our Environment”. A live session was broadcasted with leading women in the field of microbiology and biotechnology in Pakistan; Dr. Shaper Mirza, Dr. Azra Yasmin, and Dr. Sajida Rasheed. Dr. Fozia Parveen, who is a Postdoctoral Fellow and Faculty moderated the session.

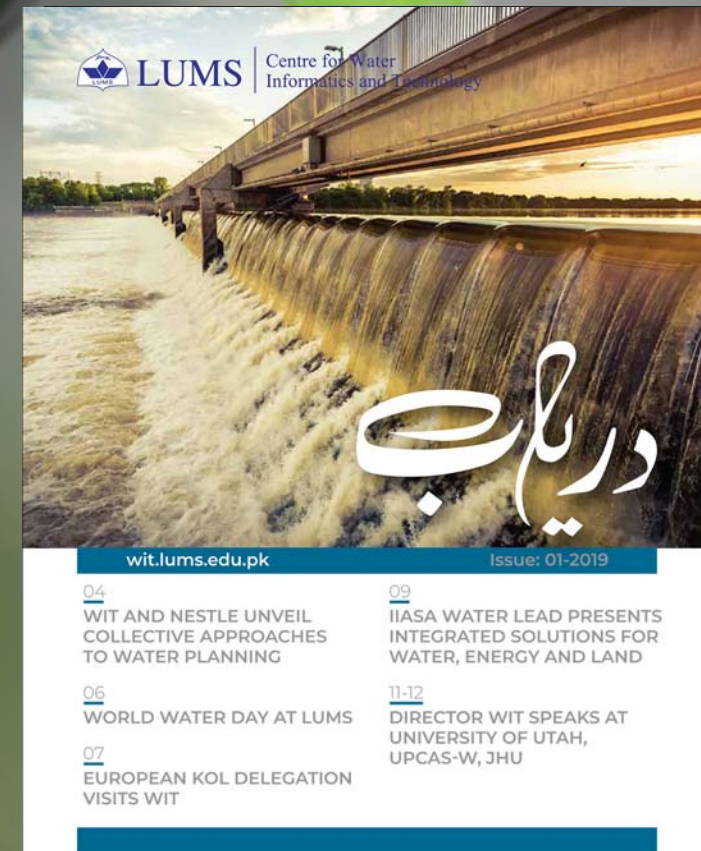
Microorganisms play an important role in sustaining life, as Louis Pasteur once said, “Life would not long remain possible in the absence of microbes”. COVID-19 has spread the fear of microorganisms and encouraged us to live a microbe-free life. In these times of fear, it is important to discuss the value of microbial services in supporting life on this planet alongside the hazards posed by viruses.

Virtual Talk on “how Earth Observation Applications Help in Timely Assessment of a Natural Resources and Impact Policy Decision”.

Center of Water Informatics & Technology (WIT) and National Agriculture Robotics Lab at SBASSE collaborated to organise a virtual talk on ‘How earth observation applications help in timely assessment of natural resources and impact policy decision.’ It was held on June 23, 2020, to discuss the application of geospatial technologies in natural resources management and how these technologies can help researchers, scientists and practitioners around the world to understand earth processes and management needs for natural resources.

In conversation with Dr. Ahmad Khan from the University of Maryland USA, it was brought into discussion, how to apply earth observation time-series data at the Global Land Analysis and Discovery (GLAD) laboratory in the Department of Geographical Sciences, investigate methods, causes and impacts of global land surface change. Earth observation imagery is the primary data source and its application in natural resource management is the primary topic of interest.

First issue of WIT Newsletter, is now available at:
<https://wit.lums.edu.pk/wit-newsletter>.

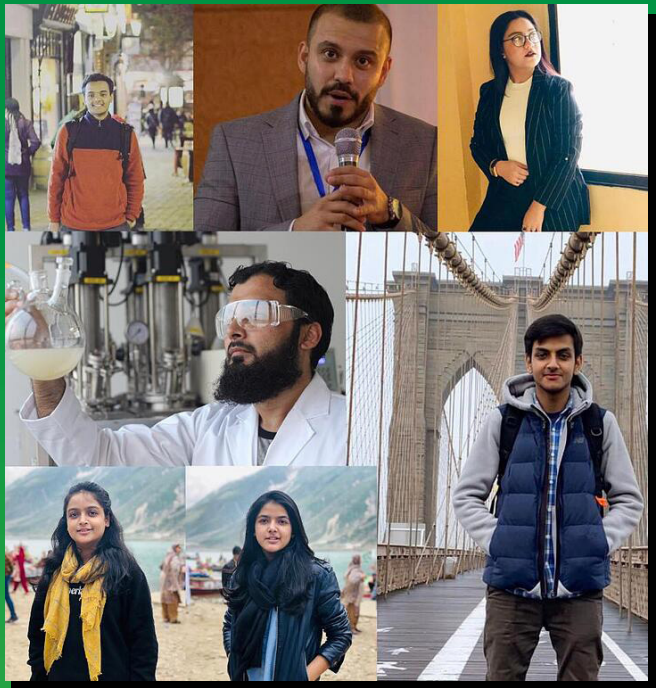


SBASSE Freshman wins third place in the Social Innovation in Virtual Diamond Challenge 2020

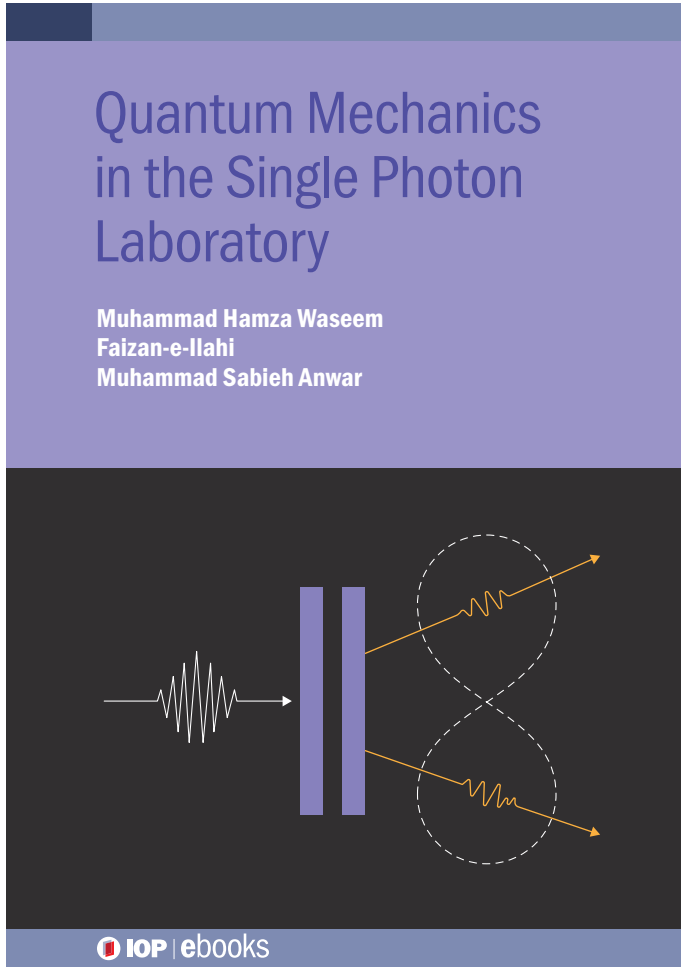


Team EZ Water, led by LUMS SBASSE student Ms. Adan Tanveer has won third place in Social Innovation in the Virtual Diamond Challenge 2020 organised by the University of Delaware USA.

Team EZ Water is determined to defy the challenge of affordability of and accessibility to clean drinking water to masses, globally. The venture has designed an innovative approach to water purification, which is hyper-local, eco-friendly, off-grid, energy-efficient, and low-maintenance. The technology removes all bacteria, viruses, and suspended solids from water that are hazardous to health. Their aim is to empower the communities in which the venture operates by bringing economic growth from the grassroots level as well as provide access to affordable, clean drinking water.



PhysLab team published a book on ‘Quantum mechanics in the single photon laboratory’



Dr. Anwar, writes about it in the preliminary section of the book:

It not only describes the experiments, but provides all the necessary working knowledge of quantum mechanics, quantum states and quantum operators that is required to motivate the reader towards performing these experiments, and providing the necessary tools to interpret and understand the experimental outcomes.

The book starts with a survey of how research labs around the world have helped create a portfolio of some wonderful experiments that can be easily translated for instructional purposes in physics teaching laboratories worldwide. As such, these experiments are a true distillation of cutting-edge research in quantum optics and quantum information science with single photons and epitomise how research in the laboratory can directly enrich the teaching of a counter-intuitive mathematical and physical framework that we call quantum theory.

