THE PARTICLE

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WHO BROKE THE GLASS?!

THE FLY ROOM

SYED BABAR ALI RESEARCH AWARDS 2020

اردو میں فنی و تکنیکی نثر اور تھامسن سول انجینئرنگ کالج، رُڑکی: مختصر تعارف

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شعاعِ اوّلین

دی پارٹیکل کا پندرھواں شمارہ حاضرِ خدمت ہے۔ اس شمارے میں آپ سید بابر علی سکول آف سائنس اینڈ انجنیئرنگ میں رُونما ہونے والی تحقیق اور تدریسی کاوشوں کی ایک جھلک دیکھ پائیں گے۔ اِس مجلّے کی ترتیب میں ہم نے تین طلبہ معاون مدیروں کو بھی شامِل کیا ہے۔ ہمیں خوشی ہے کہ اطیب گُل نے ہماری دعوت پر شریک مدیر کی ذمہ داری بھی قبول کی۔ اِس شمارے کی تیاری میں ہمیں احمد دائوُد چیئر فنڈ کی معاونت بھی حاصل رہی جس کے لیے میں اُن کا شُکر گذار ہوں۔ بالخصوص زیرِ نظر شمارے میں عبداللہ جوہر نے شعبہ حیاتیات میں قائم مکھیوں کی پرورش گاہ کی اندرونی کہانی لکھی ہے جو امید ہے ہمارے پڑھنے والوں کے ذوقِ تجسّس کو ہوا دے گی۔ نیز مکرمی محقق ساجد نظامی کا تھامسن سِول انجنیئرنگ کالج پر مضمون اُردو اور سائنس کے باہمی رابطے کو گرد کی دبیز تہوں سے نکال کے ہمارے سامنے لے آتا ہے۔ ہمیں اپنی رائے سے ضرور نوازیں اور نئے مضامین، نئی خبریں اور کہانیاں بھیجتے رہیں۔

والسلام

ڈاکٹر محمد صبیح انور

ڈین سید بابر علی سکول آف سائنس اینڈ انجنیئرنگ

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THE COLLOID

مرکب

THE FLY ROOM
at SBASSE

Muhammad Abdullah Jauhar

The quest for a deeper understanding of life at the molecular level has led biologists to use organisms like bacterium, yeast, frog, mouse, fruit fly, and thale crest plant, etc., as model systems for experimentation. Some of these organisms have been used in science for centuries and they offer an opportunity to answer research questions that are otherwise impossible to answer through experiments on humans.

Although notorious for destroying fruit crops, the fruit fly has provided insights into the biggest mysteries of the 20th century, and scientific research on it has led to six Nobel Prizes! It is worth pondering: what is so fascinating about the 'gnat'?

The common fruit fly—Drosophila Melanogaster—has been used for biological research for over a century. Drosophila Melanogaster offers a relative mean between the most complex and most simple biological systems known to science. E. coli, the microscopic bacterium, weighs about ten-trillionth of a gram. Homosapien, the amazingly complex descendant of the primates, weighs about a hundred thousand grams. The fruit fly falls at the approximate average of the two, weighing less than two thousandth of a gram. Humans tend to have a generation time of about ten thousand days whereas E. coli has a generation time of a hundredth of a day. The fruit fly again falls in between, having the generation time of about ten days. Even the total number of genes fall at the rough average between the two extremes—Drosophila Melanogaster has about fifteen thousand genes for four thousand in a bacterium and twenty-two thousand in humans.

The real exciting fact is that nearly 60% of the fruit fly DNA is conserved in humans and about 75% of the human disease-causing genes are fully conserved in their function in the Drosophila genome, which makes the fruit fly the best model organism to work on. The similarity is shocking to the extent that some geneticists think that "they were designed to help scientists" (The Guardian).

The journey started at the start of the 20th century in the laboratory of Thomas Hunt Morgan. Morgan and his students observed different mutations in Drosophila Melanogaster which helped them prove the Chromosomal Theory of Inheritance. This showed that genes indeed lie on the chromosomes. Gene Mapping, Genetic Recombination, Sex-Linked Inheritance, and Chromosomal Nondisjunction are the major achievements of Morgan's Lab using the fruit fly. For their remarkable discoveries, the 1933 Nobel Prize in Physiology or Medicine was for the first time awarded to a non-physician—Thomas Hunt Morgan.

After Morgan's demise, his students took on the job of exploring the fruit fly. His student, Hermann Joseph Mueller, used X-rays to induce genetic mutations and chromosomal changes in Drosophila Melanogaster. These mutants were then studied for the functional aspects of the mutations combined with their evolutionary value. Mueller was awarded the Nobel Prize in Physiology or Medicine in 1946.

