

THE

PARTICLE

Syed Babar Ali School of Science and Engineering's Magazine

Issue No. 16 | October – December 2020

~THE GREAT CONJUNCTION~

ICC Accredited Cricket Lab

کورونا کی قینچی !

Patent approved



LUMS

A Not-for-Profit University

ظلمين

Small Sagittarius
Star Cloud
M24



سابق

قلبِ عقرب

مُشتري

ملکی وے

The mid-summer Milkyway rising above the horizon near river Chenab.

This photograph is a combination of individual 30-second exposures adding up to a cumulative exposure of 5 minutes.

Photo by the Science Communication Cell, SBASSE.

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قطرہ نیساں



"دی پارٹیکل" کا سولھواں گلدستہ آپ کے ہاتھوں میں یا نظروں کے سامنے ہے۔ مجھے امید ہے ہماری یہ ادنیٰ سی کوشش رفتہ رفتہ بڑھے گی اور ملک میں سائنسی اور علمی تشہیر کی جو بھی دیگر کوششیں ہو رہی ہیں، اُن کو مزید تقویت ملے گی۔ سر سید احمد خان کی سائنسی تبلیغ سے شروع ہوتے ہوئے اب عوام اور خواص میں سادہ زبان میں سائنس کے ابلاغ کی تحریک کافی طاقت حاصل کر چکی ہے۔ اس کا اظہار ان بیسیوں سائنسی انجمنوں اور سائنسی جرائد کے ذریعے ہوتا ہے، جو ملک کے کونوں میں پھیل چکے ہیں۔ زیرِ نظر "دی پارٹیکل" بھی اس تحریک کا ایک حصہ ہے۔

سولھویں شمارے میں آپ کو سید بابر علی اسکول برائے سائنس اور انجینئرنگ میں رونما ہونے والے اہم واقعات اور خبروں کے بارے میں معلومات تو ملتی ہی رہے گی، مگر دلچسپ مضامین کا سلسلہ بھی جاری رہے گا۔ روشن بخاری کا اجرامِ فلکی کے عظیم الشان ملاپ کے بارے میں مضمون اسی سلسلے کی ایک لڑی ہے۔ محمد حسن رضا نے کووڈ میں حیاتیاتی ایجادات پر بڑی سیر حاصل گفتگو کی ہے۔ کرکٹ کا کھیل ہمارے ملک کی شہ رگ بن چکا ہے۔ ہمارے سکول میں بین الاقوامی کرکٹ کی تنظیم آئی سی سی سے سند یافتہ تجربہ گاہ کی حیران کن کہانی بھی اس شمارے کا جز ہے۔ ہمارے تہ خانے میں موجود تخلیق گاہ یعنی میکروز لیب کا مختصر تعارف بھی پیش خدمت ہے۔ منصور چیمہ ہمارے قابلِ قدر ساتھی ہیں اور ایک بہادر مہم جو ہیں جو اپنی وہ پیٹیوں کی سواری پہ ملک کے دور اور دشوار پہاڑی رستوں کا سراغ لگاتے ہیں۔ ان کے اسفار کی روداد بھی پڑھ لیں۔ حسان الرحمن ہمارے قابلِ فخر سابق طالب علم ہیں۔ مشرق وسطیٰ کے معروف اخبار "دی خلیج ٹائمز" میں ان کا برقی گاڑیوں پر حسبِ حال اور چشم کشا مضمون ہے۔ تو قارئین ہمیں اپنی تجاویز سے آگاہ کرتے رہیں۔ ہم آپ کے منتظر رہیں گے۔

خیر اندیش

محمد صبیح انور

ڈین احمد داؤد چیئر

سید بابر علی اسکول برائے سائنس اور انجینئرنگ



The Great Conjunction 2020

Story by Syed Roshaan Bukhari

A Cosmic Ballet 800 Years In The Making

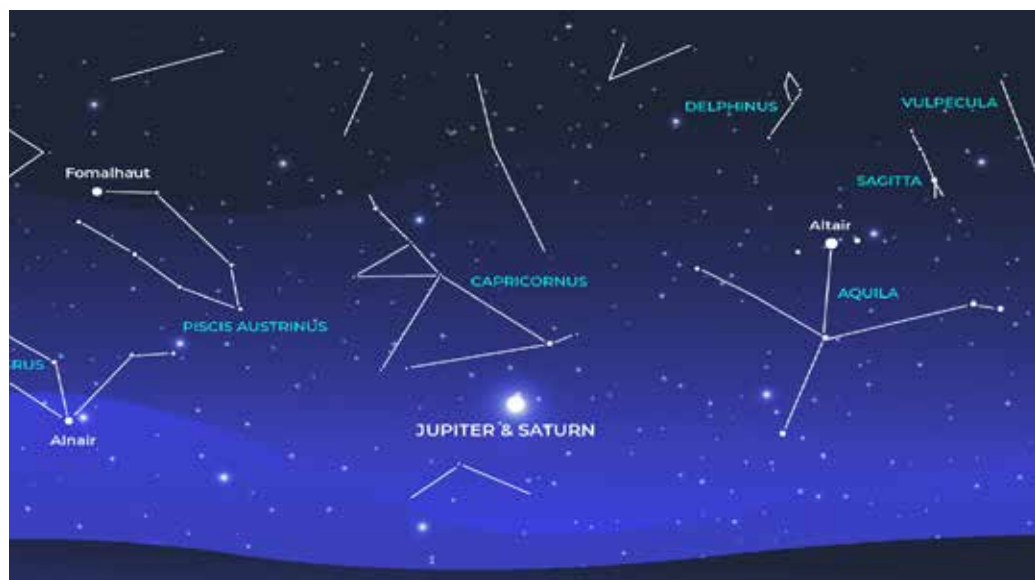
It was nothing short of visual poetry; mighty Jupiter spreading its cape and joining Saturn in a brief cosmic ballet. Saturn – dim, shy and light, bowing its head to the invitation of the king; a sight to behold!

Hanging weightlessly above the horizon, awash in the dusky twilight of December 21, 2020, the two largest planets of our solar system, Jupiter and Saturn, were closer to each other than they've been in the past 800 years. In the weeks leading up to this visual showcase, the moniker 'The Great Conjunction 2020' was quickly adapted by astronomers across the world, as

they set their sights, and their telescopes, to the magnificent union of the gas giants of our solar system.

Conjunctions Are Everywhere!

The National Flag shows a conjunction between the crescent moon and a star. A conjunction is an astronomical event where two or more celestial bodies appear to be in close proximity of each another. It must be noted that while celestial objects may appear close together in the sky, they're in fact millions of kilometers apart – sometimes, even light years apart! A conjunction is therefore just a chance alignment between celestial objects and the line of sight of an observer on Earth (or anywhere in space for that matter); an alignment that lasts for just a few earthly hours.



A Tangy Cocktail Of Orbital Mechanics

Conjunctions happen all the time.

The last one happened just a few weeks ago, when the Moon drifted into close proximity of Mars, another happened last year where Venus appeared to pass right through the beautiful star cluster called the Seven Sisters, known as *Surayya* / سُرَيَّا in the local dialect, otherwise known as The Pleiades (pronounced play-deez). The next one may happen sometime this month – or this week! However, things are just a little different with Jupiter and Saturn. Saturn completes one orbit around the Sun in about 30 years while Jupiter, orbiting closer to the Sun and therefore going faster, does the same in about 12 years. Add to the scenario that the Earth is also orbiting the Sun, once every year,

and now you have a tangy cocktail of orbital mechanics that makes it harder to have *both* Jupiter and Saturn lie in the same line of sight for an observer on Earth. As a result, conjunctions of Jupiter and Saturn do not occur every other month or year but once every 20 years! The last one took place in the year 2000.

All Conjunctions Are Not Created Equal

Although Jupiter and Saturn have come close together in the past, they haven't been observed this close since the year 1226 A.D. All conjunctions are not created equal.



Zooming In

Small lengths can be measured with a span, however, the apparent distances and sizes of objects in the sky are measured with a set of units that are justifiably alien to the masses; degrees, arcminutes and arcseconds. To bring things into context, try doing this: extend your pinky finger to arm's length. The width of the tip of your pinky finger takes up about 1 degree of the sky or the width of two full Moons! We can also say it this way: the pinky finger at arm's length takes up about 60 arcminutes of the night sky, or the width of two full Moons. We have now established that 1 degree is equal to 60 arcminutes. The separation between Jupiter and Saturn, on the evening of December 21st, 2020 was about 6 arcminutes. That is like to seeing 6 footballs, placed next to each other, from a distance of 1 km! In fact, on December 21st, 2020, the separation between Jupiter and Saturn was so small it was barely discernible by human vision.



The Great Conjunction by Asim Sohail



Size Comparison between Saturn and Earth



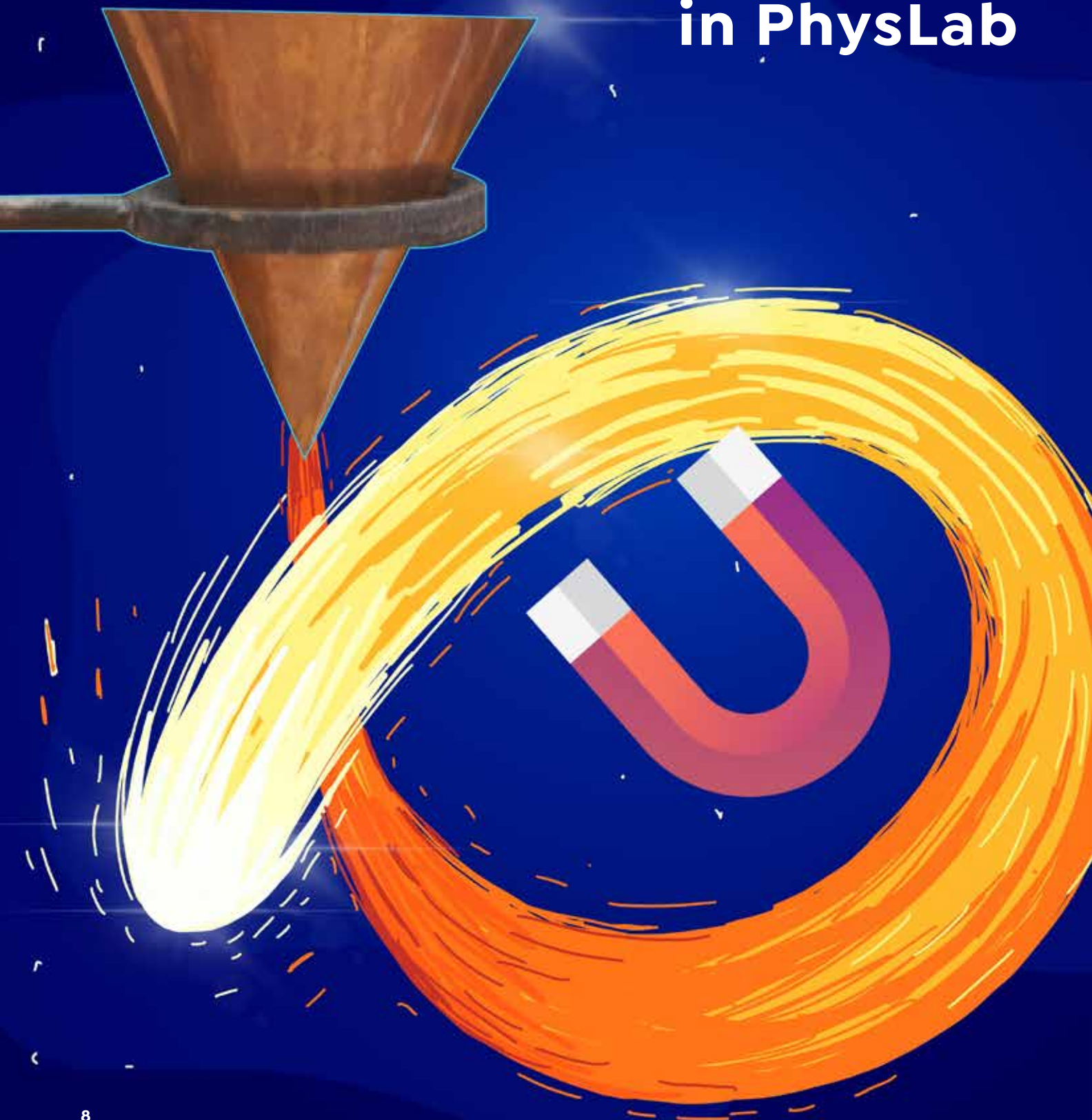
In a remote future, 21st June, 7541

See You In 2080! The next time these two Titans come this close will be on March 15, 2080. We hope to feature that story in the then umpteenth edition of The Particle!