Since our working units for qubits are photon’s polarisation state, we make a brief digression into the classical picture of light. Some of the mathematical tools introduced in the second chapter, carry over, in a quantum garb, to the quantum experiments. We also describe some experiments with lasers that can act as a springboard for the quantum experiments.

In this book, we attempt to present our single-photon quantum experiments in a modular fashion, with one building on the other. The concluding chapter also presents some suggestions for teachers and researchers who are interested in reproducing these experiments, for possible pathways of building these activities in our advanced physics laboratories; or for offering these experiments, in a simple-to-complicated ladder, to students undertaking lab courses.

Dr. Sabieh Anwar and students Hamza Waseem and Faizan-e-Ilahi from UET Lahore describe their innovative experiments at the heart of quantum information processing

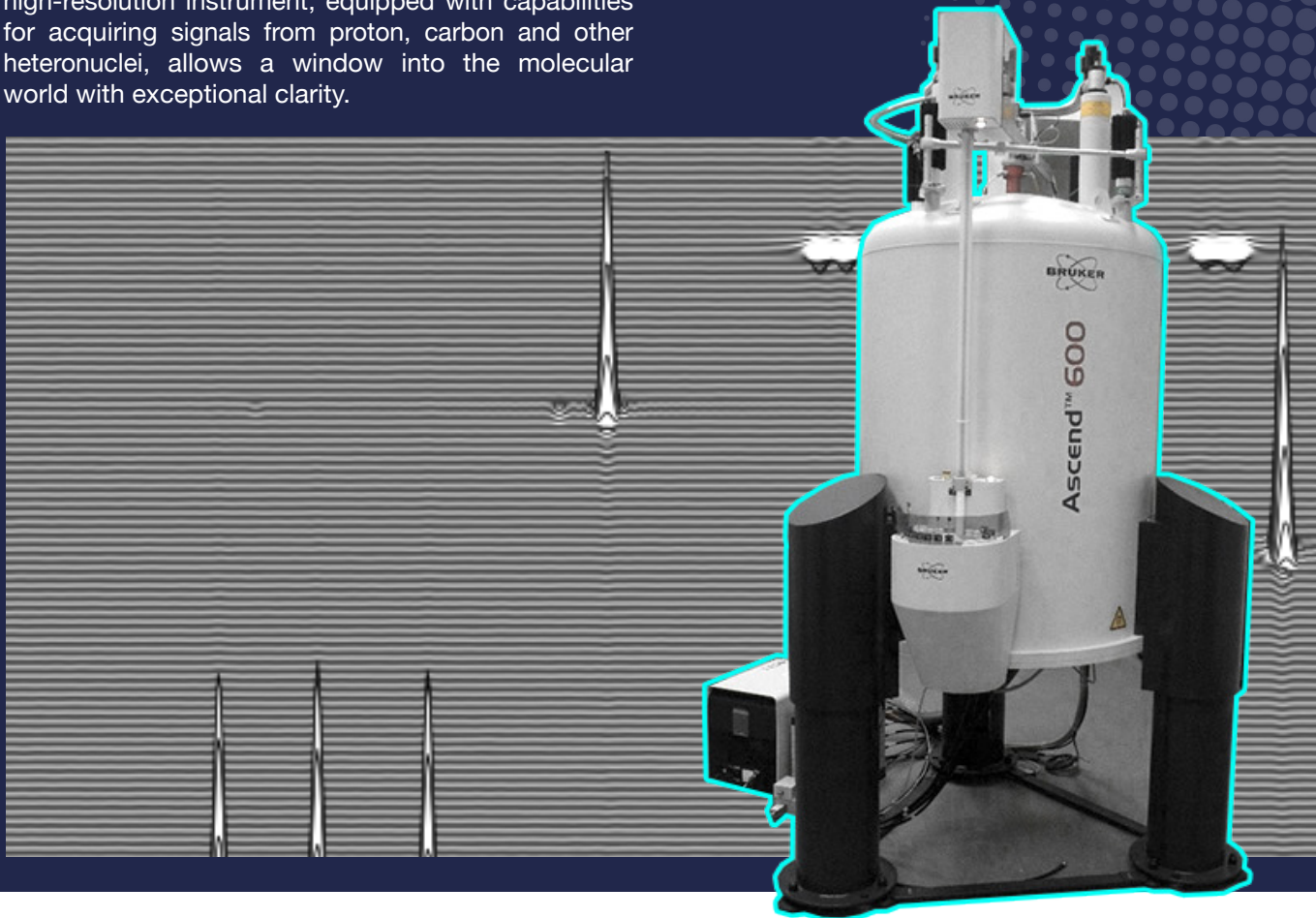
Nuclear magnetic resonance, vibrating sample magnetometry and scanning electron microscopy now accessible for Pakistan’s scientific and industrial community

Syed Babar Ali School of Science and Engineering has announced that its 600 MHz nuclear magnetic resonance (NMR) spectrometer will be accessible for molecular analysis.

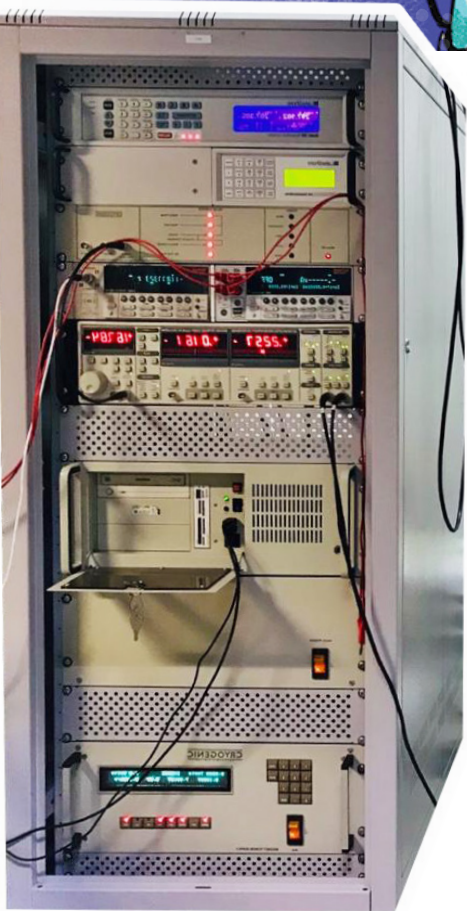
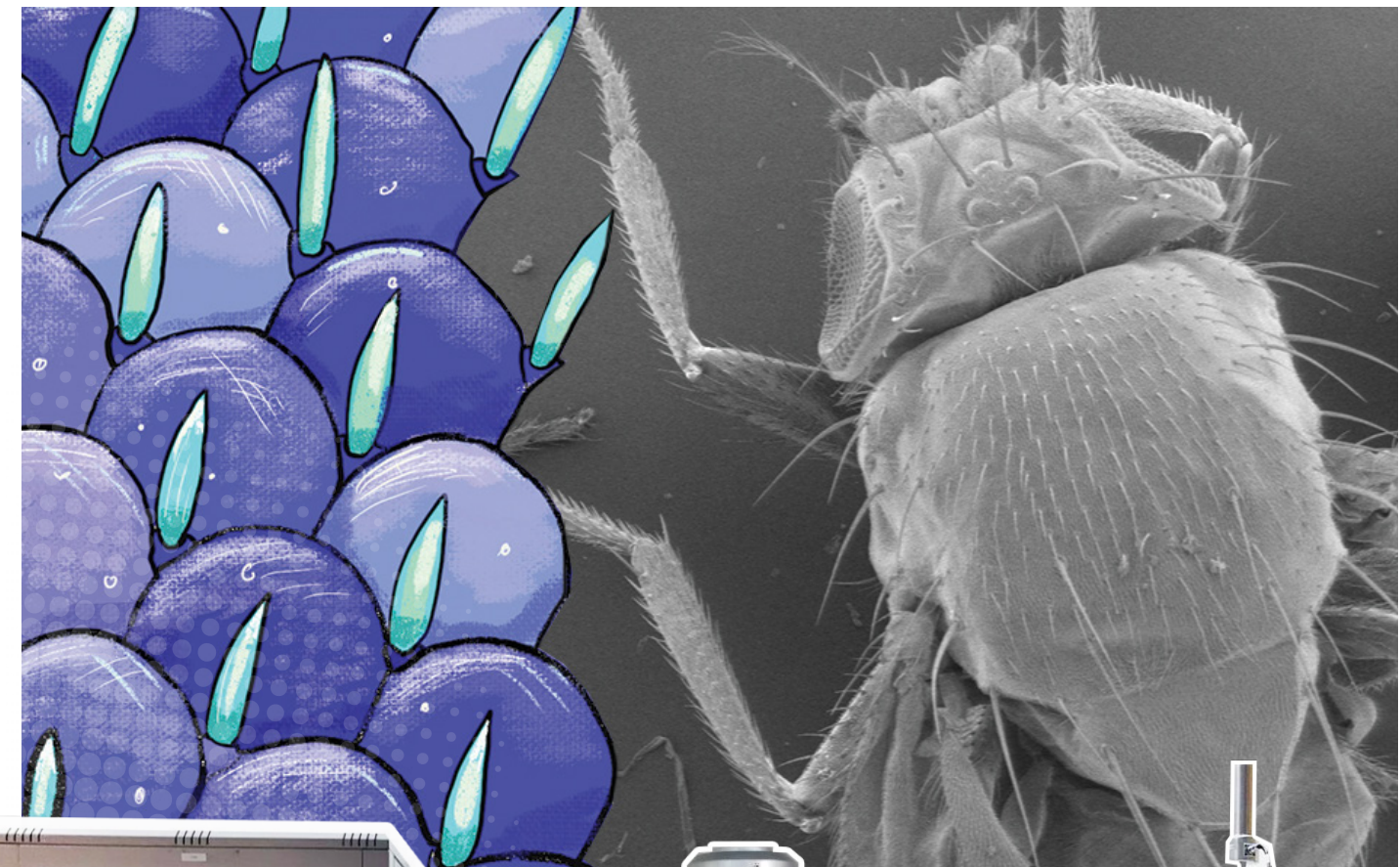
Pakistan wide researchers can now send their samples, according to prescribed protocols, and obtain high-resolution spectra, both in one and two dimensions. This is a valuable tool for structure determination, screening of synthetic organic compounds, protein folding analysis, and drugs. The high-resolution instrument, equipped with capabilities for acquiring signals from proton, carbon and other heteronuclei, allows a window into the molecular world with exceptional clarity.