Towards the end of the 20th century, Drosophila Melanogaster once again solved the mystery of development when Edward B. Lewis, Christiane Nüsslein-Volhard, and Eric F. Wieschaus used the fly embryo to understand the genetic control of development. This led the trio to win the Nobel Prize in Physiology or Medicine in 1995. Key developmental genes discovered in flies responsible for body axis formation and patterning are astonishingly conserved in humans and other vertebrates.

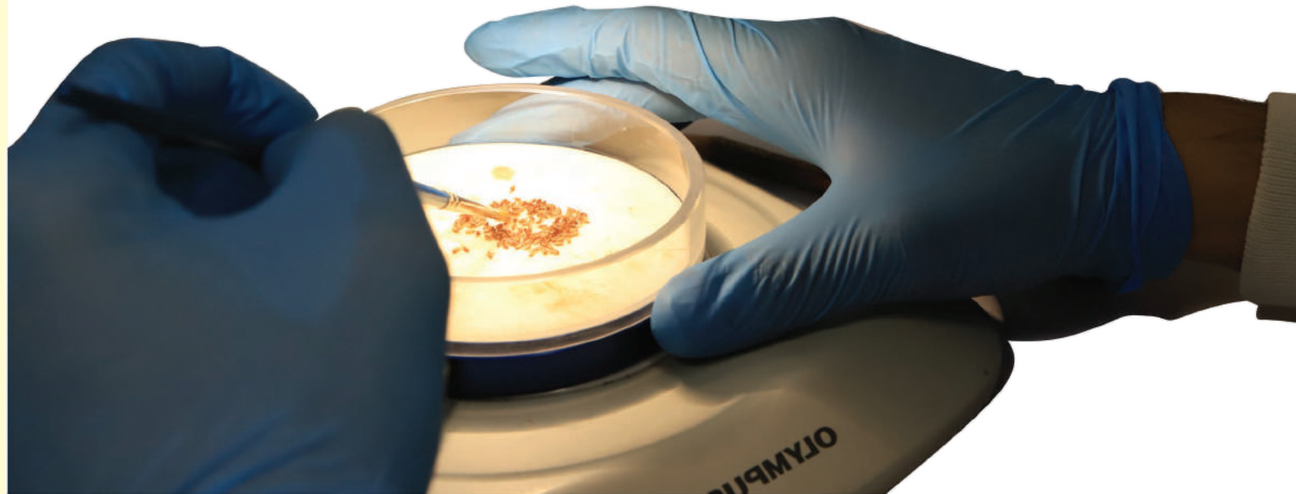
In the middle of the 20th century, Seymour Benzer at Caltech started using Drosophila Melanogaster to understand another mystery in biology—the atomic theory of behaviour.

He was interested in knowing about the 'atoms' of behaviour. Several behaviour genes were discovered in the fruit fly and it was the very first time when behavioural phenotype was proved to be due to the presence of specific genes in the genome. Benzer did not live to see the success of his work, but the ground-breaking work on the fruit fly circadian rhythm (sleep genes) by his post-doctoral fellows, Jeff Hall along with Michael Rosbash and Michael Young went on to win the Nobel Prize in Physiology or Medicine in 2017.

The Fly Room at SBASSE was started in 2009 when Dr. Muhammad Tariq, founding chair and associate professor at SBASSE, returned to Pakistan to establish a cutting-edge epigenetics research programme. The Fly Room at LUMS is the first and, so far, the only fruit fly lab in Pakistan and it is an integral part of learning fundamental concepts of genetics, developmental biology, molecular biology, and epigenetics at undergraduate and post-graduate levels. Through specifically designed experiments for both undergraduates and graduates, students visually observe giant larval chromosomes, proteins associated with chromosomes, activation of genes in response to heat shock, and much more.

In the beginning, rearing flies at LUMS was a massive challenge due to largescale deaths of precious fly stocks because of fluctuating electricity issues and the break down of incubators in extreme heat. However, presently the Fly Room houses nearly five hundred different fly stocks, each of which is maintained in multiple vials to minimise the risk of loss of a specific fly stock due to the accidental death of these flies. Due to extremely high temperatures, flies related to various ongoing experimental research projects as well as for teaching laboratories are ordered only during winter times from the Bloomington Drosophila Stock Centre in Indiana, USA. As soon as these flies arrive they pass through quarantine and then they are bred on specialised corn-starch food prepared in the biology department. Besides a walk-in incubator there are two refrigerated incubators maintained at 18˚C and 25˚C for maintaining stocks and experimentation, respectively.