In a remote future, interplanetary humans may want to consider revisiting Earth to observe an even closer conjunction on June 21, 7541 A.D., and watch in glee as the proximity of the resident giants brings together their moons into a single cluster of dim and bright shimmering points of light, reminding some of fable of an ancient event back in the year 2020.



Cold Magnetic Ballet in PhysLab



NEWS STORY

In an absolutely stunning display of beauty, a drop of liquid oxygen, and its tail of gaseous oxygen, is seen orbiting a magnet almost exactly like a distant icy comet that dives into the inner solar system, developing a tail of dust and ice, making a tight U-turn around the Sun, only to slip back into the darkness of the abyss.

Liquid nitrogen is no stranger to pop culture and is considered a darling ingredient for many fun science experiments. This reputation is due to its extremely cold temperature. When liquid nitrogen is poured into a copper cone, the copper runs so cold that oxygen from thin air surrounding the metal condenses onto the tip of the cone, creating droplets that soon start dripping. In an interesting digression, Anne Hathaway, a celebrated American actress is seen as the 'White Queen making perfume', using a cone that's eerily similar to this experiment!

This is no different from glass gathering water droplets when a cold beverage is poured in. Science – it works no matter if it's cold water or liquid nitrogen! These droplets run off an inclined plane on to a black sheet, which hides a strong magnet beneath. As the drops slide on to the black sheet, they appear to deflect at varying degrees. How this reminds us of Rutherford's experiment where electrons would deflect because of the presence of a dense nucleus in the middle of atoms. Indeed, the beauty of this experiment is that it is a low-energy version of Rutherford's experiment.

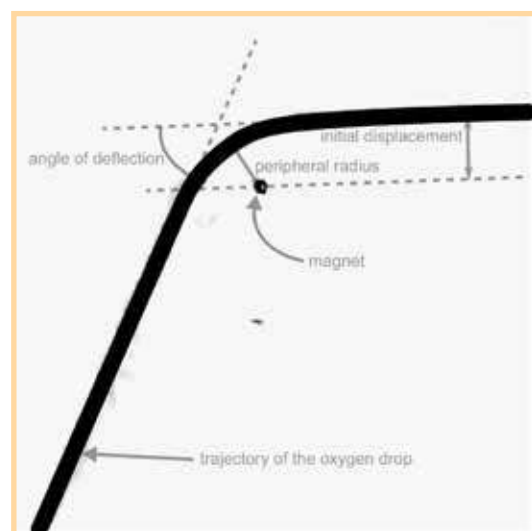
This display of magnetic ballet is in part courtesy of oxygen's weak, but observable response to magnetic fields without retaining permanent magnetism. We say that oxygen is paramagnetic. In addition to this, from the time the drop falls off the cone to getting deflected over the black sheet, it never touches any surface – the liquid oxygen drop levitates!

***This is one strange experiment.
It can be explained through what is
known as the Leidenfrost Effect.***

Simply put, the bottom of each drop of liquid oxygen vapourises very quickly, creating an 'Aladdin's magic carpet' of gaseous oxygen that keeps the drop afloat.

Fascinating! Conventional methods of demonstrating this magical property of oxygen involve bulky magnets and expensive setups. At PhysLab, the experiment demonstrated the use of cheaper, simpler materials without significant compromise on the intended output.

The beauty of physical laws is in their consistency. If they're true on a desk in PhysLab, they must also be true in the remote reaches of the universe.



The screengrab shows the wake of a liquid oxygen drop as it goes around a magnet, much like a comet bending around a planet.

Dr. Sabieh Anwar, along with physics major Mr. Abdullah Irfan helped develop this experiment. The data from this experiment was recorded and analysed by students at the PhysLab.

Their detailed analysis can be seen here:

<https://physlab.org/experiment/steering-paramagnetic-leidenfrost-drops-in-an-inhomogeneous-magnetic-field/>

An Insight: Bioentrepreneurship During The Pandemic

with Muhammad Hassan Raza

Interview by Mohammad Irtaza Tafheem

Within this situation, incident rates of COVID-19 are now increasing rapidly in Pakistan. Strategies are being created to control this outbreak, meanwhile, the treatments and vaccines are under progress. As for the latter, it requires months for clinical trials, before being supplied to healthcare institutes, and ongoing studies are investigating the rapid way for vaccines to pass through trials.

Also, with limited resources available for staff to diagnose patients with COVID-19, it creates an impediment to rule out patients with other similar diseases. All in all, along with these obstacles, an unemployment rate is increasing in Pakistan. Due to tight budgets, hospitals are requiring experienced candidates, but with less salary demands and for now, less traineeship opportunities are available, to train candidates for their work purpose.

On the other hand, an idea of establishing a business, providing customers with innovative products, known as 'Entrepreneurship', is popular, globally. And with integrating biotechnology, to generate a product, can save time and budget, especially, within this period. It's known as 'Bioentrepreneurship'. As for the

startups, it's widely mentioned the reason for opening up the business, by fulfilling the needs of customers and even, of society. So, by fulfilling demands of biotech innovatives within our country, we can save time and money.

Today, we will hear about the experience of Mr. Hassan Raza; co-founder of Pakistan's pioneering community lab Codon Corps, who has recently co-founded a startup Scienovative that focuses on industry oriented synthetic biology, 3D bioprinting & microfluidic systems, and laboratory equipment manufacturing.

Can you briefly describe yourself?

My name is Muhammad Hassan Raza and I am currently working as a Manufacturing Design Lead at Scienovative. My work focuses on development of cross-disciplinary technologies with a particular focus on genome engineering, bioprinting, and synthetic biology for addressing scientific questions.

How was your experience of participating in the iGEM competition?

iGEM sparked the fire of addressing local problems using synthetic biology. It also provided me with a platform to learn and implement solutions that encompass multiple disciplines.

What things have you learned, to make this country better for Science?

If I would sum up the brewed product of all the strategies that I and my team have implemented, it is one word: Education. I believe that educating a nation at grass-root level will not only enable development of curiosity-driven learning platforms but also a country whose masses are enthusiastic learners.

So, as of your first start up, i.e. being a co-founder of Codon Corps, can you tell us about the purpose of establishing it?

Codon Corps is not a startup but a community education focused organisation that emphasised on promotion of do-it-yourself biology

education in three key areas: Open-source genome engineering, 3D bioprinting, and community-driven lab-on-a-chip systems.

How was your experience at Codon Corps?

I and my team established a 3D bioprinting and biomechatronics group at Codon Corps and led pioneering work on 3D bioprinting of hydrogels. We also introduced a country-wide CRISPR focused education programme with outreach surpassing thousands of researchers.

We are still witnessing increasing rates of unemployment worldwide. Despite such a situation, how were you capable of establishing another start up?

COVID-19 has impacted almost every sector of our lives ranging from economy to education and healthcare. Similarly, it has also drastically impacted the research sector of Pakistan where the majority of the research laboratories lack access to timely provision of required tools and reagents for conducting fruitful research. This is where Scienovative aims to aid and act as a one stop shop solution for the life sciences researchers of Pakistan.

What's the purpose of 'Scienovation', within this scenario?

Scienovative's goal is to provide products and services in three areas; molecular biology laboratory products and equipment, microfluidic devices, and 3D bioprinting.

According to your knowledge, how do you describe 'Bioentrepreneurship' and to what extent is it capable of establishing a startup.

Bioentrepreneurship focuses on addressing the local problems that we face in our daily lives using biotechnology. With that being said, the solutions developed using bioentrepreneurship are also globally scalable. Immense potential of biotechnology for tackling the issues we face in the environment, energy, health, and agriculture sectors has allowed the economy based on bioentrepreneurship to grow exponentially with total global revenue ranging in billions of dollars.

Is it possible to open a start up, within this condition?

Yes, if you are addressing a question with a solution that can be commercialised, have a good team,

and are able to develop a good business plan, go for it.

What problems have you faced in Pakistan, with regards to providing your current services and products?

We have not faced any specific problems yet but the major difficulty is outreaching and fighting the dilemma that our research community usually prefers products manufactured in foreign countries and avoids indigenously manufactured products. We need to realize that in most of the cases, local products are equally competent and in many cases, surpass the quality of imported products.

Lastly, a brief message for our readers?

It is never too late to learn and work on your dreams. Go, put in the efforts, and work neck and neck to make Pakistan reach the height of glory.



You can contact Mr. Hassan Raza at hassan@scienovative.com or hassan.raza1898@gmail.com.

جیٹروفا کا پودا مستقبل میں ایک زبردست انقلاب لا سکتا ہے۔ زندگی کے دیگر شعبوں میں بھی اس کی منفرد خصوصیات سے استفادہ کیا جا سکتا ہے۔ جیٹروفا کا بیج بڑی مقدار میں نائٹروجن رکھنے کی بدولت نامیاتی کھاد کا اعلیٰ متبادل ہے۔ جیٹروفا کے پتوں کو ایک خاص قسم کے زہریلا خامرے کو خارج کرنے کی بدولت پانی میں حل کر کے فصلی حشرات کے خاتمے کے لیے بطور اسپرے استعمال کیا جاسکتا ہے۔ جیٹروفا کے پتے اور پھل پوٹاشیم سے بھرپور ہونے کی بدولت پیپائٹس سی کے علاج میں بہت کارگر ثابت ہوتے ہیں۔ ایک تحقیق کے مطابق جیٹروفا کے پتوں سے حاصل ہونے والی ایک مخصوص دوا شریانوں کو کھولنے کے ساتھ ساتھ بلڈ پریشر کو قابو میں رکھنے، دماغی امراض اور برین ہیمرج جیسے موذی امراض سے مستقل چھٹکارا فراہم کرتی ہے۔ ماہرین کے نزدیک یہ دوا بلڈ پریشر کے لیے استعمال ہونے والی ایک انتہائی مہنگی اور مشہور دوا ”بالوہا“ سے بھی زیادہ کارآمد ثابت ہوتی ہے۔

حکومت پاکستان کو چاہیے جیٹروفا پلانٹ کی افادیت سامنے رکھتے ہوئے اس سے فوری طور پر مستفید ہونے کے لئے ترجیحی بنیادوں پر اقدامات کرے۔ قدرت کے اس حسین تحفے سے نہ صرف پاکستان کا سب سے دیرینہ توانائی کا مسئلہ حل ہو سکتا ہے بلکہ ماحولیاتی آلودگی میں بھی خاطر خواہ کمی لائی جاسکتی ہے۔

ماہرین کے مطابق پٹرولیم ڈیزل اور جیٹروفا بائیو ڈیزل کی کیمیائی ساخت میں نمایاں فرق ہے۔ بائیو ڈیزل دراصل سادہ ہائیڈروکاربن کی لمبی زنجیروں کا حامل ہوتا ہے جو فوسل ایندھنوں سے حاصل کردہ پٹرولیم کے برعکس سلفر، زنک یا ارومیک مالیکیولز سے نہ صرف مکمل طور پر پاک ہوتا ہے بلکہ تقریباً ۱۲ فیصد آکسیجن رکھنے کی بدولت یہ قدرتی طور پر آکسیجینیٹڈ ایندھن ہے۔ جیٹروفا بائیو ڈیزل میں زہریلے کیمیکلز کی غیر موجودگی اور اس کا فلیش پوائنٹ انتہائی زیادہ ہونے کی بدولت اسے لمبے عرصے تک آسانی سے ذخیرہ کیا جاسکتا ہے۔ یہی خصوصیت جیٹروفا آئل کو منفرد اور محفوظ بناتی ہے۔