Our School’s agenda is to make cutting edge technologies and scientific inquiry accessible to everyone in the country. In this vein, the Central Labs offer services for state-of-the-art scanning electron microscopy to external users.

With our FEI NOVA 450 Nanosem and its field-emission capabilities, we promise to provide stunning, high resolution micrographs for your experimental investigations in all scientific disciplines. Even though we do not provide interpretation, you can rely on our committed, highly qualified staff for high quality imaging of biological, nanoscopic, mesoscopic samples and materials from a range of industries and applications.



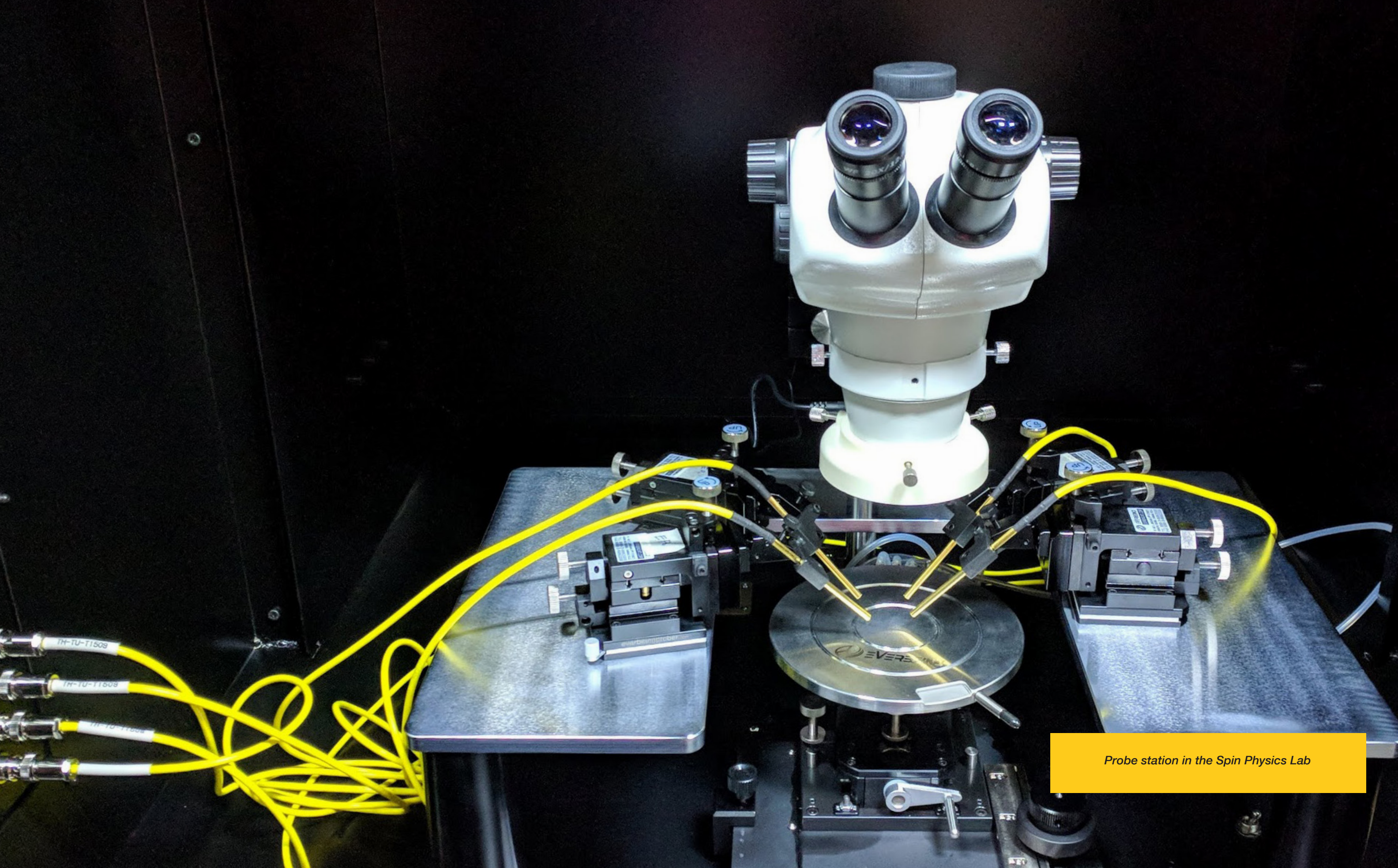
The Particle by SBASSE



The Particle by SBASSE



Please visit our Central Lab’s website:
<https://centrallab.lums.edu.pk/>
for further details and procedures.



Probe station in the Spin Physics Lab

Summer

2020

Courses

– Open

to All!!



BIO 232: R Programming (3 credits)

Prerequisite: None
Instructor: Aziz Mithani

This hands-on course is designed to teach students programming and data analysis using the programming language R. Starting from the basics including installation and software configuration.

BIO 132: Introduction to Bioinformatics (3 credits)

Prerequisite: None
Instructor: Aziz Mithani

This course describes how computers can be used to analyse biological data. Topics include fundamentals of nucleic acid and protein sequence analysis, protein structures, introduction to molecular evolution and biological networks.

BIO 101: Introductory Biology (3 credits)

Prerequisite: None
Instructor: Amir Faisal, Muhammad Tariq and Safee Ullah Chaudhary

This course is designed to provide an overview of biology as it stands today, exposing students to a variety of topics in modern molecular and cellular biology.

CHEM 112: Modern Society and Technology (3 credits)

Prerequisite: None
Instructor: Muhammad Saeed

This course is designed to bridge the gap between scientific jargon and the layperson's understanding of scientific and technological topics.

CHEM-103: Introduction to Forensic Science (3 credits)

Prerequisite: None
Instructor: Muhammad Zaheer

This course is designed to introduce the basic concepts and applications of forensic science. It will cover various aspects of forensic chemistry used in collection, preservation and the analysis of physical evidence to solve crimes.

CS100: Computational Problem Solving (3 credits)

Prerequisite: None
Instructor: Junaid Haroon Siddiqui

This course provides a conceptual and practical introduction to programming. The focus is on programming rather than the particular choice of programming language.



MATH 242: Financial Modeling and Analysis - Foundations and Applications (3 credits)

Prerequisite: None

Instructor: Zahra Lakdawala and Anoushe Sheharnaz Hassan

This project-based course aims to provide students with the skills to conduct statistical analysis on financial data in order to make inferences about risks and returns.

PHY 30X: Python for Computing and Visualization (3 credits)

Prerequisite: None

Instructor: Adam Zaman and Muhammad Faryad

This course will provide hands-on programming experience with python with focus on solving and visualising scientific problems in basic sciences and engineering.

PHY 314 / EE 313: Introduction to Quantum Engineering (3 credits)

Prerequisite: Knowledge of basic quantum mechanics. This course is not recommended for freshmen.