The Fly Room is a busy place where students and researchers are either setting up fly crosses or analysing results of their crosses by sitting long hours on stereo microscopes. Since setting up an experimental cross requires identifying female virgin flies as well as young males, it demands all researchers be extremely organised and available seven days a week. Moreover, the Fly Room also houses a microinjection facility which is used to inject freshly-hatched embryos to generate transgenicflies required to understand the genetic and epigenetic basis of genes being probed by the Tariq Lab at LUMS. The



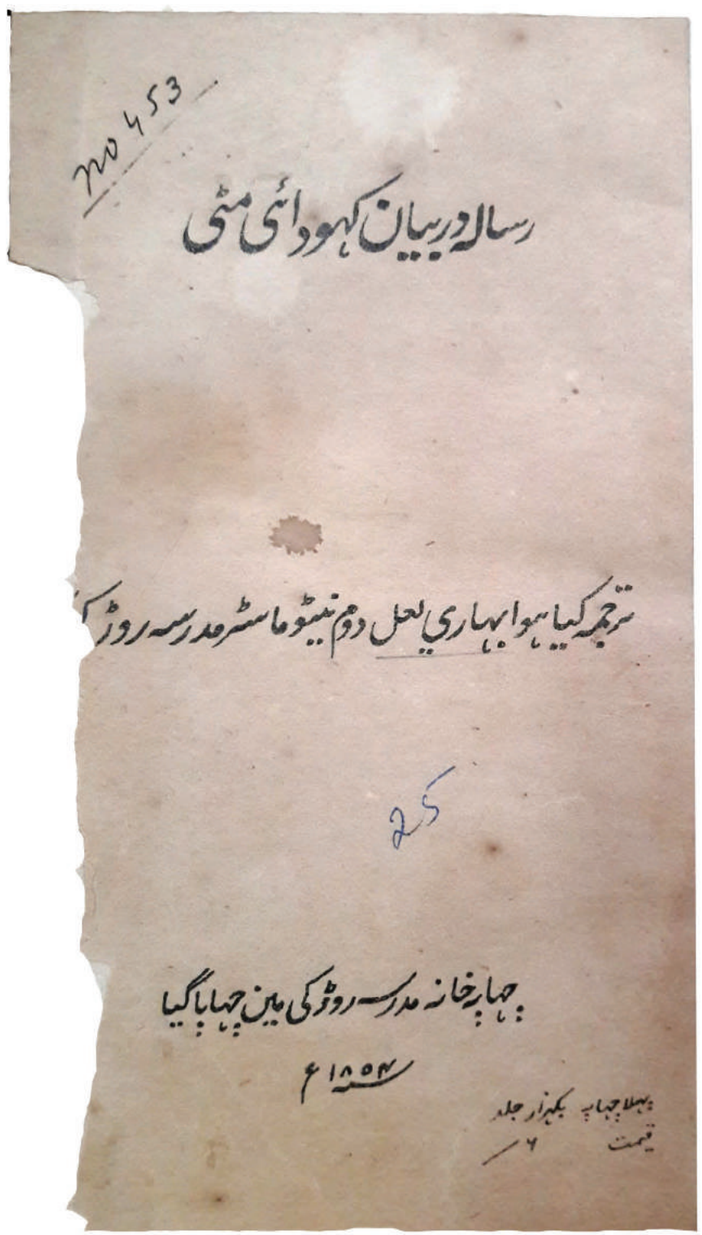
Tariq Lab focuses on understanding how the identity of different cell types is maintained and how cell fates can be changed.

Answers to these fundamental questions have implications in the field of cancer and regenerative medicine. Genetic and molecular analysis has discovered two groups of genes known as the Polycomb group (silencers) and Trithorax group (activators) which are responsible for the maintenance of cell fates. The Fly Room aims to understand how activities of Polycomb group or Trithorax group can be modulated and consequent cell fates changed.

To honour the renowned tale of the fruit fly research and its contribution to understanding some of the major questions related to humans, the Drosophilists at the SBASSE call the Fly Room, the Morgan Room, in the loving memory of Thomas Hunt Morgan who was the pioneer of Drosophila research.

The fruit fly still has wonders to reveal ...

Muhammad Abdullah Jauhar is a Biology Junior and member of the Epigenetics group (Tariq Lab) who coordinates all seminars of the MCB series.



پیمانے پر کیوں تھا؟ تو یہ بات خاطر نشان رہے کہ تھامسن سول انجینئرنگ کالج، رڑکی کے قیام کا اصل مقصد سول انجینئرنگ کی تعلیم دینا تھا۔ کالج کے منتظمین کی توجہ صرف اس بات پر تھی کہ تدریسی امور سے متعلق کچھ مواد مقامی طلبہ کے لیے تیار کروایا جا سکے۔ اس مقصد کے حصول کے لیے انھوں نے کالج کے مقامی تدریسی عملے میں سے ہی چند اساتذہ کو منتخب کیا۔ ان اساتذہ نے نصاب سے متعلق چند ضروری کتب کو اردو میں ترجمہ و تالیف کیا۔ اس کوشش میں ان اساتذہ کی ذاتی لیاقت ہی کام آئی۔ ان کی رہنمائی کرنے کو کوئی باقاعدہ ادارہ بھی نہ تھا اور نہ ہی کوئی سرپرست تھا۔اسی باعث کالج میں ہونے والے تصنیفی و تالیفی کام کی تنگ دامانی کھٹکتی ہے مگر اس کے باوجود کالج کے اساتذہ کا یہ امتیاز ہے کہ انھوں نے مقدور بھر کام کے ذریعے ایک نئے چلن کی بنیاد رکھی۔