علاوہ ازیں جیٹروفا کی لاگت پٹرولیم اور تیل سے انتہائی کم ہے۔ سونے پہ سہاگ تو یہ ہے کہ اسے پہلے سے موجود انجنوں میں بغیر کسی رد و بدل کے استعمال کیا جاسکتا ہے۔ اسے بھاری بھرکم گاڑیوں میں استعمال کر کے ڈیزل سے بھی بہتر کارکردگی حاصل کی جاسکتی ہے۔ مذکورہ ماحول دوست انجن کے چلنے سے نہ تو زہریلے مواد خارج ہوتے ہیں بلکہ یہ فضا میں موجود گرین ہاؤس گیسوں کو کم کرنے والا واحد ایندھن ہے۔ لہذا جیٹروفا بائیو ڈیزل کو فوسل ایندھن سے حاصل کردہ پٹرولیم ڈیزل کی جگہ استعمال کر کے انتہائی خطرناک ذراتی مادے، کاربن مونو آکسائیڈ، سلفر ڈائی آکسائیڈ اور کاربن ڈائی آکسائیڈ کے اخراج میں خاطر خواہ کمی سے ماحول کو محفوظ بنایا جاسکتا ہے۔ حال ہی میں ہونے والی ایک تحقیق کے مطابق جیٹروفا کا ایک پودا تقریباً ۷ سے ۸ کلوگرام سالانہ کاربن ڈائی آکسائیڈ جذب کرنے کی صلاحیت رکھتا ہے۔

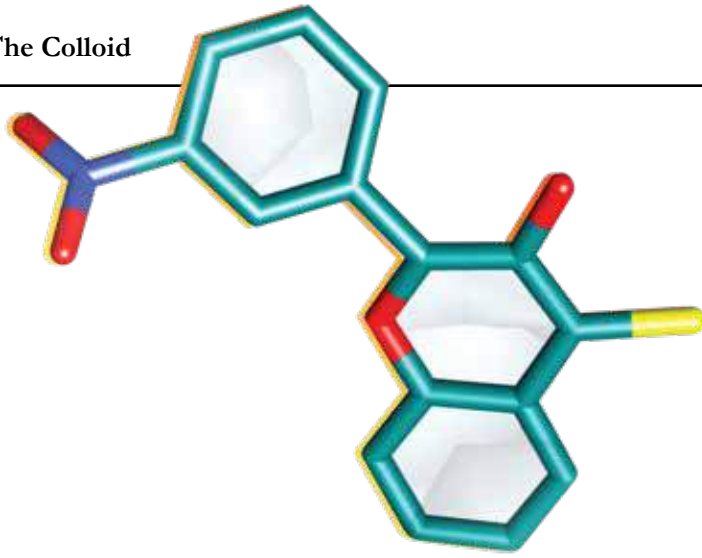
جیٹروفا کرکس، قدرت کا ایک انمول تحفہ

مصنف
زوہیب اسلم، ایم ایس کیمسٹری

اس ضمن میں جیٹروفا کرکس کا پودا اپنی منفرد خصوصیت کی بدولت قدرت کے ایک انمول تحفے کے طور پر سامنے آیا ہے۔ یہ واحد غیر خوردنی اور قابل تجدید بائیو ڈیزل پیدا کرنے والا پودا ہے جو ہر قسم کی زمین، اور خاص طور پر بنجر و صحرائی زمین کے ساتھ ساتھ انتہائی سخت و گرم مرطوب موسم میں بھی زبردست طریقے سے نمو پاتا ہے۔ اس کا بیج تقریباً 40 فی صد تک تیل کا حامل ہوتا ہے۔

جیٹروفا کے بیج سے حاصل کردہ یہ ڈیزل کیمیائی طور پر دراصل فیٹی ایسڈ میتھائل ایسٹر (fatty acid methylester) ہے جسے اس پودے کے تطہیر شدہ آئل سے ایسٹریفیکیشن (esterification) کے عمل کے ذریعے ایک عمل انگیز استعمال کرتے ہوئے گلیسرول کو گلیسرین کی شکل میں علیحدہ کر کے حاصل کیا جاتا ہے۔

قدرت کا ایک حسین تحفہ بائیو ڈیزل ہے، جو اپنی چند منفرد خصوصیات کی بدولت توانائی کے متبادل ذریعے کے طور پر عالمی سطح پر خاصی مقبولیت اختیار کر چکا ہے۔ ماہرین کا خیال ہے کہ اس کے استعمال سے زمین کچرے کا ڈھیر بننے سے شاید بچ جائے۔ ماہرین کے مطابق بائیو ڈیزل کی خوبصورتی یہ ہے کہ یہ پٹرولیم مصنوعات سے مکمل طور پر پاک اور ان کا ایک بہتر متبادل بننے کی بھرپور صلاحیت کا حامل ہے۔ لہذا اس کے استعمال سے گاڑیوں سے خارج شدہ بدبودار دھوئیں اور دیگر زہریلے مضر صحت کیمیکلز سے ماحول کو پاک کیا جاسکتا ہے۔



کورونا کی قینچی!

ڈاکٹر سعید اور ان کی ٹیم نے کورونا کی قینچی کو مفلوج کرنے والا ایک اہم کیمیائی عنصر ٹی-ایف-۹ کے نام سے دریافت کیا ہے جو کورونا وائرس کے مین پروٹیز کے ساتھ جڑ کر اسے بے اثر کرنے کی صلاحیت رکھتا ہے۔

ڈاکٹر سعید کا کہنا ہے کہ بد قسمتی سے پاکستان میں اس طرح کی تحقیق کرنے کے لیے تعلیمی اداروں کا بنیادی ڈھانچا کمزور ہے جس کی وجہ سے ادویات کے شعبے میں ہمارے تحقیقی مقالوں کا معیار بہت سطحی ہوتا ہے اور عالمی برادری میں ہمارے تحقیقی نتائج کو خاطر خواہ پذیرائی نہیں ملتی۔

ڈاکٹر صاحب نے مزید بتایا کہ ان چیلنجز کے باوجود لمز میں تحقیق کے لیے معاون ماحول موجود ہے جس سے تحقیقی عمل میں نہ صرف آسانی پیدا ہوتی ہے بلکہ اس کا معیار بہتر کرنے میں بھی مدد ملتی ہے۔ ڈاکٹر سعید نے یہ تحقیق اپنی پی ایچ ڈی طالبہ فردا بتول کی مدد سے مکمل کی۔ اس تحقیق کو مزید آگے بڑھانے کے لیے بین الاقوامی اداروں کے ساتھ اشتراک بھی حاصل کیا جا رہا ہے۔ ڈاکٹر سعید کا کام مندرجہ ذیل تحقیقی جریڈے میں شائع ہونے پر ہم ان کو مبارک باد پیش کرتے ہیں۔

حوالہ:

Synthetic flavonoids as potential antiviral agents against SARS-CoV-2 main protease, Journal of Biomolecular Structure and Dynamics,
DOI: 10.1080/07391102.2020.1850359

Farwa Batool, Ehsan Ullah Mughal, Komal Zia, Amina Sadiq, Nafeesa Naeem, Asif Javid, Zaheer Ul-Haq & Muhammad Saeed (2020) <https://www.tandfonline.com/doi/full/10.1080/07391102.2020.1850359>

کورونا وائرس کی عالمی وبا نے جہاں انسانی ترقی کا امتحان لیا ہے وہاں ہماری خود اراہیت کو بھی جھنجھوڑا ہے۔ ۲۰۲۰ کورونا کا سال تھا مگر ۲۰۲۱ اس وبا کے خاتمے کا سال ہوگا۔ دنیا بھر کے بہت سے سائنسدان اس وائرس کے طریق واردات کو سمجھ کر اس کو مفلوج بنانے کی کوشش میں مصروف ہیں۔ لمز میں ڈاکٹر محمد سعید اور ان کی ٹیم، جن کا تعلق شعبہ کیمیا و کیمیائی انجینئرنگ سے ہے، اسی عالمی کوشش کا حصہ ہیں۔ حال ہی میں ان کی تحقیق سے جڑی ایک اہم پیش رفت ہوئی جس سے یقیناً کورونا وائرس کو شکست دینے میں پیش رفت ہوگی۔

کورونا کی قینچی! جی ہاں۔ کورونا وائرس جب بھی کسی غلیے میں داخل ہوتا ہے تو اس کی پوری مشینری کو اپنے تابع کر لیتا ہے جس سے لاکھوں غلیے وائرس کی فوٹو کاپی مشینیں بن جاتی ہیں۔ اس طرح ایک کورونا وائرس نہایت چالاک سے اپنے جیسے ہزاروں وائرس بنا لیتا ہے۔

ڈاکٹر سعید اور ان کی ٹیم نے دیکھا کہ وائرس کو اپنی کاپی بنانے کے لیے اہم پروٹین کی ضرورت ہوتی ہے۔ جب یہ وائرل پروٹین بنتے ہیں تو کپڑے کے تھان کی طرح لمبے طرز کے ہو جاتے ہیں جن کو کٹائی کے بغیر استعمال نہیں کیا جاسکتا۔ یہ بالکل ایسے ہی ہے جیسے ہم ناپ کے مطابق کپڑا کٹواتے ہیں اور بقیہ کپڑا قابل استعمال نہیں رہتا۔ اس مثال میں جو کام درزی کی قینچی کرتی ہے وہ وائرس کا ایک اہم کیمیائی خامرہ کرتا ہے جسے مین پروٹیز کہتے ہیں۔ ڈاکٹر سعید کی تحقیق کے مطابق اگر اس مین پروٹیز کو روک دیا جائے تو کورونا وائرس ہر غلیے میں گھس کر اپنے جیسے مزید لاکھوں وائرس بنانے میں ناکام ہو جائے گا۔

Patent Approved!

NEWS STORY



Dr. Wasif Tanveer Khan, an Assistant Professor at the Department of Electrical Engineering, LUMS just got his invention patented, which will enable integration of antennas in embedded wafer level package with higher efficiency! His patent application has been approved by the US Patent Office (US Patent Number 10541464). We are thrilled to share this announcement with you!

emWLB is a technology that enables the integration of RFICs/MMICs, passive components and antennas at mm-wave frequencies (30-300GHz) with smaller interconnect loss compared to Flip Chip and wire bond technologies. Dr. Wasif and his team have patented a microwave antenna coupling apparatus that rivals contemporary antenna technologies that have narrower operating bandwidth and suffers from radiation pattern having ripples due to the nature of their design (presence of a thick mold compound). In this invention, a new way of embedding antennas in emWLB package along with various chips has been claimed with relatively better antenna performance. A few antenna coupling techniques in emWLB have also been claimed in this patent.

What's the big deal with microwaves, you ask? RF/Microwaves are everywhere and you probably would not have been able to read this article without information packets hitching a ride on them! (aka, your Wi-Fi). We use them to make calls and use internet on the go. However, you may have heard of 5G Communication. This is a technology that uses millimeter-wave frequencies and massive MIMO (Multiple Input, Multiple Output) technology and requires multiple antennas to be packed in a smaller form factor with higher efficiency. Automotive Radars at 77 GHz is another area where this technology can be effectively used. The antennas and antenna coupling techniques resulting from this patent will pave the way to design various types of antennas in embedded Wafer Level Packaging Technology at mm-wave frequencies.

This work was sponsored by Sony GmbH and the IP was developed at LUMS. LUMS, through an agreement, transferred the IP to Sony GmbH so that it can be used in their products.

***Congratulations to
Dr. Wasif and his team for
getting their patent
approved and issued by
the US Patent Office!***

Apogee of Ambition

Dr. Zubair Khalid, an Assistant Professor at the Department of Electrical Engineering at SBASSE, has been recently elected to the editorial board of IEEE Signal Processing Letters as an Associate Editor!

The IEEE (Institute of Electrical and Electronics Engineers) is a world renowned organisation for advancement of research in technology. It has more than 400,000 members, spanning over 160 countries. Dr. Zubair is no stranger to IEEE himself. Many of his research papers have been accepted to IEEE Transactions on Signal Processing and IEEE Signal Processing Letters, for publication.

We are very happy to share this wonderful news with the public to showcase how the apogee of our faculty's ambitions is not just limited to the campus. It is this ambition that creates a tether-less outreach of our faculty within the international community of researcher and scientists.