Instructor: Adam Zaman and Atta ul Haq

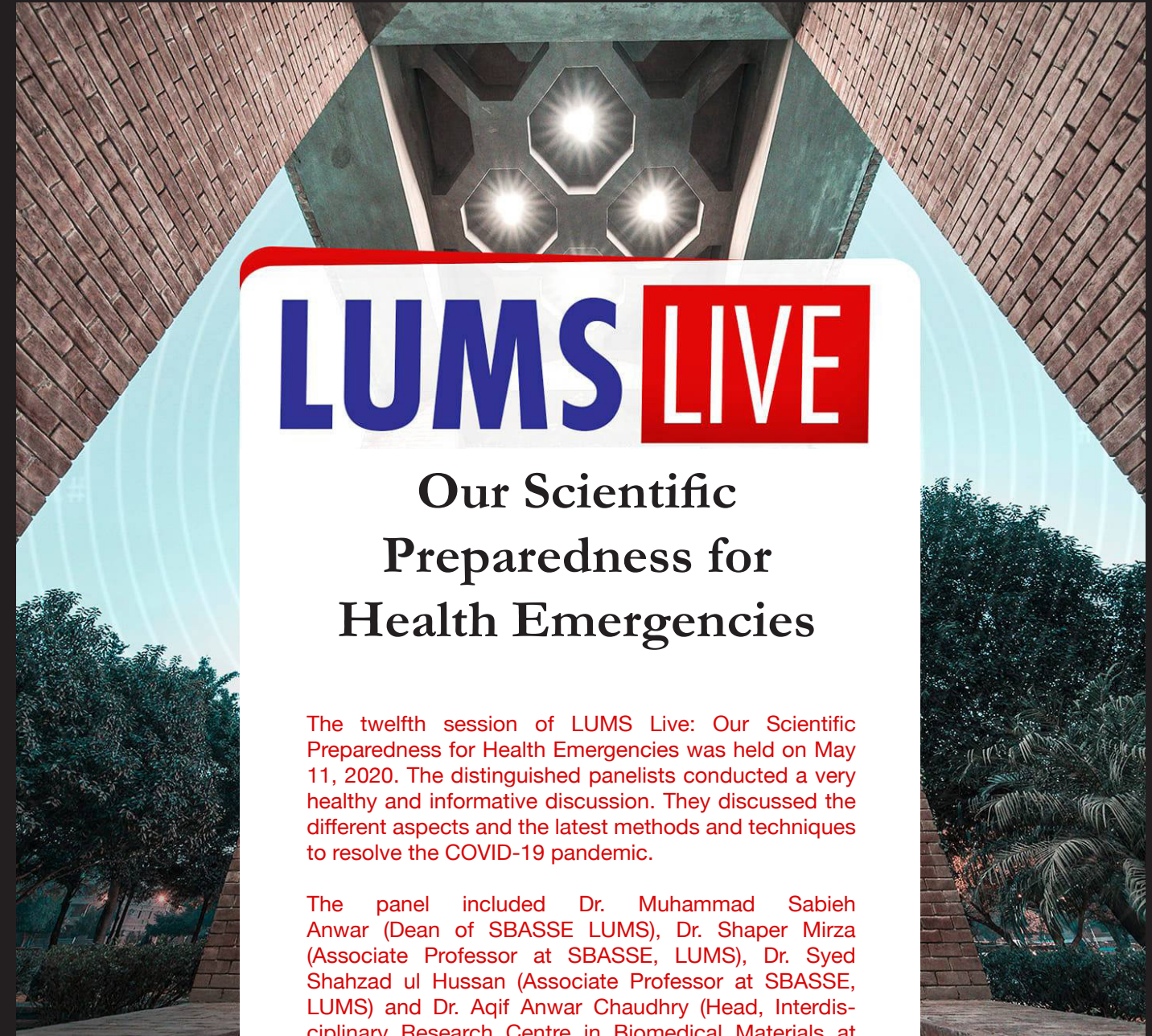
In this course, the theoretical foundation and practical implementation of these emerging quantum technologies will be discussed.

SCI103: Introduction to Environmental Sciences (2 credits)

Prerequisite: None

Instructor: Fozia Parveen

The globe has declared a state of climate emergency. Unless drastic changes in resource consumption are made at the individual, local, regional, and national levels, the damage to our home planet's environment will be irreversible.



LUMS LIVE

Our Scientific Preparedness for Health Emergencies

The twelfth session of LUMS Live: Our Scientific Preparedness for Health Emergencies was held on May 11, 2020. The distinguished panelists conducted a very healthy and informative discussion. They discussed the different aspects and the latest methods and techniques to resolve the COVID-19 pandemic.

The panel included Dr. Muhammad Sabieh Anwar (Dean of SBASSE LUMS), Dr. Shaper Mirza (Associate Professor at SBASSE, LUMS), Dr. Syed Shahzad ul Hussan (Associate Professor at SBASSE, LUMS) and Dr. Aqif Anwar Chaudhry (Head, Interdisciplinary Research Centre in Biomedical Materials at COMSATS University, Islamabad).

This discussion was moderated by Mr. Adeel Hashmi and broadcasted live via the LUMS social media platforms.

SPIE Hosts Webinar on Metamaterials

SPIE Student Chapter at LUMS organised a webinar on May 12 2020, where international guest speaker Dr. Ari Sihvola from Aalto University, Finland, spoke on 'Electromagnetic emergence behaviour from metamaterials: how optical properties are dictated by material structure'. Dr. Muhammad Faryad (Chapter Advisor) and Wardah Mahmood (Society President) were also in attendance.

Dr. Sihvola is a Professor of Electromagnetics with interest in electromagnetic theory, complex media and metamaterials, materials modelling, remote sensing, and radar applications. In the webinar he explained how optical properties are dictated by material meta structures and other related topics.

More than 70 faculty and students joined the webinar from different universities in Pakistan including LUMS, Quaid-e-Azam University, Information Technology University, Air University Islamabad, COMSATS University (Islamabad and Lahore campus), as well as international participants.

UX Pakistan 2020: Conversation on the Past, Present and Future of Design in Pakistan

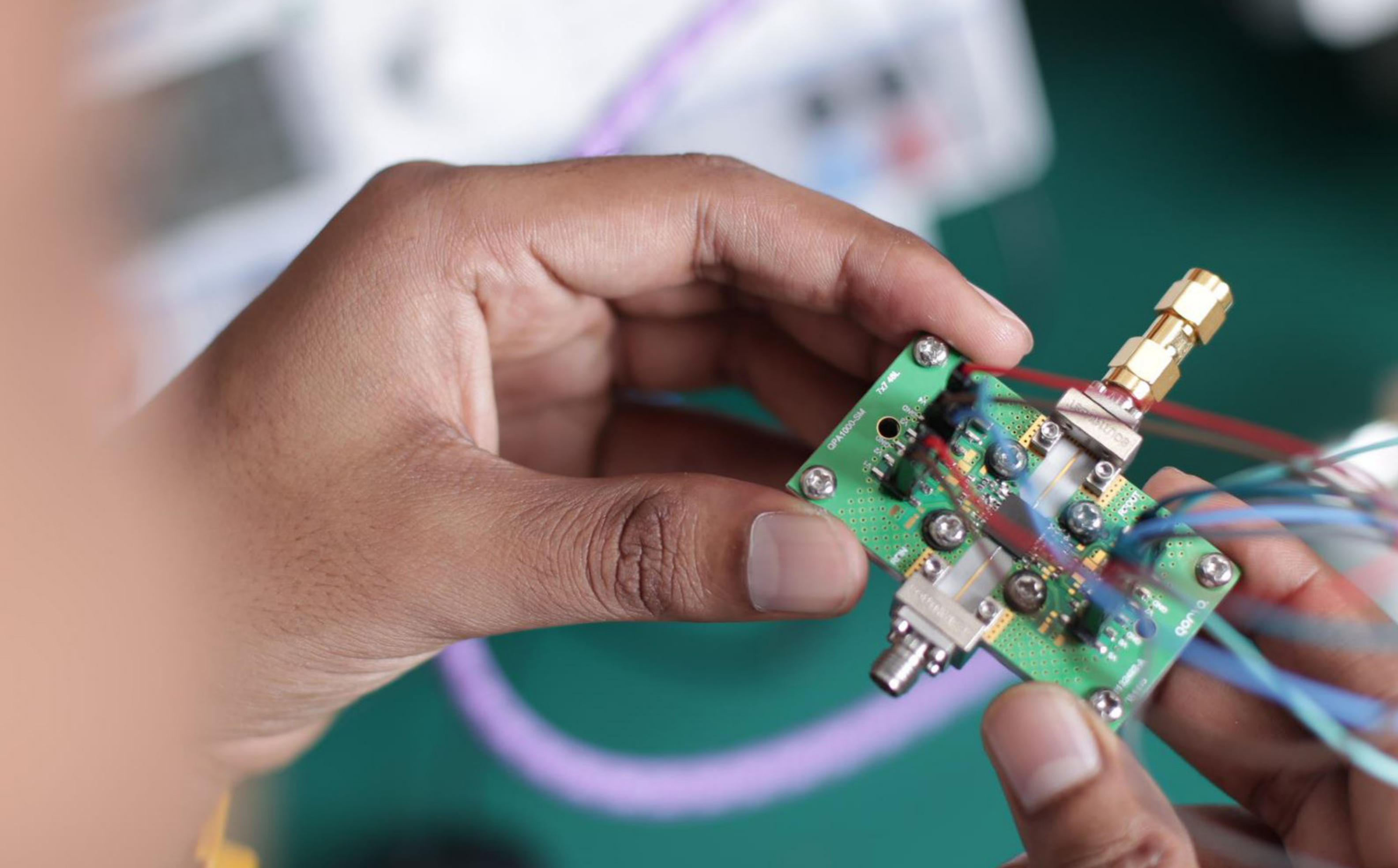
Like most events and conferences around the world, the **UX Pakistan 2020** conference, held on April 18 - 19, 2020, also went virtual and continued to inspire individuals with conversations and workshops around the latest design trends and skills. The event was organised by the Design Innovation Society at LUMS (INDEX) in collaboration with the Department of Computer Science at SBASSE; Designist, an experience design agency, and Cordoba, a human-centred design and market research agency. The conference was streamed live to over 500 attendees around the world through the online video conferencing platform.