کالج میں ہونے والے تالیفی کام میں موضوعات کے ساتھ ساتھ ان کی پیشکش میں بھی خاصا تنوع پایا جاتا ہے۔ گو موضوعات زیادہ تر سول انجینئرنگ سے ہی متعلق ہیں مگر اکثر ریاضی اور جغرافیہ کے موضوعات سے بھی اتنا کیا گیا ہے۔ اپنے موضوعات کے تناظر میں کالج کی کتب میں زیادہ تر عملی مشقوں سے متعلق مباحث ہوتے تھے۔ اسی طرح عملی نوعیت کے سوالات اور ان کے حل ہوتے تھے۔ کالج کی تالیفات کے معتدبہ حصوں میں عملی نوعیت کے سوالات اور مشقیں دیکھی جا سکتی ہیں۔ شکلوں اور تصاویر کے ذریعے موضوع کی وضاحت کی جاتی تھی۔ ان کتب کی نثر بھی اکثر و بیشتر صاف تھی اور اس میں اتنی صلاحیت تھی کہ وہ تکنیکی و فنی موضوعات کو بغیر کسی اشکال کے منطقی طور پر پڑھنے والے تک پہنچا سکے۔

رڑکی کالج میں اردو زبان میں سول انجینئرنگ کے مضامین بیان کرنے کی اس ابتدائی کاوش کے بعد ایک طویل عرصے تک ہمیں اور کوئی کاوش نظر نہیں آتی۔ ۱۹۱۷ء میں جامعہ عثمانیہ اور پھر دارالترجمہ کے قیام نے پھر اس چراغ کو روشن کیا۔ اس ضمن میں یہ امر قابل توجہ ہے کہ منتشر اور وقفے وقفے سے ہونے والی ان کاوشوں کی افادیت کے باوجود مستقل انگریزی ذریعہ تعلیم نے یہ خیال عام کر دیا کہ اردو زبان سائنسی و تکنیکی مضامین بیان کرنے سے بیشتر معذور ہے۔

اردو میں تھامسن انجینئرنگ کالج، رڑکی کے اساتذہ، مترجمین و مؤلفین کی یاد نگاری نہ ہونے کے برابر ہے۔ یہ بات ضرور نشانِ خاطر رہے کہ یہی لوگ تھے جنھوں نے اردو میں خالص فنی و تکنیکی موضوعات بیان کرنے کی داغ بیل ڈالی۔ انگریزی کتب کو ترجمہ کیا، ان کے موضوعات میں مقامی حالات کے تحت اضافے بھی کیے۔ تراجم و تالیفات میں قابلِ ذکر تنوع ہونے کے باوجود اندازِ نثر کی اِکسانیت قائم کرنے میں کافی کامیاب رہے۔ اس اندازِ نثر میں اتنی صلاحیت تھی کہ معمولی خواندہ شخص بھی بغیر کسی اشکال کے زیرِ بحث موضوع کی تفہیم میں آسانی محسوس کرتا تھا۔ تیزی سے کروٹیں لیتے وقت کی زد میں، یہ فاضلین بے شک گم نام سہی مگر ان کے کام کی افادیت اور اہمیت بہرحال مسلّم ہے۔