*Congratulations,
Dr. Zubair
Khalid!*

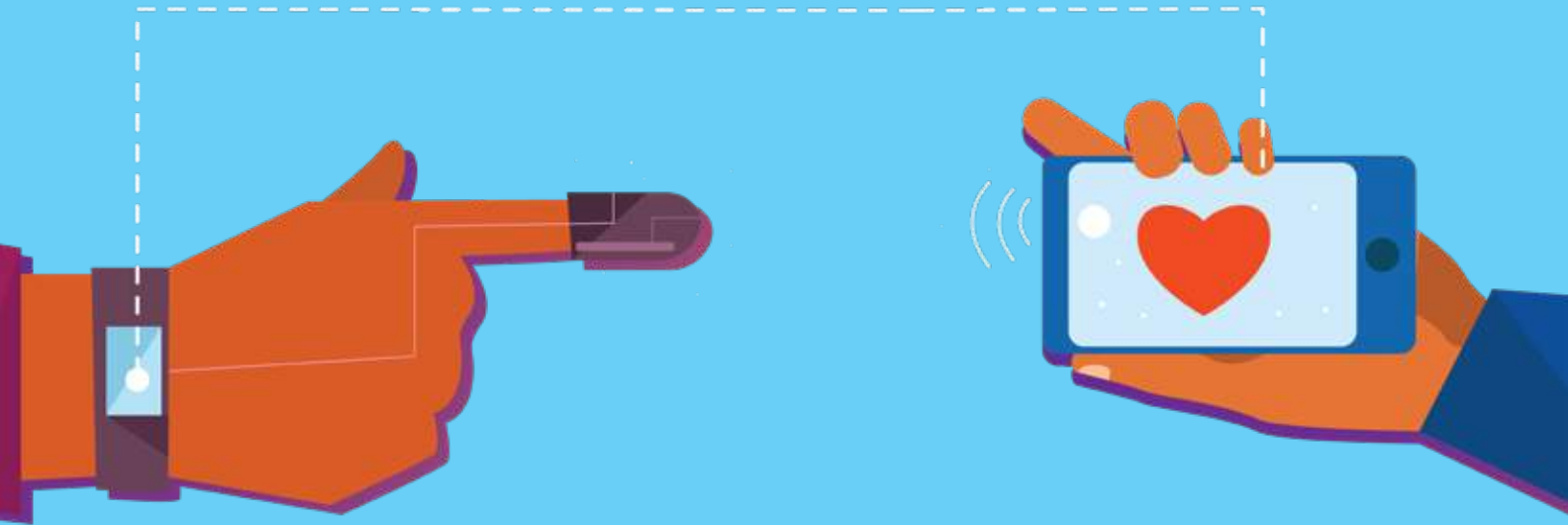


Complete Vitals Remote Monitoring Device

*Survival –
life lusts for it.*

Its strategies and decisions, from birth till death, are guided by survival. It is an instinct that's hard wired into every living being on this planet. Thus, it is the common denominator between us and the coronavirus. Both of us are united by the need to survive, thrive and spread. In this skirmish of biological dominance, human perseverance has been challenged and has contested its viral counterpart with fervour. At the forefront of the battle strategy are researchers like Dr. Wala Saadeh who are keen on helping COVID-19 patients deal with this terrible disease without making regular visits to the hospital environment, where they risk spreading the virus to others.

We are delighted to announce that Dr. Wala Saadeh has won a grant of USD 93,000 for her project to remotely monitor vitals of COVID-19 patients using wearable devices, thereby decreasing their exposure to a hospital environment, and helping reduce financial toils of regular hospital visits. This is poised to be the world's first complete vitals monitoring system-on-chip solution. Dr. Wala sees to develop a device that can measure and track a variety of vitals such as body temperature, heart rate and its variations, respiratory rate, blood oxygen level and blood pressure. This device will also be available to patients presenting symptoms of the common flu, asthma and non-COVID-19 related diseases like SARS, H1N1, etc.



Her grant comes as a result of her winning proposal for the Islamic Development Bank (IsDB) Engage Transform Fund. Her project was selected among the top 30 from around 5000 applications, worldwide.

*We offer our
heartiest
congratulations to
Dr. Wala Saadeh
and wish her
success in fulfilling
her wonderful
project.*



متحرک آکسائیڈ آئن، رواں بجلی

روایتی طور پر اس برق پاش کو ۷۰۰ سینٹی گریڈ کے درجہ حرارت پر رکھا جاتا ہے تاکہ آکسائیڈ آئنز کے لیے اس کی ایصالیت برقرار رہے۔ لیکن اتنے زیادہ درجہ حرارت کو طویل مدت کے لیے برقرار رکھنا SOFCs کے استعمال کو مشکل بنا دیتا ہے۔ اس مسئلے کو سلجھانے کے لیے ایک نئے قسم کے برق پاش پر تحقیق کی گئی جس میں آکسائیڈ آئنز کی ایصالیت کم درجہ حرارت (۶۰۰ سینٹی گریڈ) پر بھی برقرار رکھی جا سکتی ہے۔

پیرووسکائیٹ (perovskite) سے اخذ کردہ کرشل ($\text{Ba}_3\text{VWO}_{8.5}$) کی برقی صلاحیتوں کا جائزہ لیا گیا اور معلوم ہوا کہ اس میٹریل کو SOFCs میں بطور برق پاش استعمال کر کے مطلوبہ نتائج حاصل کیے جا سکتے ہیں۔ اس کرشل میں پائے جانے والی آکسیجن کی بے ترتیبی اس کی ایصالیت بڑھانے میں اہم کردار ادا کرتی ہے۔ اس تحقیق کی قیادت ڈاکٹر فلک شیر نے کی اور ان کی پی ایچ ڈی شاگرد اسماء گیلانی شریک مصنف ہیں۔ یہ تحقیق مندرجہ ذیل مقالے میں شائع کی گئی۔

شدید گرمی اور جس کے موسم میں باہر نکل کر کام کرنے کا دل چاہتا ہے؟ نہیں؟ آکسائیڈ آئنز (oxide ions) کا بھی نہیں! لیکن انسان اور آکسائیڈ آئنز میں ایک بنیادی فرق ہے: جب ہم زیادہ چلتے ہیں تو تھک جاتے ہیں، جبکہ آکسائیڈ آئنز حرکت میں آئیں تو بجلی بنا سکتے ہیں۔ جی ہاں! سائنسدانوں نے آکسائیڈ آئنز کی ”چہل قدمی“ کے لیے بہتر ماحول پیدا کر کے بجلی بنانے کا ایک ایسا طریقہ دریافت کیا جس میں صرف ہائیڈروجن، ہوا اور آکسائیڈ آئنز کی روانی درکار ہے۔ اس دریافت میں solid oxide fuel cells (SOFCs) کا مرکزی کردار ہے۔

یہ سارا عمل تین آسان اور مختصر نکات میں بھی بتایا جا سکتا ہے

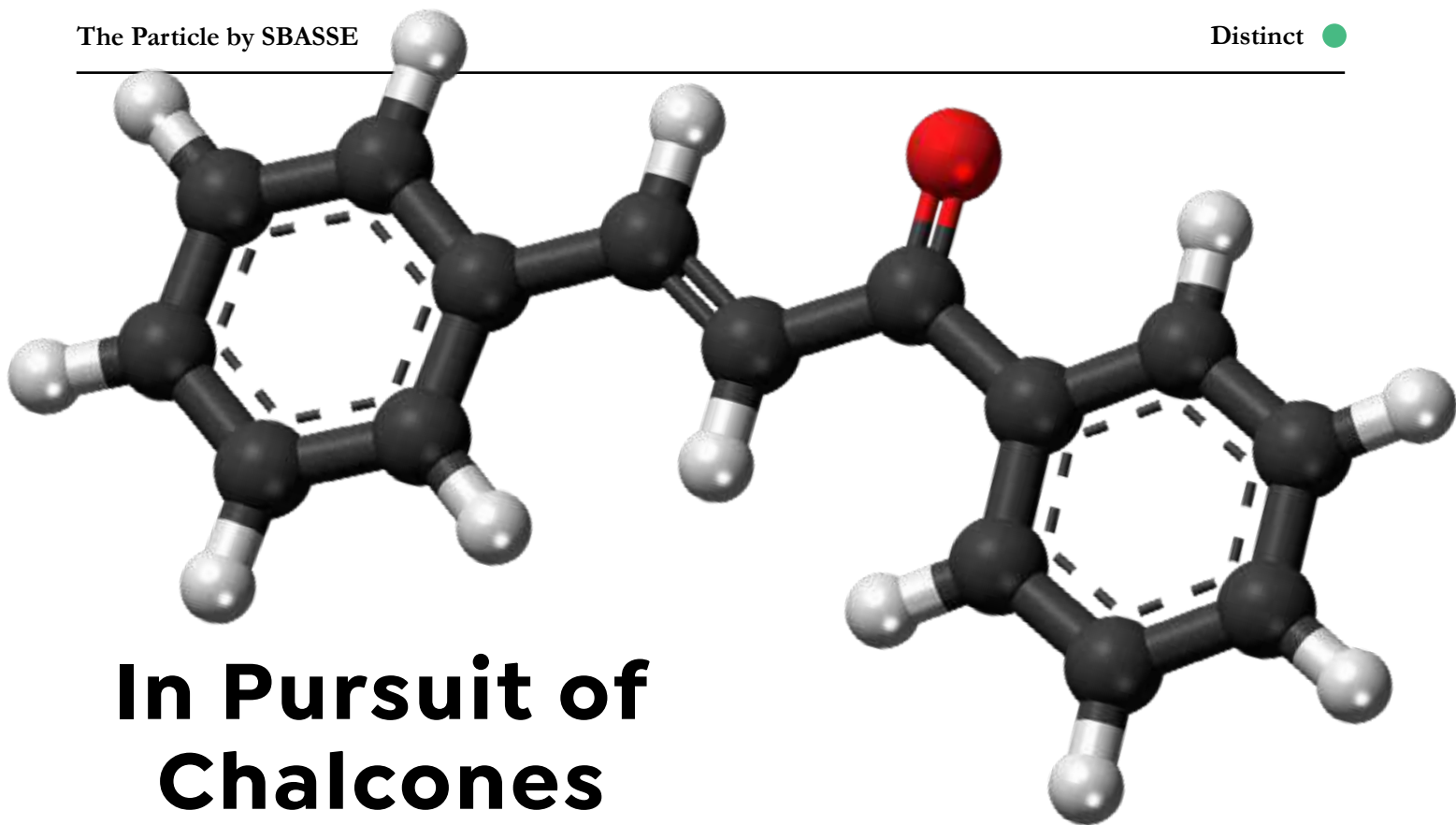
- ۱- ایک طرف ہائیڈروجن گیس کو توڑ کر ہائیڈروجن آئنز (H^+) بنائیں۔
- ۲- دوسری طرف آکسیجن گیس کو توڑ کر آکسائیڈ آئنز (O^{2-}) بنائیں۔
- ۳- ان دونوں کو ایک دوسرے سے ملا کر بجلی حاصل کریں۔

اس عمل کو بروئے کار لانے میں ایک بڑا چیلنج درپیش ہے۔ دراصل SOFCs سے بجلی بنانے کے عمل میں آکسائیڈ آئنز کو ایک ٹھوس برق پاش (electrolyte) سے گزر کر ہائیڈروجن آئنز سے ملنا ہوتا ہے۔

حوالہ:

J. Mater. Chem. A, 2020, 8, 16506-16514
(DOI: 10.1039/DoTA05581F)

<https://pubs.rsc.org/en/content/articlehtml/2020/ta/dota05581f>



In Pursuit of Chalcones

What have you been up to during the COVID-19 lockdown? The battle of attrition between headspace and work routine has exhausted many, but motivated others. To err on the side of caution while staying home is surely safer for the body, but it has left the mind and the intellect unfulfilled. During this time, Rimsha Irfan and Shikufa Mousavi, who are SProj students of Dr. Rahman Shah Zaib Saleem, ventured out on an intellectual pursuit of fulfillment to gather literature on 300+ magical molecules known as Chalcones.

Initially led by Rimsha, the effort soon saw Shikufa join in. They worked to find and assemble a detailed literature on Chalcones, a family of plant derived compounds that are famous for their diverse application portfolio. Their effort culminated in the form of the publication of a review article titled “A Comprehensive Review of Aminochalcones”, in the open access journal *Molecules*. Structured like two rings attached with a thin bridge, Chalcones find important health applications in anti-cancer, antiviral, antibacterial, anti-inflammatory and antioxidant immunomodulation.

The work of Rimsha and Shikufa can be seen here for further reading:

Irfan, Rimsha; Mousavi, Shikufa; Alazmi, Meshari; Saleem, Rahman S.Z. 2020.
“A Comprehensive Review of
Aminochalcones.” *Molecules* 25, no. 22: 5381.
<https://doi.org/10.3390/molecules25225381>

So, what have you been up to during the COVID-19 lockdown?