The theme for this year's UX Pakistan conference was 'The Past, Present and Future of Design in Pakistan' through which participants explored the national design landscape while taking on an expansive and holistic view of the past, how it has shaped our present, and what the future of design in Pakistan entails. The two-day conference hosted over 25 renowned speakers from international tech companies including Google and Facebook, local design and tech companies including Careem, Xavor, Cordoba, and Designist, and universities such as the Indus Valley School of Art and Architecture.

Along with a stellar line up of conference talks, the event featured five exclusive Masterclasses to teach students skills like design documentation, speculative and critical design, and how to visualise ideas and turn them into products and services. The participants not only actively took part in the discussions but gained practical design and problem-solving skills, and developed critical thinking abilities.

In light of the Coronavirus pandemic, a complete session on the role of design, technology and entrepreneurship in fighting pandemics and large-scale disruptions was also held. The panel was a part of the new Covid19 hackathon which has been initiated by Open Data Pakistan under the National Centre for Big Data and Cloud Computing at LUMS. This year, UX Pakistan partnered with Rizq and all acquired funds were donated to help communities who have been adversely affected by the nationwide lockdown in response to the spread of the virus.

The fourth edition of the conference concluded with renewed vigour to continue to provide a platform where designers, developers, business leaders, artists, end-users and everyone in between can come together to share, collaborate, learn, and emerge as the creators of a better tomorrow.



Belles-lettres

It's never too late to amend

Life is a journey through thick and thin,

Built on your deed of virtue and sin.
At every step, the path divides in two,
For you to choose the one that's true.
Should you choose the one that's wrong?
You have entered a path where you do
not belong.

It is a path of ruse and illusions,
Of deceit, doubts, and confusions.
It seems good, for you do not see
beyond the bend;
What really matters is the path's end.

You wander this path without a clue,
But the path of morality runs beside you.
You enjoy what it has to give,
Oblivious to true happiness, you live.

You are addicted to the path and its fun,
Giving away all desires to spoil and run.
But after some time you perceive the reality,
The path of true nature and its brutality.

The truth hits you on the face,
Revealing the nature of this wretched place.
Hold on to your principles and rules,
Come back and rid yourself of fools.

You turn around to find the bend,
For redemption and to mend.
But then you come to know,
The way back is hard and slow.

A strong and cool force pulls you back
To keep you leaving this dreaded track.
A voice pulls you back in different tones,

You feel its allure in your very bones.
On your way back, you tumble, you fall;
"Get up, brave lad, and stand tall!"
Shout out loud, "It's never too late to amend,"

The call of heroes and the call of men.
Keep walking, keep climbing, and keep rowing,
For when the going gets tough, the tough
gets going.

A part of you doesn't want to leave,

Shove it aside and continue to heave.
Do not give up hope and keep coming,

Thrust away your doubts and keep running.
Soon you come across the fork once more,

Exhausted and thirsty but wiser than before.
Now you enter the path where you belong,

The one for which you have suffered for so long.
The people here are good as they are,

But among these people, you are a star.
For you have done what none other can,

Among these boys, you are a brave man.
Be proud of what you have achieved,

You struggle for the sake of what you believe.
Now you live your life as you are meant to do

With a mind free of doubts and heart fair and true.
All the struggle that you did, this is what it brings,

Makes you king among men and god among kings.

Muhammad Azhan is student of BS Chemistry at SBASSE, LUMS.

MY ODE TO MATHEMATICS

*Nothing less than an art it is, my friends;
High up in the heavens my mind it sends.*

*Art of the nuance that comes to the fore
When those like Mozart perform extempore.*

*No less than the balance of yin-yang it displays,
The order, the grace a Kung-Fu routine portrays.*

*Stately dance or fierce jitter whether it be,
Motion of bound stars or atoms wild and free,*

*My art is a language to maneuver it all,
Every dusk to dawn, every spring through fall.*

*“Art? Art? What the hell is it?” you ask;
Maths it is, folks; maths does the task.*

*For eons, it has been and would continue to be
Beauty’s quintessence, transcendence’s epitome.*

*Attesting to its wonders, my pen bows to scrawl,
“My art has them all! My art has them all!”*

Irfan Javed, is student of Mathematics, Student
of Syed Babar Ali School of Science and Engineering.

مسافر

چھوڑ جاتے ہیں سائے بھی جب اندھیرا جواں ہوتا ہے
پرندوں کا سر شام ہائے جو نالہ و فغاں ہوتا ہے
چل پڑتے ہیں بے فکری میں ڈر بھلا کس بات کا
پیروں تلے اپنے زمیں سر پہ جو آسمان ہوتا ہے
میں سوچتا نہیں اُس کو پھر بھلا کیسے کیوں کر
نس نس میں اتر جاتا ہے رگوں میں رواں ہوتا ہے
کبھی کبھی چاہتا ہے جی تو مجھ میرے پہ یوں چھا جائے
جیسے پھول پہ خوشبو، رنگ قتلی پہ مہرباں ہوتا ہے
مانتا ہوں راحتیں تو غم بھی اِس راہ پہ مگر ناصح
جہاں دل لگی ہو وہاں کیا سُود و زیاں ہوتا ہے
میرا تو لوگو اب کچھ یہ عالم ہو چلا ہے
دھڑکن پہ بھی اُسکی آہٹ کا گماں ہوتا ہے
دل سے میرے تو خیر اب وہ آشنا بھی نہیں شاید
رہتا ہے اِس گھر میں جیسے کوئی مہماں ہوتا ہے
زندگی کے کٹھن سفر سے تھک کر کہاں جاؤ گے
ٹیاب مسافر کا بھی بھلا کوئی آشیاں ہوتا ہے

تحریر: افتخار ظفر، آئی ایس ٹی

فراق

اسے کہنا مجھے اس کے بنا رہنا نہیں آتا
بہت کچھ دل میں آتا ہے مگر کہنا نہیں آتا
بہت ہی سخت جاں ہوں میں بہت سے غم اٹھاتا ہوں
بس اک درد جدائی ہے کہ جو سہنا نہیں آتا
مری آنکھوں میں اکثر اک نمی موجود رہتی ہے
یہ آنسو کیسا آنسو ہے جسے بہنا نہیں آتا
ہمارا مسئلہ شاید کبھی حل ہو نہ پائے گا
کہ یہ زخم جدائی ہے جسے بھرنا نہیں آتا
مگر اذعان تیرے ہجر میں بے چین رہتا ہے
اسے اس شہر میں کیوں ڈھنگ سے رہنا نہیں آتا

تحریر: محمد اذعان، بی ایس کیمسٹری، سکول
آف سائنس اینڈ انجینئرنگ

غیروں کی نگاہیں لے کر

کردار: رضی نام اور ان کی جازت سے تحریر
 پروفیسر مائر: جرمنی یونیورسٹی سے، ماہر ریاضی دان
 پروفیسر بیکر: سویٹزرلینڈ، جرمنی سے، فزکس
 ڈاکٹر سادات: عرب، جرمن یونیورسٹی میں ریسرچر

منظر: لاہور کی نجی یونیورسٹی سے مینارِ پاکستان اور پرانے
 لاہور کا دورہ۔ میں بحیثیت گائیڈ اور ڈرائیور۔ کانفرنس انتظامیہ
 کی درخواست پر چونکہ انکی نظر میں مجھے کچھ جرمن آتی ہے
 تو ان کی مدد میں آسانی ہوگی، تینوں پروفیسرز سے ہیلو
 ہائے کے بعد گاڑی میں بٹھایا اور روانہ ہوئے۔