نام کتاب	مصنف/مترجم	سنہ اشاعت	صفحات
۱۔ اصول علم جغرافیہ اور ترکیب بنانے نقشہ کرۂ زمین کی	منّو لال	۱۸۵۰ء	۱۴۹
۲۔ رسالہ در باب مضبوطی اشیائے سامانِ عمارت	منّو لال	۱۸۵۱ء	۴۹
۳۔ رسالہ در باب راجباہوں کے	منّو لال	قبل از ۱۸۵۳ء	---
۴۔ رسالہ در باب پلوں دریاؤں ہند کے	منّو لال	۱۸۵۴ء	۹۳
۵۔ اصولِ جبر و مقابلہ	منّو لال	قبل از ۱۸۵۸ء	۲۸۴
۶۔ رسالہ در باب تعمیرِ عمارت	منّو لال / بہاری	۱۸۵۶ء	۱۶۰
۷۔ استعمالِ جزّ ثقیل	منّو لال / بہاری	۱۸۵۶ء	۱۴۱
۸۔ رسالہ در بیان کھدائی مٹی	بہاری لال	۱۸۵۴ء	۵۴
۹۔ پیمائش خسرہ یعنی ہندوستانی طور پر پیمائش کھیتوں کی	بہاری لال	قبل از ۱۸۵۸ء	۹۷
۱۰۔ رسالہ علمِ مساحت	بہاری لال	قبل از ۱۸۵۸ء	۱۶۴
۱۱۔ تعریف ہندسہ اور اس کی حدود (اصولِ علمِ ہندسہ)	بہاری لال	قبل از ۱۸۵۸ء	۱۴۴
۱۲۔ در باب فنِ نجاری	بہاری لال	۱۸۷۰ء	۱۲۰
۱۳۔ رسالہ پلوں کے بیان میں	بہاری لال	۱۸۸۶ء طبع سوم	۶۰
۱۴۔ مجموعہ سامانِ عمارت	بہاری لال	۱۸۸۸ء	۱۳۵
۱۵۔ بیان نقشہ کھینچنے طرح طرح کی محرابوں کا جو تعمیر مکانات میں مستعمل ہیں	کنہیا لال	۱۸۵۴ء	۱۹
۱۶۔ رسالہ در بیان داخ بیل لگانے سڑکوں و نہروں کے خم دار حصوں کا	کنہیا لال	۱۸۵۴ء	۳۷
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۱۸۔ بیان لوکارتم و استعمال ٹیبل لوکارتم	شنبھو داس	۱۸۶۲ء	۲۲
۱۹۔ رسالہ در باب پیمائش	شنبھو داس	۱۸۶۹ء	۲۲۴
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۲۱۔ رسالہ علم مساحت	موہن لال	قبل از ۱۸۵۸	۲۲۰
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۲۳۔ سوالات تحریر اقلیدس	---	قبل از ۱۸۵۸ء	۱۷
۲۴۔ ترکیب پیمائش جریب اور پلین ٹیبل	---	قبل از ۱۸۵۸ء	۸۷
۲۵۔ ہدایت مبتدی اردو میں	---	قبل از ۱۸۵۸ء	۳۸

۲۶۔ قاعدے علم حساب کے	---	قبل از ۱۸۵۸ء	۱۰۴
۲۷۔ نقشہ ضلع سہارن پور	---	قبل از ۱۸۵۸ء	---
۲۸۔ ٹریورس ٹیبل (Boileau's Traverse Table)	---	قبل از ۱۸۵۸ء	---
۲۹۔ کنوؤں کی بنیادوں میں	---	قبل از ۱۸۵۸ء	---
۳۰۔ کتاب نہر گنگ کی (اردو میں)	---	قبل از ۱۸۵۸ء	---
۳۱۔ کھگول ونود (ناگری رسم الخط میں) (Conversations in Astronomy)	کُنج بہاری لال	قبل از ۱۸۵۸ء	۲۲۲
۳۲۔ دشملب دیپکا (ناگری رسم الخط میں) (Treatise on Decimal Fractions)	پنڈت بنسی دھر	قبل از ۱۸۵۸ء	۲۲
۳۳۔ کتاب نہر گنگ کی (ناگری رسم الخط میں)	---	قبل از ۱۸۵۸ء	---
۳۴۔ کالج کی دستیاب تصانیف و تالیفات کے جائزے سے Vocabulary in English and Oordoo and Dictionary in Oordoo and English	---	۱۸۵۴	۱۵۵

عموماً کالج سے چھپنے والے رسائل کے سرِ ورق کی عبارت یوں ہوتی تھی:

رسالے

جو کہ واسطے طلبائے مدرسہ رڑکی کے تیار

کیے گئے ہیں

رسالہ نمبر دوم

در باب مضبوطی اشیائے سامان عمارت کے

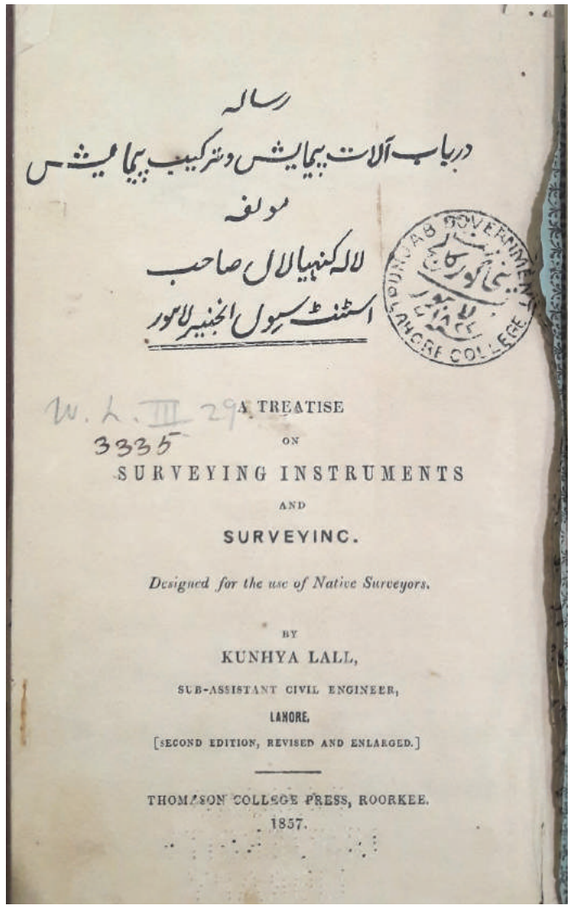
ترجمہ کیا ہوا منو لعل

اول نیٹو ماسٹر مدرسہ رڑکی کا سنہ ۱۸۵۱ء

کالج کی تاسیس کے وقت سے تقریباً ایک چوتھائی صدی تک مقامی ہندوستانیوں کو اردو زبان میں ہی تعلیم دی جاتی رہی۔ اس مقصد کے لیے ان موضوعات سے متعلق زیادہ تر انگریزی کتب کو اردو میں منتقل کیا گیا۔ افادی پہلو کو مد نظر رکھتے ہوئے کالج کے نصاب میں شامل کتب ہی اس کام کے لیے منتخب کی گئیں۔

یہ نکتہ بھی قابلِ توجہ ہے کہ کالج میں ہندوستانی طلبہ کی تدریس کے لیے ذریعۂ تعلیم، اردو زبان کو منتخب کیا گیا۔ کالج کیلنڈر ۱۸۷۱ سے ۱۸۷۲ء میں کالج کے ہندوستانی طلبہ کی فہرستوں پر نظر ڈالنے سے باآسانی اندازہ ہو جاتا ہے کہ کالج میں مسلمان اور ہندو طلبہ کی شرح تقریباً یکساں تھی۔ ہندو طلبہ میں سے بیشتر کا تعلق اتر پردیش سے ہی تھا، اس کے باوجود یہ کالج اردو ہندی تنازعہ سے دور تھا۔ اسی باعث کالج کی بیشتر تالیفات اردو رسم الخط میں جبکہ محض چند ایک کتب ناگری رسم الخط میں شائع ہوئیں۔ اس سے یہ بھی معلوم ہوتا ہے کہ انیسویں صدی کی تیسری چوتھائی تک بھی شمالی ہندوستان میں اردو زبان اور رسم الخط کو بیشتر طبقات میں، مذہبی و ثقافتی بُعد سے قطعِ نظر، قبولِ عام حاصل تھا۔

ایک سوال یہ پیدا ہوتا ہے کہ کالج میں ہونے والا تالیفی کام اتنے محدود


رسالہ
در باب آلات پیمایش و ترکیب پیمایش
مولفہ
لالہ کنہیا لال صاحب
اسسٹنٹ سیول انجنیر لاہور
PUNJAB GOVERNMENT
THOMASON COLLEGE
LAHORE
W. L. III 29
3335
A TREATISE
ON
SURVEYING INSTRUMENTS
AND
SURVEYINC.
Designed for the use of Native Surveyors.
BY
KUNHYA LALL,
SUB-ASSISTANT CIVIL ENGINEER,
LAHORE.
[SECOND EDITION, REVISED AND ENLARGED.]
THOMASON COLLEGE PRESS, ROORKEE.
1857.

مقرر کیا گیا۔ ۱۸۵۴ء میں کالج کا نام تبدیل کر کے تھامسن انجینئرنگ کالج، رڑکی رکھ دیا گیا۔ آغاز میں طلبہ کے تین زمرے قائم کیے گئے، دو زمرے یورپی کمیشنڈ اور نان کمیشنڈ افسروں کے لیے جبکہ تیسرا زمرہ مقامی ہندوستانی طلبہ کے لیے مخصوص کیا گیا۔ کالج کے قیام سے لے کر کم از کم ۱۸۷۰ء تک ہندوستانی طلبہ کے لیے ذریعہ تعلیم کے لیے اردو زبان کو اختیار کیا گیا۔ کالج کی مساعی سے قبل سول انجینئرنگ کے موضوعات پہ اردو میں کوئی کام نہیں ملتا تھا۔ اگرچہ ریاضیات، ہیئت، فلکیات، جغرافیہ، جبر و مقابلہ، مساحت وغیرہ پہ کچھ نہ کچھ مواد ہم دست تھا لیکن سول انجینئرنگ سے متعلقہ موضوعات اردو میں منتقل نہیں ہوئے تھے۔ لہٰذا کالج انتظامیہ نے اس حوالے سے بنیادی نوعیت کے مضامین پر کتب ترجمہ کروانی شروع کیں۔