Shikufa Mousavi

Rimsha Irfan



Critical Combo

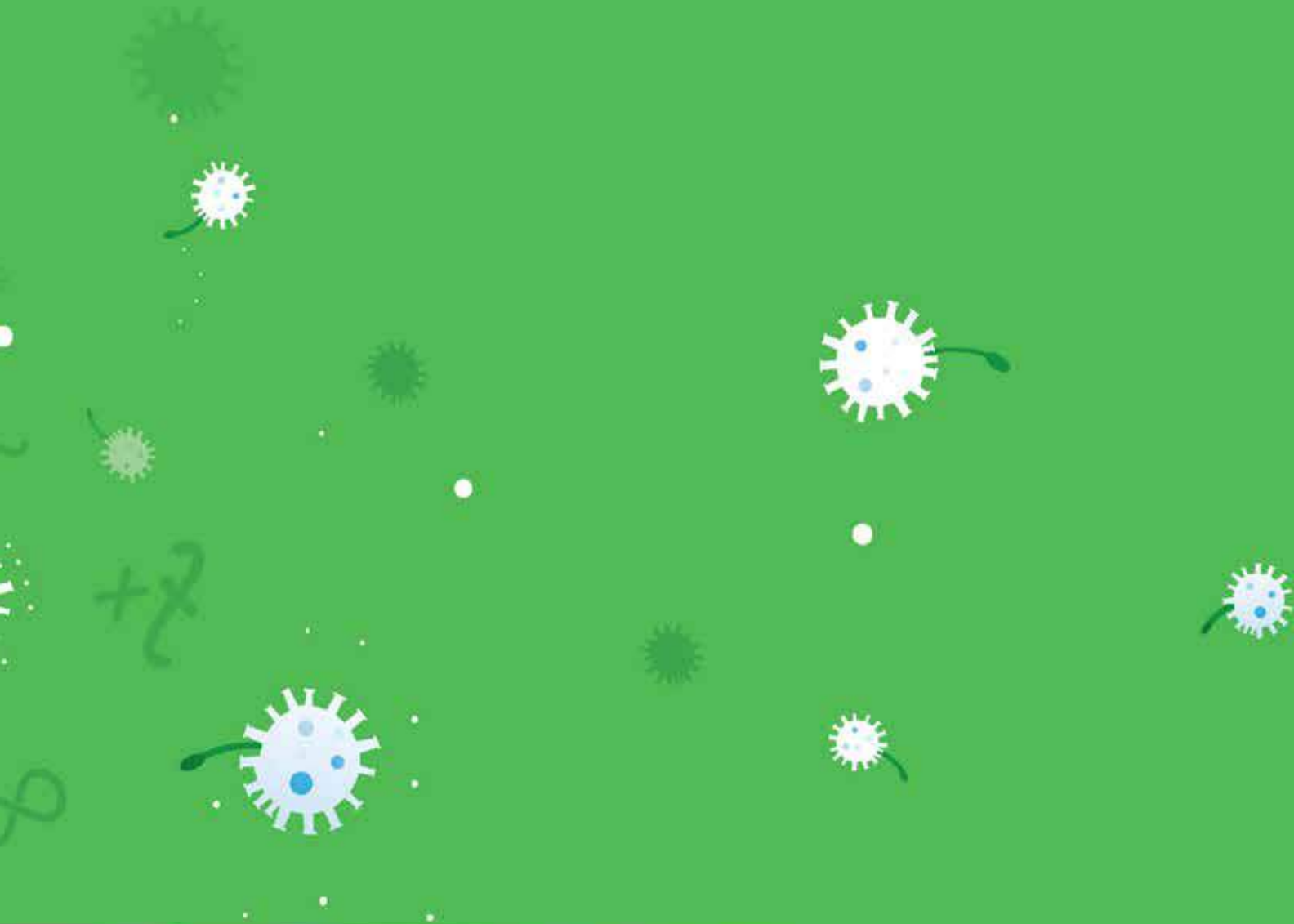
COVID-19 & Mathematics



The COVID-19 pandemic has pushed us all back to the drawing board to reconfigure our strategy for healthcare monitoring and preparedness. Like a commander watching his battalion in need for a massive backup, we have explored backup plans, deployed rapid response measures and have invested a fortune to try and understand more about the transmission, progress and management of this disease. At last, we're bringing math to the mix!

Mohsin Ali, from the Department of Mathematics, SBASSE, LUMS, along with Adnan Khan have been part of a team who've scrutinised transmission dynamics of COVID-19 through mathematical modelling and have tried to understand the significance of pharmaceutical intervention in the deployment of a strict lock down, which may help guide public healthcare policy.

Using realistic parameters in rate and efficacy of treatment through medication, the team learned that the time for quarantine is significantly reduced and that quarantine may still be needed albeit for a smaller, more specific



population. The study compared control strategies (quarantine and isolation) both when medication was available and when it is not. In terms of coming up with theorems, using beautiful but complex equations to gauge parameters and to visualise results with beautiful plots – no stone was left unturned. From the theory of optimal control by Lev Pontryagin, to developing R_0 , a parameter that shows status of the outbreak in the model – this detailed study has concluded that premature relaxation in lockdowns and social distancing will result in greater disease numbers and has recommended against this relaxation.

This work is published in the journal 'Letters in Biomathematics' and can be found here: <https://lettersinbiomath.journals.publicknowledgeproject.org/index.php/lib/article/view/365>

Reference: Ali, M.; Imran, M.; Khan, A. COVID-19: Can Medication Mitigate the Need for a Strict Lock Down?. Lett. Biomath. 2020.

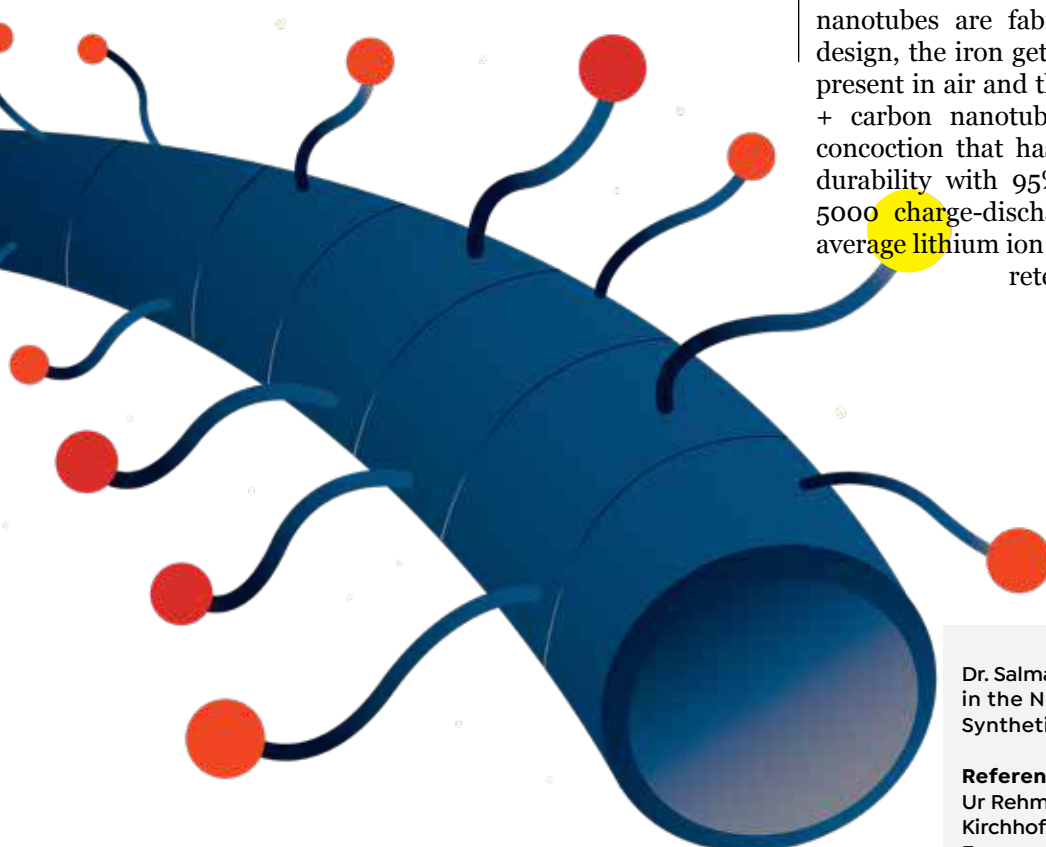
Supercharging Battery Tech with Nano Technology!

It is the bane of our modern-day existence – dying batteries! Batteries, which are essentially another name for capacitors, are everywhere; from mobile phones, laptops, toys, cars and a plethora of portable electronic devices – in fact, you're probably reading this on one right now. Batteries are a lot like any other consumable, they deplete over time and akin to the end-user, get weaker over time too. The multi-billion-dollar electronics and tech industry cannot wait for the next breakthrough in battery technology. This research might have had the ball rolling and we are extremely excited to share this with you!

Dr. Salman N. Arshad (Department of Chemistry and Chemical Engineering) has been working to re-imagine

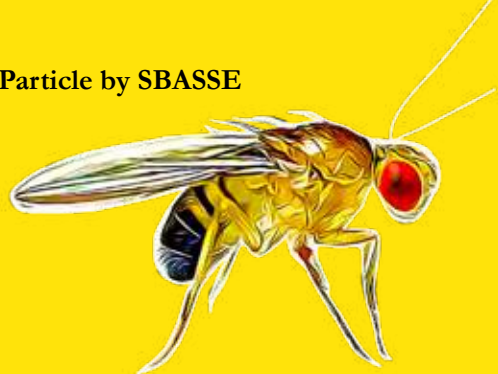
battery tech from the ground up to help alleviate us from the conundrums of current battery technology. His research focuses on developing carbon-based electrode material for an increase in specific capacitance and charge retention. But there's more – his team has developed a method where carbon nanotubes, nanofibers and iron oxide work together in a beautiful display of chemistry to produce desired results for capacitance retention.

Through what seems a microscopic miracle, Iron nano particles are fabricated on to carbon nanotubes through a process called chemical vapour deposition. The resulting contraption looks a lot like a matchstick (an iron blob sitting on top of a thin carbon nanotube). Millions of these tiny iron-encapsulated carbon nanotubes are fabricated to a carbon nanofiber. By design, the iron gets 'rusty' or oxidised through oxygen present in air and this resulting apparatus of iron oxide + carbon nanotube + carbon nanofiber is the key concoction that has been shown to exhibit long term durability with 95% capacitance retention even after 5000 charge-discharge cycles. Compare this to your average lithium ion battery that falls to well below 70% retention after that many charge cycles.



Dr. Salman's research paper will be published in the November 2020 issue of the journal Synthetic Metals.

Reference: Faryal Aftab, Shahid Tanveer, Shahid Ur Rehman, Samina Ghafoor, Hatice Duran, Katrin Kirchhoff, Ingo Lieberwirth, Salman N. Arshad, Encapsulation of Fe/Fe₃O₄ in carbon nanotubes grown over carbon nanofibers for high performance supercapacitor electrodes, Synthetic Metals, Volume 269, 2020, 116575, ISSN 0379-6779.



Using Flies to Fight Colorectal Cancer

The fruit fly is a celebrated veteran guinea pig for research in genetics. This infamy results from its large chromosomes, numerous varieties and rapid rate of reproduction. Recently, this mundane insect has helped with finding a therapy to fight the onslaught of colorectal cancer!

Imagine cancer not as a disease but as a prisoner on the run; chances of escape increase if there are seldom check posts in its way. The 'check posts' here refer to a complex system within the body to regulate and, well, keep a check on cell growth rate. Too high a rate and we risk onset of cancer. Sometimes, however, help from the military is deployed to put an end to the prison escape.

Working at the Biomedical Informatics Research Lab (BIRL) in Syed Babar Ali School of Science and Engineering, Dr. Safee Ullah Chaudhry and his team have discovered a new way to put an end to erroneous cell growth of very specific cells, in this case, cells that cause colorectal cancer. However, not all colorectal cancers are made alike. Dr. Safee Ullah's team also worked on patient specific mutation data along with combinations of therapeutic drugs, specifically Zoledronate in combination with Trametinib, to come up with up a model that will help better understand the highly elusive and variable nature of colorectal cancer's genetic genesis.