معزز پروفیسرز اس بات سے آگاہ نہیں تھے کہ میں تھوڑا
 بہت جرمن سے مانوس ہوں ماسوا ڈاکٹر سادات کے۔ ان
 کی باہم گفتگو جرمن زبان میں رہی ماسوائے جب مجھ سے
 مخاطب ہوئے۔

اس روئیداد کا آغاز استادِ محترم عالی صاحب کے ایک شعر
 سے کروں گا۔
 جی چاہتا ہے غیروں کی نگاہیں لے کر اپنی آمد کا تماشہ
 سر محفل دیکھوں۔

ایک ہاؤسنگ سوسائٹی سے رنگ روڈ کی طرف راستے میں
 پروفیسرز کو عالیشان مینگلوز نظر آئے۔

پروفیسر مائر میں نے سنا تھا یہ بہت غریب ملک ہے؟
 پروفیسر بیکر آپ نے صحیح کہا اتنے عالیشان محل، لگژری
 گاڑیاں، گھروں کے باہر اسلحے سے لیس گارڈز کی سمجھ نہیں آئی؟

ڈاکٹر سادات: شاید چوری سے بچنے کے لیے، آپ نے سیکورٹی
 چیک پوائنٹ نہیں دیکھے؟

پروفیسرز: ہاں، ہاں۔۔۔ مگر یہ پولیس آفیسرز صرف موٹر
 سائیکلسٹ اور بائیسیکل والوں ہی کو کیوں چیک کر رہے ہیں؟

پروفیسر بیکر: حقیقی کالونی ازم کی باقیات ہے۔ تقریباً دو
 صدیوں تک استحصال پر مبنی معاشرہ رہا۔ جو استحصال نہ کرے
 اس کا استحصال شروع ہو جاتا تھا اور ہے اور شاید ایک
 صدی اور رہے گا۔

میں: اندر ہی اندر انکی باتوں سے کڑھ رہا تھا۔ حقیقتیں بہت
 تلخ ہوا کرتی ہیں۔ اکثر ایک نسل کی کرنی کئی نسلوں
 کو بھگتنا پڑتی ہے۔ خیر!

ایک لگژری کار انٹرچینج کے پاس ریڈھی بان سے مکئی کے
 دانے لیتے دیکھ۔

پروفیسر بیکر: ڈاکٹر یہاں رک سکتے ہیں مجھے ایک تصویر لینا ہے۔

میں: یہاں رکنا مشکل ہوگا سو انہوں نے گاڑی سے ہی تصویر
 لے لی۔ حیرت زدہ باہم گفتگو ہوئے۔ بہت متضاد معاشرہ
 ہے۔ جی جی مگر ہمیں اتنی جلدی نتیجہ اخذ نہیں
 کرنا چاہیے۔

پروفیسر بیکر: مجھے نہیں لگتا کہ تعلیم یہاں کے طلباء کی اور
 ملک کی کسی بھی حد تک ترجیح ہے۔

پروفیسر مائر، سادات: وہ کیسے؟ سبجے نہیں!

پروفیسر بیکر: آپ لوگوں نے غور نہیں کیا کہ کانفرنس میں
 طلباء کی شمولیت سپییکرز کی تعداد سے کم ہی رہی اور ادارے
 کی بھی کوئی خاطر خواہ دلچسپی نظر نہیں آئی۔ طلباء کے
 زیادہ طرح سوالات یہ تھے کہ وہ یہ ادارہ اور ملک چھوڑ
 کر کیسے یورپ یا امریکہ پرواز کر سکتے ہیں۔ شاید میں غلط
 ہوں؟

پروفیسر مائر، سادات: آپ شاید درست فرما رہے ہیں۔ اسی
 طرح کی صورتِ حال کا ہم کو بھی سامنا رہا۔
 ۳۵ روپے رنگ روڈ نواز شریف انٹرچینج مال فی ادا کی
 اور طرف راوی دریا، مینارِ پاکستان روانہ ہوئے۔
 میں اب ذہنی طور پر تیار تھا سوالات کے جوابات دینے
 کے لیے۔

پروفیسر مائر: ڈاکٹر یہ کونسا اور کن لوگوں کا علاقہ تھا اور
 یہ بائیں جانب کن لوگوں کی آبادیاں ہیں؟

میں: سر! یہ ہاؤسنگ سوسائٹی تھی، وثوق سے نہیں کہ
 سکتا براہِ راست کس کے ماتحت ہے۔ اور یہاں ہر طرح
 کے لوگ آباد ہیں صرف آرڈ فورمز کے نہیں۔ اور ساتھ
 میں پرانی آبادیاں ہیں جو کبھی گاؤں ہوا کرتے تھے۔ تسلی
 بخش جواب نہ سن کر ہلکا سا مسکرا دیے۔

پروفیسر سادات: جانتے ہوئے کہ مجھے جرمن سمجھ آتی
 ہے موضوع بدلتے ہوئے۔
 ڈاکٹر: مجھے علی ہجویر ضرور جانا ہے۔
 میں: تھوڑا سوچتے ہوئے۔ وہ ہاں آپ کا مطلب ہے داتا
 دربار علی ہجویری۔؟
 پروفیسر سادات: دربار نہیں روضہ ڈاکٹر!
 میں: فرق کیا ہے؟

پروفیسر سادات: بعد میں بتاؤں گا، جب کبھی کافی پلاؤ
 گے۔ ہا ہا۔۔۔ لمبی نشست درکار ہے۔

لاہور ائر پورٹ تک پہنچتے میرے چودہ میں سے کچھ
 طبق روشن ہو چکے تھے۔ ابھی اسی ہاؤسنگ سوسائٹی میں
 فلسطین کی طرح قید آبادی، مینارِ پاکستان، علامہ سے
 حاضری اور گورنمنٹ کالج کے واقعات تحریر طلب
 ہیں۔۔۔ جاری ہے

ریڈیو پر عطا اللہ نیازی وطن عزیز کے بارے میں FM
 فرما رہے تھے۔۔۔ جگر مراد آبادی
 یہ ہے مے کدہ یہاں رند ہیں، یہاں سب کا ساقی امام ہے۔

یہ حرم نہیں ہے اے شیخ جی، یہاں پارسائی حرام ہے۔
 کوئی مست ہے کوئی تشنہ لب، تو کسی کے ہاتھ میں جام ہے۔

مگر اس پے کوئی کرے بھی کیا، یہ تو مے کدے کا نظام ہے۔
 یہ جناب شیخ کا فلسفہ، ہے عجیب سارے جہاں سے
 جو وہاں پیو تو حلال ہے، جو یہاں پیو تو حرام ہے

تحریر: ڈاکٹر مدثر رزاق شعبہ ریاضی

کرونا وبا کا شکار ہونے والے پیادوں کے نام

بهار رت سے حسین چہرے
شگفتگی کا استعارہ چاند چہرہ ستارہ آنکھیں
مہکتے لہجوں کی کھنکھناہٹ
شوخ و شنگ نظروں کی جھلملاہٹ
زندگی کی تپش کو راحتوں میں بدلنے والے
جھلنے صحرائیں نخلستان کی مانند
وہ سہارے چٹانوں جیسے
بلند و بالا حصاروں جیسے
کبھی کسی آگینے کی مانند
کبھی سایہ کبھی گھٹا کبھی آئینہ کبھی دعا
وہ جن کی ہنسی سے کلیاں چٹکتی تھیں
فضائیں گنگنائی تھیں، ہوائیں کھل کھلائی تھیں
جن کے عنوان سے ہمارا نشان تھا
وہ جن سے ہمارا دل بہلتا تھا
وہ جن کو کھونے سے ہمارا دل دہلتا تھا
جن کے بغیر سانس رکنے کا احتمال تھا
وہ جو چلیں تو زمانے چلتے تھے
جن کے ٹھہرنے سے وقت رکتا تھا
لہجوں کی قید میں سرکتی ریت کی مانند
اور پھر یوں ہوا جیسا، ہمیشہ ہوتا آیا ہے
سرائے فانی سے سب ہی کو کوچ کرنا ہے
یہاں اس دار میں جو بھی آیا ہے
پلٹ کر واپس وہاں وہ لوٹ جاتا ہے