اس سلسلے کا آغاز ۱۸۵۰ء سے قبل ہی ہو گیا تھا۔ ۱۸۵۰ء کے بعد سے تسلسل سے مطبوعات سامنے آنا شروع ہو گئیں۔ زیادہ کتب تو اردو میں ہی شائع ہوئیں لیکن چند کتب ناگری حروف میں بھی شائع ہوئیں۔ اس زمانے کی چند دستیاب کتب بکھری ہوئی حالت میں برصغیر کے مختلف کتب خانوں میں موجود ہیں۔

راقم کی تلاش و تحقیق کے نتیجے میں پہلی مرتبہ رڑکی کالج سے شائع ہونے والی چونتیس (۳۱ اردو اور ۳ ناگری حروف میں) کتب کی فہرست تیار کی گئی ہے۔ ذیل میں ایک جدول ترتیب دیا گیا ہے جس کے ذریعے کتب کے نام، ان کے مصنفین و مترجمین، سنہ اشاعت اور تعداد صفحات، جیسی معلومات درج کی جا رہی ہیں۔ جہاں کچھ معلومات میسر نہیں آ سکیں وہاں --- کا نشان لگا دیا گیا ہے۔ یہ فہرست چونکہ اب تک کے تحقیقی کاموں میں پہلی مرتبہ مرتب کی گئی ہے، اس لیے اس میں مزید بہتری کی گنجائش یقیناً باقی ہے۔

کالج کی دستیاب تصانیف و تالیفات کے جائزے سے یہ بات واضح ہوتی ہے کہ کالج کے نمایاں مصنفین و مؤلفین میں رائے منّو لال (فرسٹ نیٹو ماسٹر بعد ازاں ہیڈ نیٹو ماسٹر)، لالہ بہاری لال (فرسٹ نیٹو ماسٹر،بعد ازاں ہیڈ نیٹو ماسٹر)، کنہیا لال (سب اسسٹنٹ سول انجینئر)، شنبھو داس (اسسٹنٹ نیٹو ماسٹر، نیٹو سرویئنگ ماسٹر)، شیخ بیچا (اسسٹنٹ نیٹو ماسٹر، سیکنڈ نیٹو ماسٹر)، موہن لال اور جگ موہن لال شامل تھے۔

کسی بھی زبان کی شاہراہِ ترقی کا ایک سنگِ نشان یہ بھی ہوتا ہے کہ اُس زبان میں مختلف انواع کے مضامین اور موضوعات کس قدر اور کس طرح ادا کیے جا سکتے ہیں؟ اردو زبان کے بارے میں عام طور پر خیال کیا جاتا ہے کہ سماجی اور عمرانی علوم سے متعلق مباحث تو اِس زبان میں کسی قدر سہولت سے ادا کیے جا سکتے ہیں مگر یہ زبان جدید سائنسی مباحث، بڑی حد تک بیان کرنے سے قاصر ہے۔

یہ رائے عام طور پر زیادہ تر عمومی ناواقفیت اور چند غلط فہمیوں کی زائدہ ہے۔ یہ بیّن حقیقت ہے کہ اردو زبان میں متفرق سائنسی موضوعات کو بیان کرنے کی خاطر متعدد کوششیں اٹھارھویں صدی کی تیسری دہائی ہی میں شروع ہو گئی تھیں۔ مثلاً حیدر آباد دکن میں ۱۸۳۴ء میں نواب شمس الامراء کی سرپرستی میں ایک 'دارالترجمہ' کی بنیاد رکھی گئی، جہاں ریاضی، طبیعات، کیمیا، علم الادویہ، جیومیٹری، فلکیات اور دیگر علوم پر مختلف کتب یورپی زبانوں سے اردو میں ترجمہ کی جاتی تھیں۔ اسی دور میں لکھنؤ میں اودھ کے بادشاہ نصیر الدین حیدر کی سرپرستی میں سائنسی علوم سے متعلق چند کتب انگریزی سے اردو میں منتقل ہو رہی تھیں۔