The preprint of this work can be seen at:

<https://www.biorxiv.org/content/10.1101/2020.08.31.274829v1>

Bind, Block and Bury

*Research grant to help block
SARS-CoV-2 viral proteins*

Raise the fences – increase defenses. Block infiltration, stop proliferation. These are one-point agendas that guide Dr. Shahzad ul Hussan's latest work to arrest the workings of SARS-CoV-2 virus (more popularly known as 'the coronavirus' these days). Dr. Hussan is working to find a molecule that can bind to either of the viral proteins; RdRp, 3CL-protease and helicase, to help disable the sinister virus and its hopefully end its terrible reign.

However, first things first - our sincerest congratulations to Dr. Shahzad ul Hussan for receiving the Shahid Hussain Public Health Research Grant 2020, for "Discovery of New Potential Therapeutics Against Coronavirus by Targeting Viral Cellular Entry and Replication". In simpler words, Dr. Hussan is looking to find ways to 1) prevent the entry of the SARS-CoV-2 virus into the human body and 2) stop it from multiplying if it gets inside.

Dr. Hussan established the Biochemistry and Structural Biology (BSB) lab at the Department of Biology, SBASSE, which helped his past work in discovery of drugs related to HIV and Hepatitis C. He believes this laboratory, and the grant he has received, shall help him conduct further research to figure out a that one killer molecule, disabling the normal workings of SARS-CoV-2. We wish Dr. Shahzad ul Hussan the very best in his search to find the 'COVID killer' molecule.

ICC-Accredited Cricket Lab at SBASSE

Another First for LUMS

Cricket is considered to be Pakistan's unofficial national sport. Our emotions always run high when we see our players fighting the cricketing battle fiercely with worthy opponents. Each sixer and each wicket sends euphoria through our bodies and makes us leap out of our seats.

However, it is also a harsh reality that Pakistan's cricketing history features scandals and controversies, many a time to do with illegal or suspicious bowling actions. There had been no

way to evaluate the bowling actions when a player rose through the ranks from first-class cricket to representing Pakistan on the international stage. It was usually at the international stage that cricketing authorities discovered the bowling actions to be suspicious. Not only did that ensure the end of several promising cricketers, it also brought a bad name to Pakistan on the international sporting stage.

It is in the context of all this that SBASSE decided to

partner with the relevant agencies and decided to make history in Pakistan once again by opening the country's first-ever Cricket Lab.

It was a matter of great honour for SBASSE when, on July 2, 2019, The International Cricket Council (ICC) announced the accreditation of the Cricket Lab as a testing centre for suspected and illegal bowling actions.

The main aim of setting up this lab was to analyse the actual performance and technique of



the domestic players so that, before they were picked to represent the country in an international match, the deficiencies in their technique were identified and corrected.

In order to do that, two high-speed cameras, capable of at least 250-fps, were placed at both ends of the bowling pitch—these cameras record the bowler's action from front and behind as the bowler performs his delivery. A side-camera is also allotted to video-record the action. Two supplementary Infra-Red (IR) cameras which are placed around the pitch are made to capture the reflective-material-made-markers which are placed on the body of the player before the test starts. These critical data are then measured through the full set of software that is provided by the ICC to the SBASSE—this guarantees a consistent assessment of bowlers according to the same criteria that

are applicable the world over.

Similar testing services elsewhere cost approximately \$8000 to \$10,000 per player.

However, at the LUMS Cricket Lab the cost per player would be significantly reduced.

The Lab is in the process of reaching to an agreement with Shalimar Hospital, Lahore, where they will work with physiotherapists and doctors to resolve the various physical problems faced by players. A few students from the Shalimar Teaching Hospital have already written their theses on the work being done at the Lab. In the future,

Dr. Muhammad Awais, Professor of Computer Science at SBASSE, sees more engagement with the students as well as the doctors at the Hospital. The Lab is also helping different students and beneficiaries from the Punjab University Sports Department and a few PhD candidates from the University of Lahore who have approached with a request for data for their theses.

Dr. Nadeem Khan, Associate Professor of Electrical Engineering at SBASSE, is working on biomedicine and is heavily involved in the Lab where he and Dr. Awais have conducted overlapping projects through a few EMG devices. Dr. ImdadUllah Khan, Assistant Professor of Computer Science at SBASSE, is also actively involved with the Cricket Lab on account of his interest in Sports Analytics.

In order to build a human resource infrastructure for the future in the fields of sports analytics and 3D motion animations, the Lab is in the process of designing short summer courses—with help from the LUMS Centre for Continuing Education Studies—which will be open to students from a wide range of fields and at different stages in their education. This will help build a culture of sports analytics in Pakistan.



Photograph by
Muhammad Naeem Ur Rehman

Makers Lab

Let's Build Dreams!



Fatima Ventures Makers Lab has been established at SBASSE, LUMS, with the generous support from the Fatima Group.

Makers Lab is a set of 5 labs, built to create a nurturing environment for innovators. Makers space is laying the foundation for some ground-breaking cultural changes by striving to spawn makers culture in Pakistan.





The labs help researchers, students and start-ups to empathise towards problems and rapidly prototype solutions. Various types of facilities including machining, building electronic circuits, 3D printing, wood and metal power tools are available under one roof to cater to your prototyping needs. Makers Lab is perfect for you, if you are a start-up, a hobbyist, a product designer or just someone who likes to surround themselves with likeminded people who have a knack for problem-solving.

Lab facilities include; CNC Lab, 3D Printing Lab, PCB Lab, Wood Lab, Metal Lab.

Membership Benefits

- 1- Access to the makers space from 9 am - 6 pm.
- 2- Free to use hand and power tools.
- 3- Discounts on trainings in Makers Lab.
- 4- Free access to embedded systems, dev boards and robotics kits.
- 5- Free 3D scanning, plotting and vinyl cutting.
- 6- Trained members can operate machines and get technician charges waived.
- 7- Discounts on materials, machine and technicians' charges.

For more details, please contact:
+92 42 3560 8537

Email:
arsalan.mirza@lums.edu.pk

Website:
niclaware.lums.edu.pk/makers-lab/



Course on Classical Genetics!

Learn what makes you, you. Dive deep into the mind-boggling world of genes and broaden your perspective on life as we know it



Earth - a biosphere. A complex, subtly balanced life support system. It is home to us, our ancestors and everyone you've ever known or will ever know. On it, most life looks nothing like its biological peers. Every specie is different, every face – like no other. Life owes this beautiful and fascinating diversity to a complex set of instructions, buried deep within itself. We are an expression of the wishes of our genes. We are the physical manifestation of genetics.

The beauty of being a passionate educator is in imparting knowledge. Hence, the Department of Biology at SBASSE has introduced an online course on Classical Genetics by Dr. Muhammad Tariq, that will take you on a genetic journey beginning with introductory topics like heredity, variation, alleles – all the way to the netherrealm of mutations. The course offers a detailed study on bacterial mutants generated through transposon mutagenesis and how bacteria can exchange genetic material through transformation, conjugation and transduction.

Classical Genetics is a 221 level course that has been carefully designed by Dr. Tariq to cover basic, yet important topics which students from both within and outside of LUMS can benefit. The course is available on YouTube and can be revisited on demand. It offers clarification, in-depth insight and detailed analysis of a multitude of subtopics and concepts, which are an essential requirement for sophomore students.

Introduction to our 4-billion-year-old legacy and heritage

Introduction to Environmental Science

“Leave the planet better than you found it”.

Does that ring a bell? Have you read this before? Although we are an insignificantly small twig on the grand tree of life, watered and nurtured by mother Earth, the acute protection of Earth's biosphere is among our most cardinal responsibilities to nature. If we are to become a responsible citizen of the planet, understanding the tightly intertwined coexistence of life and its environment is obligatory. It is like parting the curtains of ignorance and taking a peek into realisation that as much as the environment depends on what we do to it, we depend much more critically to what it does to us.

Dr. Fozia Parveen's online course titled Introduction to Environmental Science, SCI103 for short, is therefore your gateway to an aware, more responsible and sincere citizen of the greater biome we all share. The discussions are extremely friendly, student-centered and engaging. The course includes lectures on the biosphere, biotic and abiotic ecosystems and a range of different types of environments that exist (terrestrial, aquatic, marine and freshwater). From the study of soil and air to how waste disposal is a shaping up to become a looming threat for our future generations' health and well-being – the course also includes



discussions on our local environmental problems and how global best practices can be morphed to suit our local needs and limitations. The course is an important component of the undergraduate programme at SBASSE.

Of all our doing in this brief phase of life and awareness, we are but to return the debt we have accumulated from consuming the flora and fauna

over our lifetime. By helping establish a sense of community between the student and their larger environment, this course hopes to waft our sense of wonderment and responsibility to preserve this ecosystem and leave it indeed better than we had found it.

Course on differential equations, *which capture change, is now accessible to everyone, and might change how you look at the universe around you!*

We use them to predict progression and regression of disease, how well your favourite smartphone did against the competition, the way plasma twists and turns on the boiling, roiling surface of the Sun and if you ever feel like figuring out the age of the Earth itself.

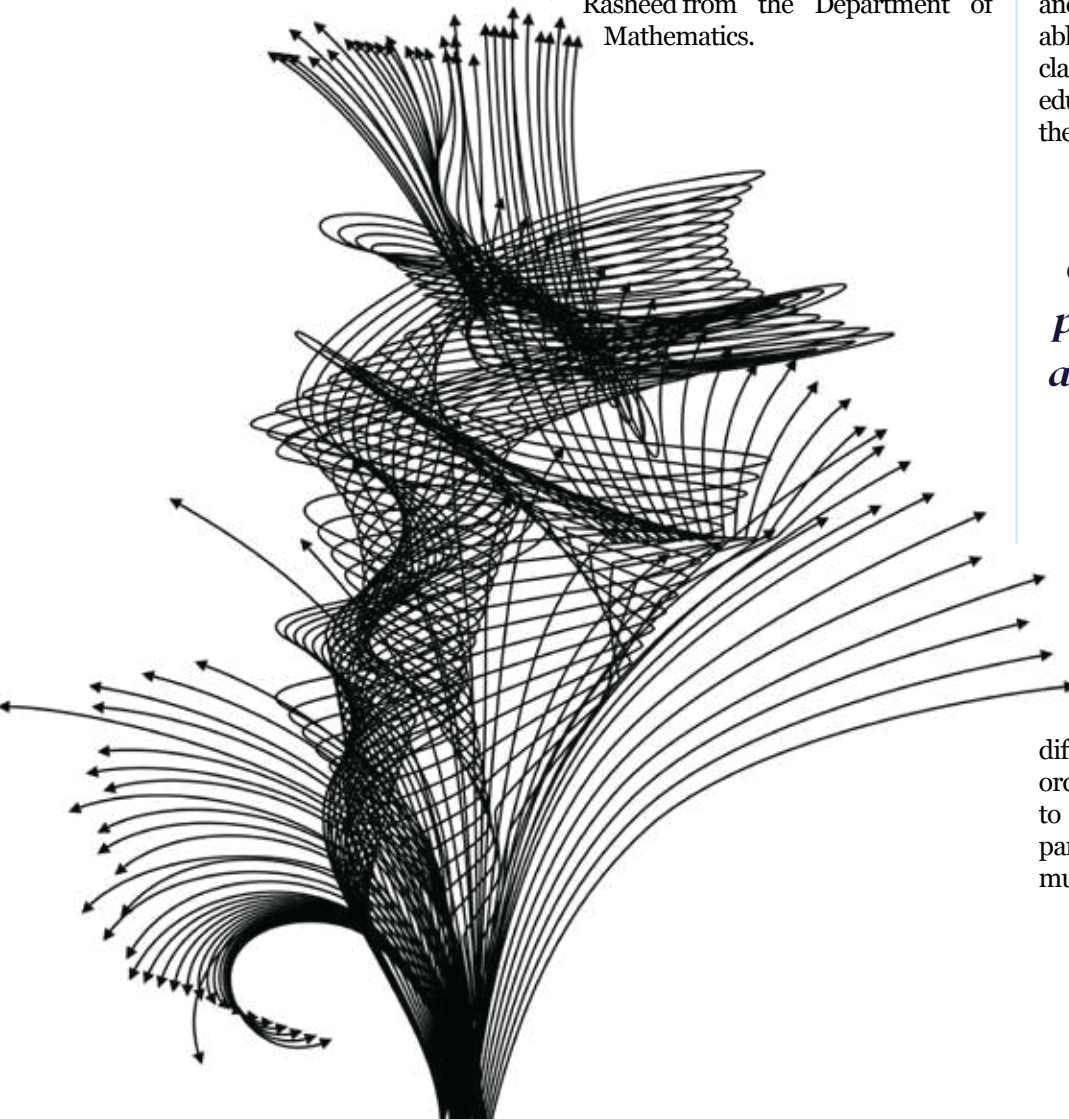
Welcome to the world of differential equations! Oh and, if they get too hard – we can always use graphs and pretty plots to look at their solutions.