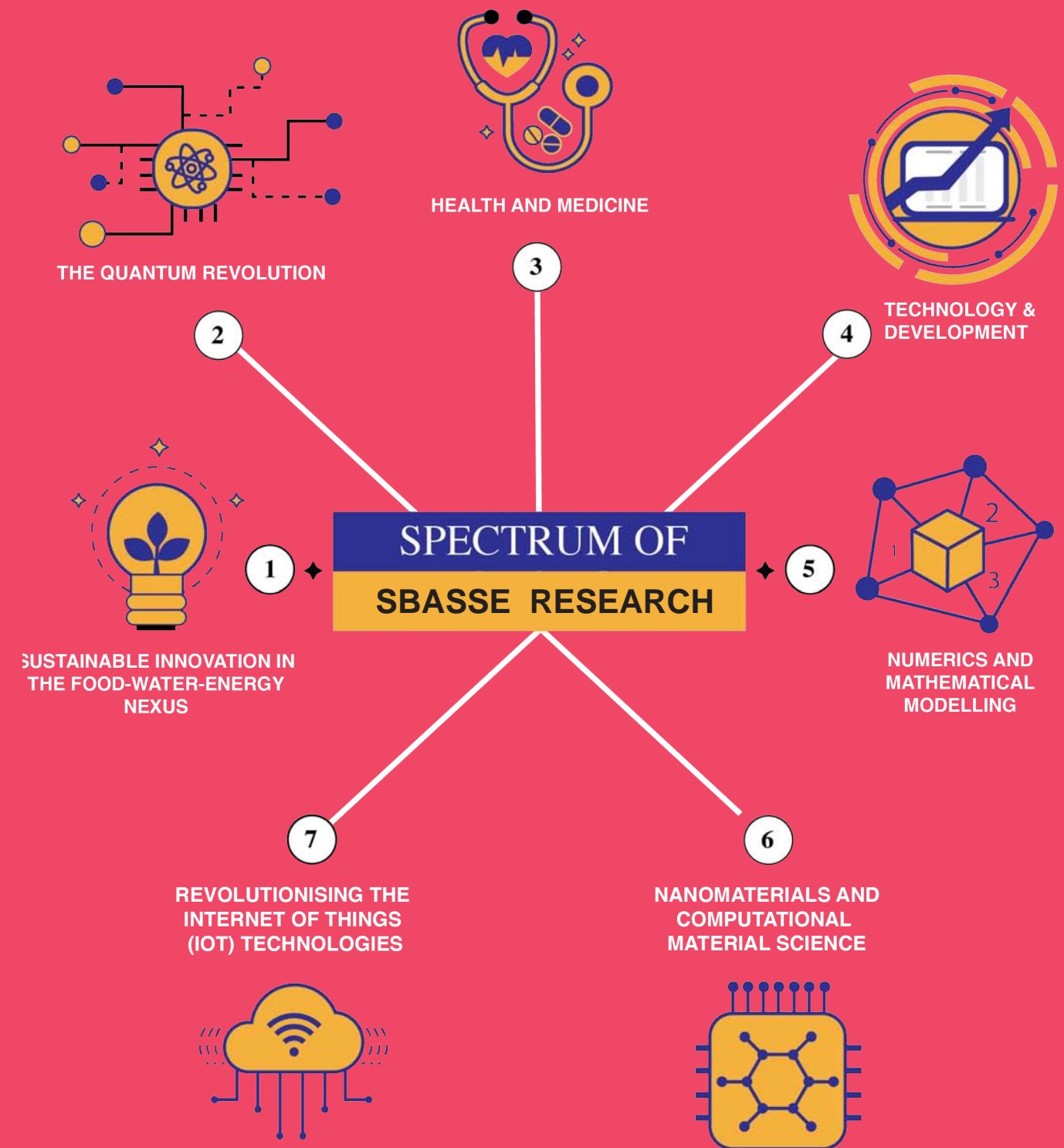
تحریر: ثروت آفتاب، والدہ محترمہ محمد جُنید
محمد جُنید ایم جی ایس ایچ ایس ایس میں بی
ایس سی آنرز کے طالب علم ہیں



“

SBASSE IS KNOWN FOR THE DIVERSITY OF ITS SCIENTIFIC INVESTIGATIONS. THOUGH IT IS IMPOSSIBLE TO COVER THE VAST VARIETY OF TOPICS PURSUED IN OUR SCHOOL, AND THEY TOO CHANGE WITH TIME, HERE IS A BROAD MAP OF THE MOST DENSELY FOCUSED THEMES:

”







COMMUNITY



View from PhysLab's International Lab Immersion Programme

Sad Demise of a Friend Indeed - An Obituary

Professor Dr. Steve Berry, a friend of LUMS SBASSE and friend of Pakistan passed away peacefully in Chicago.

Professor Dr. Steve Berry's shyness, charm, and humility was bundled up with a solid grasp on chemical thermodynamics, potential landscapes, and phase equilibria, some of the most complex phenomena in chemical physics. These potential landscapes steer the thermodynamics and kinetics of chemical and physical processes and also control whether a material forms a glass or a crystal or something in between, how a protein folds and unfolds and consequently how life emerges.

As a distinguished professor at the University of Chicago, Professor Dr. Steve Berry, had in his lifetime trained hundreds of scientists and generations of chemists in the nuances and intricacies of equilibrium and departures therefrom, the properties of the micro and the macro and where the twain shall meet, how molecules tumble and collide to generate macromolecules and how they eventually disintegrate. Furthermore, his penchant for describing molecular statistics, thermodynamics and kinetics in a simple, meaningful and insightful manner always left deep impressions on his many listeners.

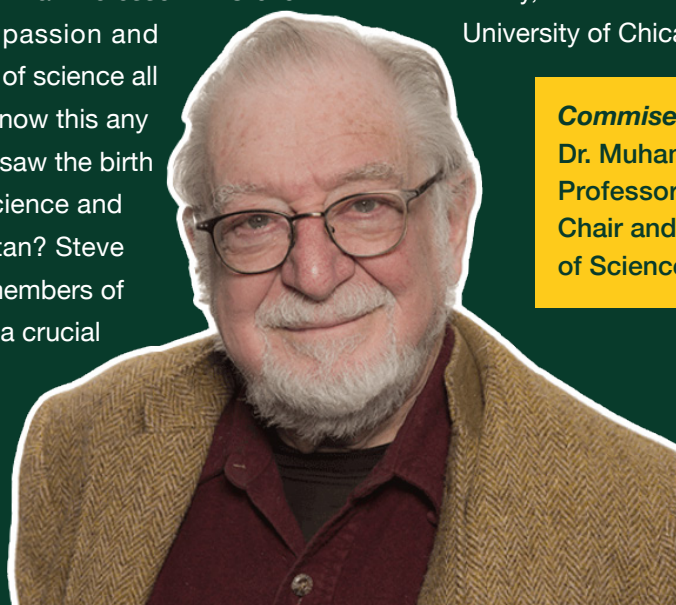
However, many would not know that Professor Dr. Steve Berry also harboured a deep passion and commitment to the furtherance of science all around the world. Who would know this any better than the individuals who saw the birth and growth of the School of Science and Engineering at LUMS, in Pakistan? Steve was among the founders and members of the Advisory Board and played a crucial role in inspiring the School's young Faculty, especially the chemists. His regular visits

to Pakistan and Lahore for participating in the School's advisory meetings not only gave many of us a chance to brush shoulders with him but also to listen to his words of wisdom on science, education, leadership and also provided us with immense confidence in launching an interdisciplinary programme of education. Consequently, the cross-pollination of ideas from diverse fields now routinely takes place at SBASSE.

Syed Babar Ali, the founder of the School, after whom the School is also named, expressed his condolences, "The School of Science and Engineering at LUMS will always remain extremely grateful to Steve Berry for his excellent contributions during the meetings of the Advisory Board that he attended. He was the founding member of the advisory board; we will miss him. He was a great mentor, advisor and a friend of LUMS and SSE. May God bless his soul."

Dr. Steve Berry has left an indelible mark on our School. My thoughts and wishes, and the thoughts and wishes of all of my colleagues here at LUMS SBASSE, go to Steve's family, friends and to all our colleagues at the University of Chicago.

Commiseration note by Dr. Muhammad Sabieh Anwar, Professor of Physics, Ahmad Dawood Chair and Dean Syed Babar Ali School of Science and Engineering LUMS.



The Particle by SBASSE

Announcing Successful PhD Graduations from SBASSE

The Brewing PhD Revolution

“

I am thankful to LUMS for providing our School with the opportunity to realise its dream of research, discovery and invention and what better way to do that than by producing PhD graduates who are far better than us!

”

In the past six months, the Syed Babar Ali School of Science and Engineering has graduated about 14 PhD students out of 18 this year, with an average graduation time of less than 5 years. This is important to mention because scientific investigations, especially in Pakistan, are protracted, riddled by the lack of resources, sub-optimal infrastructure, absence of post-docs, and bureaucratic delays coming down with public funds.

These PhD students have produced more than 50 journal articles with a cumulative impact factor of more than a hundred (100), 25 conference articles, and numerous new tools, technologies and software. This body of knowledge has also helped the Faculty apply for external grants amounting to PKR 2.5 billion in the past past one year alone with a promise for significant

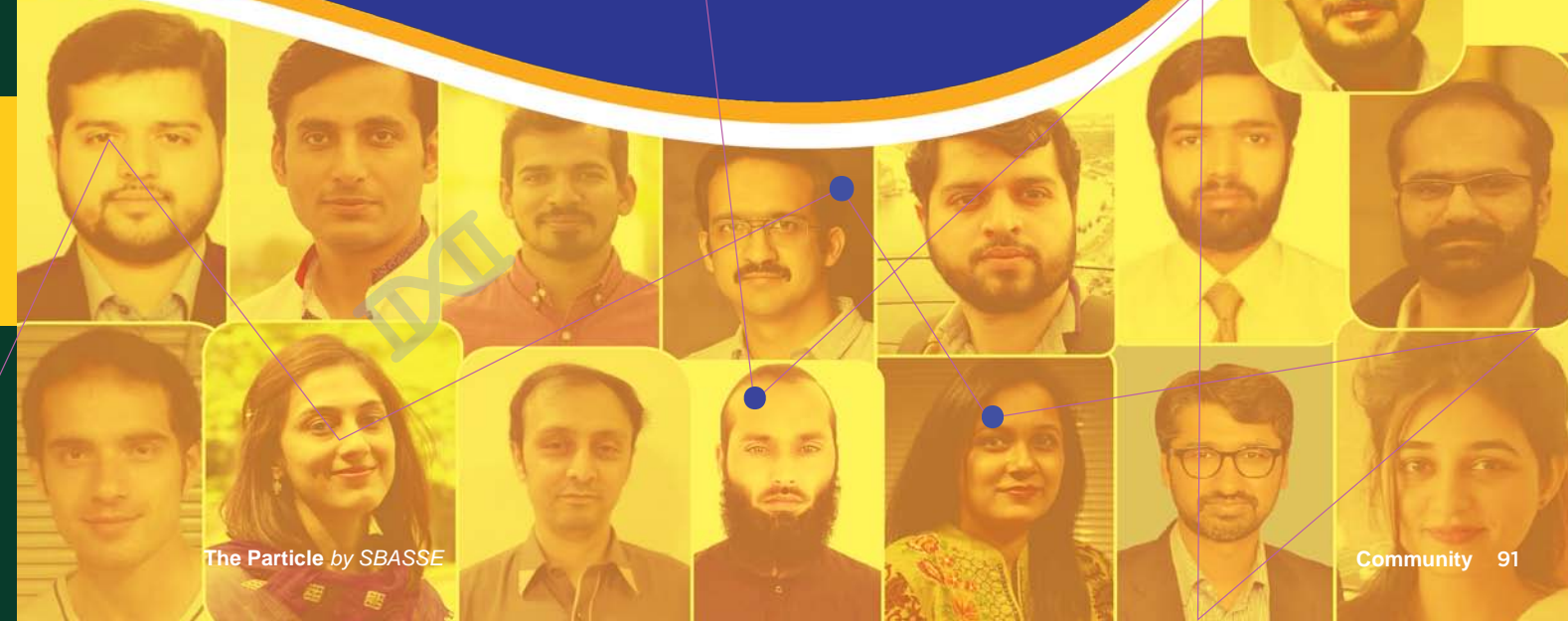
University overheads. Most of these grant applications are trans-disciplinary and under review.

The PhD cohort has worked on a myriad of problems ranging from modelling disease to inching closer to cancer therapies, from measuring quantum processes to synthesising new drug molecules, and from harnessing sun's energy for chemical reactions to advancing novel paradigms of computing.

I can label this as a mini-revolution brewing in Pakistan's scientific landscape. We had all known about globally competitive undergraduates coming out from LUMS. This news closes cycles and is, in my opinion, the culmination of visionary steps taken by the LUMS leadership, the Advisory Board and the SBASSE Faculty only ten years ago.

The journey continues!

Note by Dr. Sabieh Anwar, Dean SBASSE.



The Particle by SBASSE

Community 91

Sr #	Name	Title of Thesis	Dept.	Supervisor	Sr #	Name	Title of Thesis	Dept.	Supervisor
1	Burhan UI Haq	Classification of first integrals and closed-form solutions for dynamical systems of differential equations	Mathematics	Dr. Imran Neem	10	Aqsa Naeem	Mitigation of renewable energy source intermittency in microgrid using complementary renewable energy source	Electrical Engineering	Dr. Naveed ul Hassan
2	Sharon Riaz	Synthesis and Evaluation of Novel Chalcone Derivatives	Chemistry & Chemical Engineering	Dr. Rahman Shahzaib	11	Muhammad Kamran	Applications of coupled-wave approach for 1D gratings illuminated from planar interface	Electrical Engineering	Dr. Muhammad Faryad
3	Akhtar Munir	Development of Nanocatalysts for Water Splitting - A Sustainable Source of Energy	Chemistry & Chemical Engineering	Dr. Irshad Hussain	12	Numan Khurshid	Image Retrieval using Cross-view Matching for Remote Sensing Imagery	Electrical Engineering	Dr. Murtaza Taj
4	Munazza Shahid	Engineering of HIV-1 and HCV Entry Inhibitor Lectins and Understanding the Atomic Level Details of HIV Cellular Entry Process	Chemistry & Chemical Engineering	Dr. Shahzad ul Hussan	13	Wajeeha Nafees	Development of Novel Techniques for Signal Acquisition and Representation on Spherical Manifolds	Electrical Engineering	Dr. Zubair Khalid
5	M. Haider Farooq Khan	Kinome-wide RNAi screen uncovers the role of Drosophila Ballchen in the maintenance of epigenetic cell memory	Biology	Dr. Muhammad Tariq	14	Affan Rauf	Incremental Techniques in Automated Test Case Generation	Computer Science	Dr. Junaid Haroon
6	Jawad Akhtar	Genetic and Molecular Analysis uncovers a novel role for Drosophila Enok in Maintenance of Epigenetic Cell Memory	Biology	Dr. Muhammad Tariq	15	Maryam Abdul Ghafoor	Automated Testing of Database Driven Applications	Computer Science	Dr. Junaid Haroon
7	Rahim Ullah	Deciphering the Molecular Basis of Trophoblast Stem Cell Differentiation and Function	Biology	Dr. Amir Faisal	16	Saad Ahmed	Fast and Energy-efficient Intermittent Computing	Computer Science	Dr. Hamad Alizai
8	Asma Ahsan	Characterisation of epitope and Fcy receptor specificity of HCV and HBV neutralising antibodies, and retrospective analysis of HCV infections in general population	Biology	Dr. Shahzad Ul Hussan	17	Haroon Shakeel	Deep Learning Methods for Short, Informal, and Multilingual Text Analytics	Computer Science	Dr. Asim Karim
9	Faran Awais Butt	Next Generation Phased-MIMO Radar Systems: From Theory to Practice	Electrical Engineering	Dr. Ijaz Haider Naqvi	18	Ali Akbar	Some explorations in magneto-optics and optics-magnetics	Physics	Dr. Sabieh Anwar

FACULTY

Interim Chair Announcement and Farewell note to Dr. Imran

We take great pleasure in announcing an Interim Chair of the Mathematics Department, Dr. Haniya Azam. Dr. Azam is a topologist, a PhD from the Abdus Salam School of Mathematical Sciences, Government College University, a committed teacher and a spirited proponent of mathematical knowledge.

At this point, we extend our deepest gratitude to **Dr. Imran Naeem** who has led the Mathematics Department for the past two terms with committed dedication to mathematics and the School. We wish Dr. Imran best of luck in all his scholarly endeavours and many fruitful years ahead as a scholar and educator.

Promotion and Tenure

- **Dr. Irshad Hussain** was promoted to Professor of Chemistry in the Department of Chemistry & Chemical Engineering.
- **Dr. Hassan Abbas Khan** was promoted to tenured Associate Professors in the Department of Electrical Engineering.
- **Dr. Fareed Zaffar** was promoted to tenured Associate Professors in the Department of Computer Science.
- **Dr. Junaid Haroon Siddiqui** awarded promotion to Associate Professor with tenure on June 05, 2020
- **Dr. Mudassar Razzaq**, awarded with second contract after the successful Midterm Tenure review on August 14, 2020.

Welcome

- **Dr. Rafi Ullah** has joined as Adjunct Faculty in the Department of Physics.
- **Dr. Rizwan Khalid** has joined as Associate Professor in the Department of Physics.
- **Mr. Jawad Akhter** has joined as Teaching Fellow in the Department of Biology.
- **Mr. Muhammad Furqan** has joined as Teaching Fellow in the Department of Biology.
- **Ms. Sana Ahmad Minhas** has joined as Teaching Fellow in the Department of Chemistry.

Farewell

- **Dr. Naveed Ahmed**, Assistant Professor in the Department of Mathematics, has left SBASSE. We wish him the very best for his future endeavours.

NEWS

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