Say hello to the world of differential equations, recordings of a class, presented on YouTube by Dr. Amer Rasheed from the Department of Mathematics.

Dr. Amer Rasheed, who uses differential equations to make a living, took inspiration for his teaching in this covid impacted semester, from classrooms filled with empty chairs and silence and decided to create content that could be delivered to a broader audience both inside and outside of LUMS. Dr. Amer was able to achieve this through smart class technology that can make education outreach easy, even from the confines of a physical classroom.

We believe that this course will help many physics, mathematics and engineering majors through its free distribution on a public platform.

In SBASSE, LUMS, this is a required course for many physical science and all maths students. The course deals with first order differential equations, system of first-order linear equations, introduction to special functions, Fourier series, partial differential equations and much more!



NMR Training Internship Programme

*Mammoth Tools
to Uncover the Microcosm*

Want to know how scientists figure out the structure of complex molecules like proteins, and come up with their 3D structure?

We are offering an opportunity for you to get hands-on experience with state-of-the-art mammoth machines that help us understand the microcosm, right here from the SBASSE.

Two positions are open for BS students of SBASSE, for a training internship on the state-of-the-art NMR machine! This is your chance to learn how data from this beautiful equipment is acquired, processed and interpreted. This extensive training programme will require internees to work for 10 hours/week in the NMR lab, per semester. After an evaluation at the mid and end of the semester, successful internees will receive their training certificate. Internees will receive an honorarium of Rs. 20,000 after the completion of training.

Please send your application consisting of your brief CV and a paragraph about your motivation for acquiring this training, to Dr. Adil Raees at adil.raees@lums.edu.pk





حریر و تصنیف

BELLE LETTRES |

Sights of Earth

By Syed Roshaan Bukhari

Shades of colour in the sky,
Shift from zenith to sea,

Poets of this world float,
Above the flowering fields; free,

Specks of light through high clouds,
Some stay still, others wander afar,

Violet, orange shades of bliss,
Time ticks slowly in this abyss,

Curiosity drives them to a voyage,
Wonder turns to worry, travellers disappear

Violet, orange fades to black,
Gloom, fear, dread; there's no turning back,
Remind yourself of home one last time,
Chirp, rustle, hymn,

Fields of Tulips, fields of grass,
Memories of a distant past,

Of what purpose are these to you?
A place of peace, a familiar hue,

You long for the place of your birth,
Scents, soil, the sights of Earth

Photo: Artist's rendition of an approach to a black hole.



ذره

The Particle

ذروں کا آسمان، ذروں کا بحر بھی
ذروں میں ہے پنہاں تصویرِ ابدی

تابندہ و پُر نور ہے ہر ذرہ تخلیق
جلوت میں ستارہ تو خلوت میں موتی

زمانے سے بے گانہ وجودِ قائم عالم
نمودِ دہر بھی برپا روزِ حشر بھی

بیدار ہے ہر خاک سے جسینِ نیاز
ملتی نہیں سادہ آسرا کی آگہی

یاور عباس بخاری

Photograph of the star Sirius.

The colourful trail is a result of twinkling, as the distant star light enters the turbulent atmosphere of Earth, scattering its light into constituent colours.

Ghulam Sarwar: *A Disciple of Passion*

Mr. Ghulam Sarwar belongs to Renala Khurd, a small suburban city within the Okara district, where he completed his matriculation.

He went on to complete his F.Sc from his neighbouring city of Okara, a B.Sc from FCCU Lahore and an M.Sc in Physics from GCU Lahore. He didn't stop there and continued to pursue higher education from the University of the Punjab where he completed his M.Phil. in micro electronic engineering and semiconductor physics. Mr. Sarwar is currently pursuing his Ph.D. from GCU Lahore in piezoelectric materials, while working at LUMS as a Scientific Officer at the Central Lab in SBASSE.

What keeps you up at night? Have you discovered what makes you happy? Are you driven by a constant barrage of insatiable curiosity to know and learn more? Are you passionate about something? For Ghulam Sarwar, the answer is a resounding yes! This is a glimpse into the story of Mr. Ghulam Sarwar Butt – a passion-driven omnivore for learning.

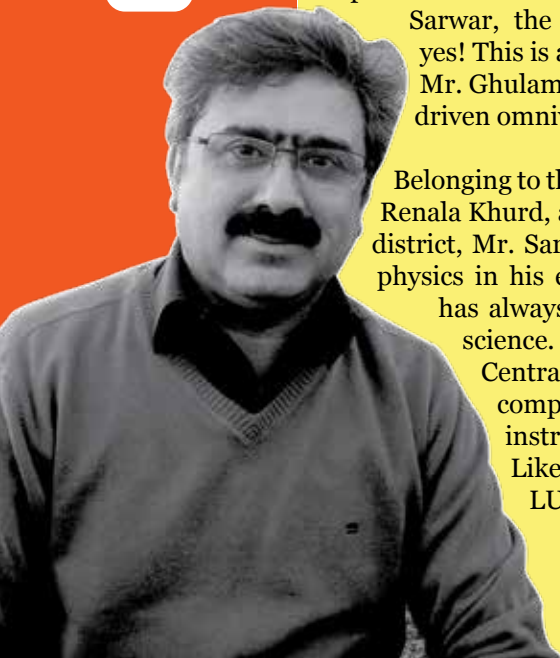
Belonging to the quiet, sub-urban city of Renala Khurd, a small town in the Okara district, Mr. Sarwar developed a love for physics in his early education days and has always been an avid learner of science. He currently works in the Central Lab at SBASSE, working complicated, state of the art instruments and machines. Like many others working at LUMS, is bathed in a vigour

for understanding how things work, particularly how instruments work. He fervently pursues hard work and is very fond of troubleshooting problems, finding solutions and coming up with ways, on a self-taught basis, to fix his beautiful machines in the Central Lab. Mr. Sarwar currently operates 3 main instruments; the Vibrating Sample Magnetometer, Plasma Etcher and the Probe Station, in addition to managing data for gas cylinders to facilitate researchers at the PhyLab and the Central Lab.

For some, passion takes a heavy toll on the body and the soul. For Mr. Sarwar, it has been the opposite. His passion has made him joyful. Happier!

Mr. Sarwar's friendly personality and his highly enthusiastic and optimistic outlook on life is contagious and can be traced to the buoyancy one experiences when afloat in a sea of like-minded people, innovative research and a very solid support system, that lets one grow personally and professionally. Recalling one of his fondest memories at LUMS, Mr. Sarwar told us how he and Dr. Sabieh Anwar sat on the floor of the central lab, legs crossed, figuring out a way to fix the vacuum pump on the notorious Vibrating Sample Magnetometer.

Mr. Sarwar believes that innovation requires freedom and facility. He feels that LUMS has a very strong support system that enables this facility by encouraging exploration of problems and a complete freedom to finding solutions. Mr. Sarwar credits Dr. Sabieh Anwar for this enabling environment and making his workplace a happy place!



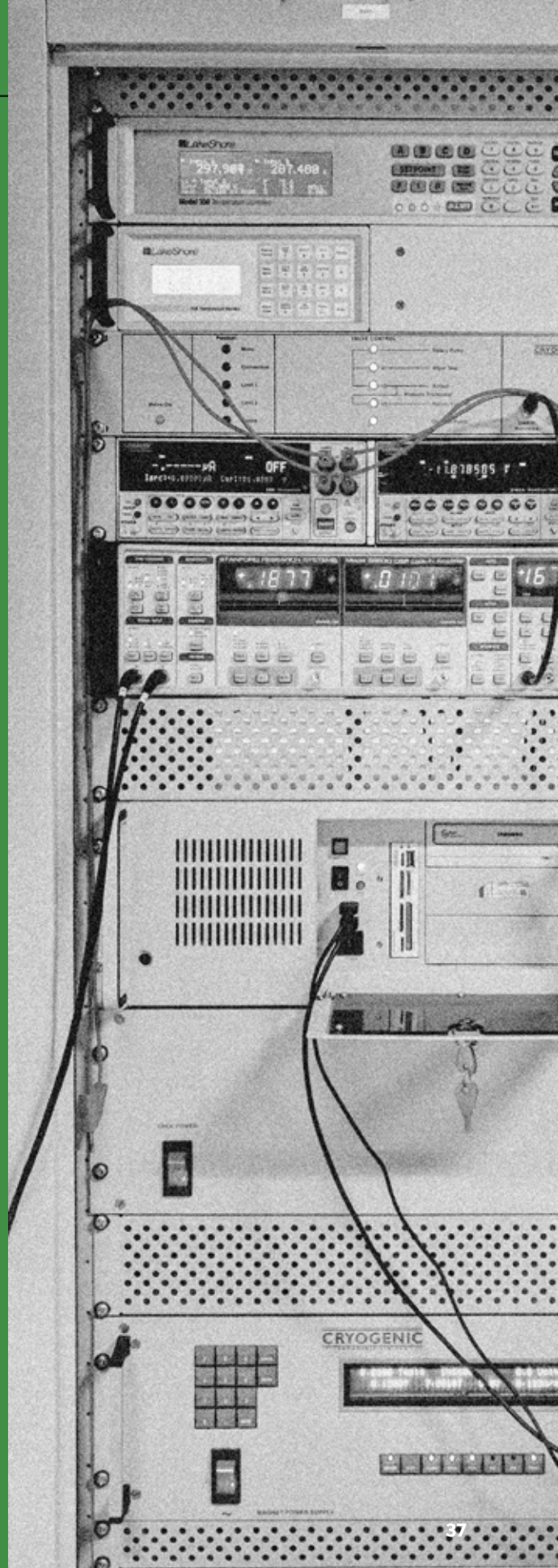
Facilities: *Magnetisation measurements*

The SBASSE is now accepting samples from the academic and industrial communities for magnetic characterisation using vibrating sample magnetometry (VSM).

Various Kinds of metrology is possible including hysteresis loops as well as field and zero field cooled measurements. We can achieve temperatures of 5 K and bipolar magnetic fields of 7T.

For more details:


<http://centrallab.lums.edu.pk>





Three High- Mountain Passes In 15 Hours

Mansoor Cheema



Please note that I am a professionally trained solo biker and mountaineer and have undergone several mountaineering exercises, survival training and climbing courses. Please do not try such adventures without rigorous training and experience.

© MANSOOR CHEEMA

Since 1997, I have completed many amazing adventures on motorbikes. I have always been interested in exploring the beauty of Pakistan's wild mountain terrains.

During these adventures, I came across extreme situations in the north, such as blizzards, extremely low temperatures, high altitudes, and difficult survival conditions.

Despite all this, I decided to undertake a journey that no solo biker had hiterto attempted. I crossed three high-altitude passes in one go, in less than 15 hours. The three passes included: Noori Pass (altitude 3959m); Batooga Pass (altitude 4300m approx.); and Babusar Pass (altitude 4173m). Here is the full story.

As a solo biker and trekker, it is crucial to choose the right bike and right gears. As someone who has a preference to use strong bikes for extreme adventures, I chose Suzuki GS 150 SE for this particular adventure. With a high power engine, one could easily manoeuvre it on rocky tracks. I named my companion on the road *Markhor*—after all, a Markhor too can climb any peak.

My aim was to cross all three passes—Noori Pass, Batooga Pass, and Babusar Pass—in a single attempt. Three different altitudes in three different directions. This is how I planned my route: Day 1, Lahore to Azad Kashmir Sharda and stay at the village Surgan; Day 2, Surgan to Noori Pass to Jalkhad, Jhalkad to Batooga pass to Chillas city, Chillas city to Babusar Pass to Jalkhad, stay at Jalkhad; Day 3, Jalkhad to Lahore.



I packed my survival kit, the first aid kit, and my camera, and started my journey from Lahore at night around 10:00 pm. Leaving the buzz of Lahore and getting into the silent range of the mountains is an experience in and of itself. I had waited for almost three years for the weather on these passes to become clear long enough for me to be able to cross them in a single attempt.

Crossing different cities and villages, I ended up in a small village of Azad Jammu & Kashmir, Surgan. It is almost 11km away from Sharda and a great place to visit. It was a very peaceful and beautiful landscape, and the people were humble, loving, and caring. A total population of 20,000, it was a memorable place to visit. I had a night nap there and left for the ultimate adventure right after Fajr prayers, around 5:00 am in the morning.

Facing the cold breeze of mountains, jumps, and hurdles, I reached the beginning of the road to Noori Pass. I found that there was no bridge on the whole 48km long pass. There were almost eight water crossings, out of which



three of them were deep water crossings without any bridge, and therefore quite deadly. Ascending through steep angles of the road and jumping on an extreme off-road track, the altitude started increasing thereby lowering oxygen levels. Not only is an active supply of oxygen crucial for breathing, it is also required for the bike's engine combustion. With a high RPM rate and an extremely slow speed, I gained the required altitude within a couple of hours.

Such passes are full of extreme off-road bike adventures, including water glacier crossings. They can be deep and freezing cold without any mercy. I crossed one of the most difficult on the 12th attempt, where

many jeeps were stuck earlier due to big boulders and deep water. I was able to cross this off-road nightmare by riding out of the saddle but still I was waist-deep in water; I then used the inertia of the bike by entering into the freezing cold-water flow which pulled my bike out. With frozen legs, I managed to ride back on the track to meet the final crazy turns. My *Markhor* climbed in full thrust, raining down the sharp-edged stones by spinning the tyres over the track. I finally managed to reach the top, a moment of relief and joy. It was 8:15 am when I crossed the pass and now I needed to rush to Jalkhad.

At 10:15 am, I arrived at Jalkhad to refuel my *Markhor*—and myself. I

left Jalkhad around 11:00am for Batooga Pass and it was more difficult than the ones I had crossed before.

After crossing the bridge (on the left side) at Gatidas, the whole scenery turned brown from green—it was a barren, rocky mountain range, an off-road track with boulders and a hot sun but with a cool wind. A very beautiful mountain range, less exposed to the tourists. After crossing the second bridge, the terrain became more difficult. I found no path to follow; clearly, on the rocks, I was driving the bike with non-stop bumps. Those couple of hours were really challenging, with water crossings making it even harder.

After a huge struggle, I finally managed to reach the top. It was a beautiful pass where I then stood alone and admired God's creation. I experienced the ultimate nature of reality. There are six lakes in the surrounding; I saw just two lakes and then started descending toward Chillas. I was the first one to have crossed this high pass alone on the bike—a record in the biker community.

I left the village and around 4:35 pm I reached Chillas city. My aim was to complete this journey within the next five hours and so did not do a stopover. My *Markhor* ran fast in

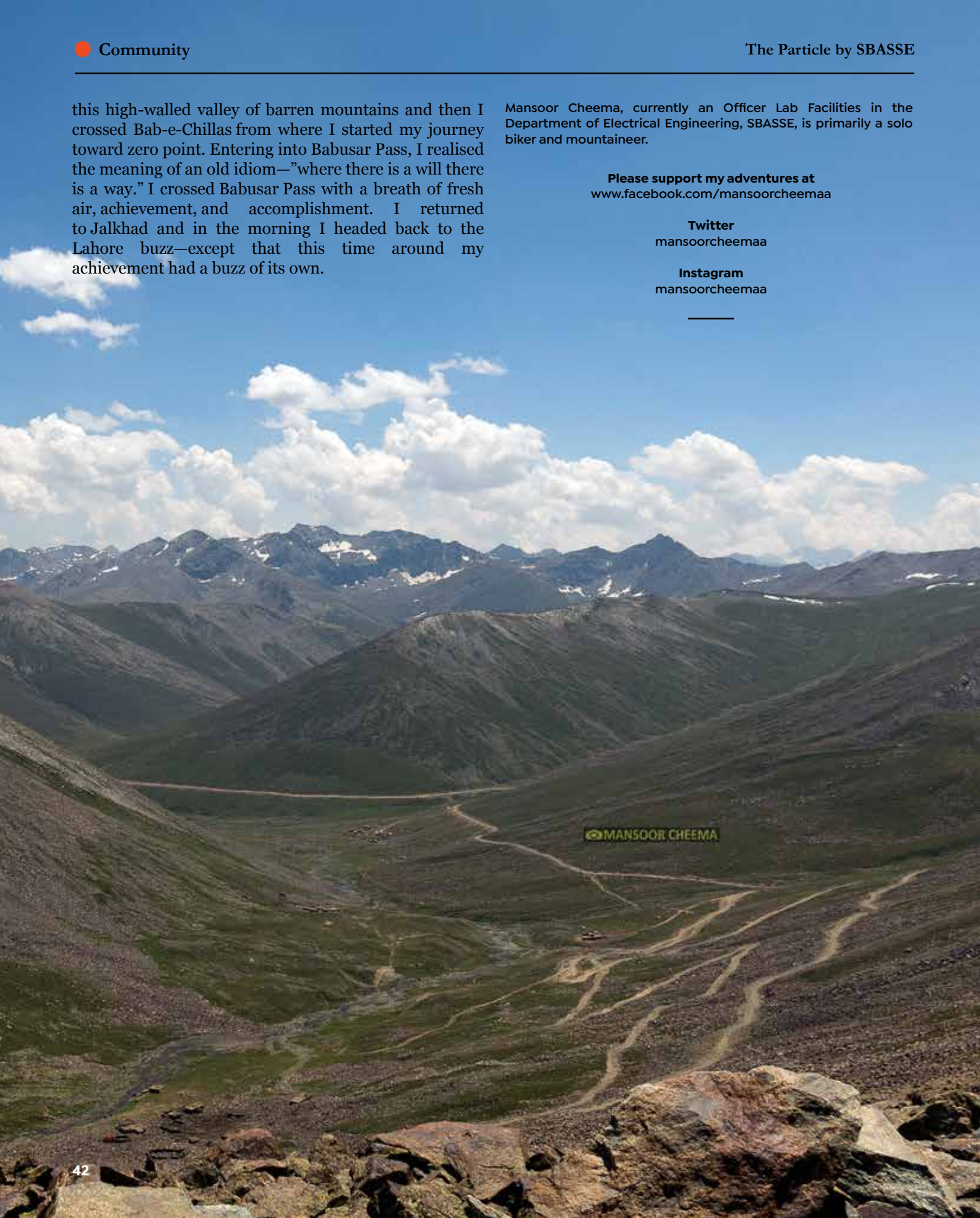
this high-walled valley of barren mountains and then I crossed Bab-e-Chillas from where I started my journey toward zero point. Entering into Babusar Pass, I realised the meaning of an old idiom—"where there is a will there is a way." I crossed Babusar Pass with a breath of fresh air, achievement, and accomplishment. I returned to Jalkhad and in the morning I headed back to the Lahore buzz—except that this time around my achievement had a buzz of its own.

Mansoor Cheema, currently an Officer Lab Facilities in the Department of Electrical Engineering, SBASSE, is primarily a solo biker and mountaineer.

Please support my adventures at
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The Curious Case for Electric Cars

*Article originally published in Khaleej Times by
Hissan Ur Rehman, filed on February 8, 2021*



*Are
electric vehicles
really the best
transportation
alternative to
gas-powered
engines?*



Electric vehicles (EVs) are considered to be the future of transport due to their perceived efficiency and low carbon output when compared to petrol or diesel cars. Fans of EVs also find them to be easier and more pleasurable to operate.

But, let's not jump for joy just yet; EVs have a lot of problems beneath the surface. Are EVs really the best transportation alternative to gas-powered engines? Many of the realities concerning electric cars are not spoken about in the mainstream corporate media.

As a result, many people tend to accept without question that electric cars are better for the environment by automatically assuming that they use less carbon. What's missing from the equation is the fact that most of our electricity comes from burning fossil fuels.

Accordingly, the media doesn't state that the increased mining activity required to extract the precious metals required for EV production is causing major damage to the environment. Additionally, the devastating effects of battery disposal are also missing from the discussion. EV batteries are made from a cocktail of chemicals that have extremely toxic effects on the soil and water.

There's no doubt that EV batteries definitely have their environmental challenges, however it should also be stated that charging an EV takes a lot of time.

Even when power sources and charger capacity are considered, it can take 30 minutes to nearly an hour to charge an EV while fueling a conventional fuel tank takes a few minutes. The time spent and

infrastructure required continues to pose challenges - even before the source of electricity comes into question.

EVs are not as CO₂ efficient as many people believe

Electricity does not magically appear in outlets. For the most part, EVs run on electricity produced by burning hazardous fossil fuels and fossil fuels still supply 84 per cent of the world's energy. The sight of wind turbines and solar panels may bring feelings of hope and optimism, however renewables have many issues that include being prohibitively expensive.

It's fair to say that EVs are much better for areas with high pedestrian traffic due to zero emissions. What's missing from that debate, however, is that scientists and engineers are continuously upgrading fossil-fuel engines so they produce less emissions.

EVs are expensive to produce

The production of electric vehicles currently poses a large cost-related problem. According to a study by the Fraunhofer Institute for Building Physics, it takes more than twice the amount of energy to produce an electric car when

compared to a conventional one due to battery production. The institute estimates that each kilowatt hour of battery capacity produces 125 kilograms or 276 pounds of CO₂ emissions. That

translates into almost 3 tons of CO₂ for a 22-kilowatt-hour battery suitable for a vehicle like the BMW i3. So much for reduced carbon emissions.

Disposing EV batteries is a global hazard

EV batteries are created from materials continuously mined from the earth's surface. This creates devastating environmental damage before the battery is even created. But the problem doesn't end there because these batteries are difficult to recycle and are potentially poisonous when disposed of.

The lithium-ion batteries used for EVs are made from a number of different materials that include acid, lead, nickel, lithium, cadmium, alkaline, mercury and nickel-metal hydride. Essentially these batteries are very much like a scaled-up version of a smartphone battery with the exception that EV battery packs comprise thousands of individual lithium-ion cells working together.

The devastating environmental and social impacts of producing these batteries are evident from their production to the end of their estimated 15-20 year lifespan. Besides requiring specialized workers to dismantle them by hand, these batteries - from their casing to their contents - are highly toxic to the earth.

It would be fair to point out that not all is doom and gloom with respect to EV batteries. While it's true that most of the world is ill-prepared to deal with their toxic effects, manufacturer Northvolt recently announced plans to set up

a recycling hub in Norway this year. Additionally, a hub in the city of Fredrikstad will use “highly automated” processes to crush and sort lithium-ion batteries with an initial capacity to process over 8,000 tons of batteries per year.

While this news seems positive, the following question remains: is this solution viable for large countries like India and China? Analysts predict that over half of all passenger cars in China will be electric by 2025.

That’s a lot of batteries for a nation of over 1.5 billion people - and a serious potential problem.

impact of fossil-fuel based transport.

Engine and conventional powertrain developments alone could reduce fuel consumption substantially for light-duty vehicles (LDVs). Implementing other technologies such as hybridisation could reduce fuel consumption when compared to the current average for LDVs. Nissan Motor Corporation is using some approaches to counter this issue worldwide like more efficient combustion, lower intake and exhaust resistance.

Often the solution to problems with existing technology is better technology.

It’s not a secret that EVs have excellent acceleration capability, zero ground emissions during operation, and are a pleasure to drive.

But it’s probably best to take a step back and view the big picture.

The reality is that most of the world’s energy — including the electricity required to power EVs — is produced by fossil fuels. The environmental effects of the mining required to produce EVs are devastating and battery disposal has serious potential toxic effects.

A clean transportation future requires a variety of solutions from all energy sectors. EVs are an excellent option, but they aren’t the entire solution.

A cleaner future requires a mix of solutions

Increased fossil fuel- efficiency is a viable solution

Currently, most of the global transportation market is powered by internal combustion engines (ICEs) and, as stated earlier, 95% of transport energy comes from liquid fuels made from petroleum. This is why it’s imperative that ICEs are improved in order to reduce the local and global environmental



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