The History of Rasselas: Prince of Abissinia

سیموئل جانسن کا ایک معروف انگریزی ناول، جس کو اردو میں 'تواریخ راسلس' کے عنوان سے منتقل کرنے والے کمال الدین حیدر عرف محمد میر لکھنوی کا نام اس حوالے سے قابل ذکر ہے کہ انھوں نے اس دور میں سائنسی موضوعات پر تقریباً اٹھارہ کتب کو اردو میں منتقل کیا ۔ ۱۸۲۵ء میں قائم ہونے والے دہلی کالج اور اسی کالج میں ۱۸۴۳ء میں قائم ہونے والی دہلی ٹرانسلیشن سوسائٹی کی خدمات بھی اس حوالے سے بہت نمایاں ہیں۔ کالج اور سوسائٹی کے زیر اہتمام متنوع علوم پر تقریباً سوا سو کتب ترجمہ کی گئیں، جن میں نمایاں تعداد سائنسی کتب کی تھی۔ سوسائٹی کے کارپرداز اس حوالے سے خاصے روشن خیال ثابت ہوئے کہ اس زمانے میں انھوں نے اردو میں ترجمے کے جو اصول وضع کیے تھے، بڑی حد تک آج بھی غیر متعلق نہیں ہوئے ہیں۔

انیسویں صدی ایسے ہی اداروں اور کاوشوں میں ایک نام تھامسن سِوَل انجینئرنگ کالج، رڑکی (پہلا نام: سول انجینئرنگ کالج) کا بھی ہے۔ رڑکی، سہارن پور اور ہردوار کے قریب ایک قصبہ ہے، جو اُس وقت شمال مغربی صوبے یا اتر پردیش کا حصہ تھا۔ آج کل رڑکی شہر، ریاست اتراکھنڈ کا حصہ ہے۔ اس کالج کا امتیاز یہ تھا کہ ۱۸۴۷ء میں اس کے قیام سے لے کر تقریباً ۱۸۷۰ء تک، ہندوستانی باشندوں کو سول انجینئرنگ کی جملہ تعلیم اردو زبان میں دی جاتی رہی۔

یہاں اس کالج کے قیام کا مختصر پس منظر بتانا ضروری معلوم ہوتا ہے۔ دوسری اینگلو مراٹھا جنگ (۱۸۰۵ء تا ۱۸۰۳ء) سے لے کر دوسری جنگ پنجاب (۱۷۴۹ء) کے خاتمے پر انگریز، شمال مغربی صوبہ جات (اتر پردیش)، صوبہ جاتِ وسطی (مدھیہ پردیش)، بہار، مہاراشٹر، گجرات، راجستھان، سندھ، بلوچستان، شمال مغربی سرحدی صوبے (خیبر پختونخواہ) پر بلاواسطہ یا بالواسطہ متصرف ہو چکے تھے۔ ان علاقوں پر سیاسی لحاظ سے غلبہ برقرار رکھنے کے لیے ضروری تھا کہ یہاں کے قدرتی وسائل (مثلاً دریاؤں، زرخیز زمینوں، زرعی پیداوار وغیرہ) سے حتی المقدور فائدہ اٹھایا جائے۔ دوم یہ کہ یہاں پہ عمومی ترقیاتی کاموں کا جال سا بچھایا جائے۔ مثلاً پہلے سے موجود سڑکوں کو ترقی دی جائے، نئی سڑکیں اور راستے بنائے جائیں، ریلوے ٹریک بچھائے جائیں، تار (ٹیلیگراف) کا نظام قائم کیا جائے وغیرہ وغیرہ۔ اس حکمتِ عملی کا انھیں دوہرا فائدہ یہ ہونا تھا کہ جہاں یہ کام ہندوستانی باشندوں کی نظر میں ان کی قدر بڑھاتے وہیں ان سب علاقوں میں انگریز سپاہ کی بآسانی نقل و حمل اور دور دراز کے علاقوں تک ان کی رسائی کو ممکن بناتے۔ یوں انگریزی اقتدار کی قوتِ نافذہ میں اضافہ ہوتا۔ ان مشکل اور طویل مدتی منصوبوں کے لیے ماہر سول انجینئرز اور ان کے معاونین کی ضرورت تھی جو اس نوعیت کے کاموں کو تکمیل تک پہنچا سکیں۔

یوں تو اس زمانے میں شمال مغربی صوبے (اتر پردیش) میں انگریزوں کے زیرِ انتظام تین کالج (دہلی کالج، آگرہ کالج، بنارس کالج) قائم ہو چکے تھے اور ۹ اینگلو ورنیکولر اسکول بھی خدمات انجام دے رہے تھے، مگر فنّی اور تکنیکی تعلیم کے لیے مخصوص ادارہ کوئی نہیں تھا۔ لہٰذا کمپنی کے مقبوضات میں عام طور پر اور خاص کر شمال مغربی صوبے میں جاری عمومی ترقیاتی کاموں کے لیے اہلکار کو مہیا کرنے کے لیے ۲۵ نومبر ۱۸۴۷ء کو سول انجینئرنگ کالج، رڑکی کا قیام عمل میں لایا گیا۔ ابتدا میں کالج کا نام کالج آف سول انجینئرنگ رکھا گیا اور لیفٹیننٹ آر۔ میکلگین کو کالج کا پرنسپل

اردو میں فنی و تکنیکی نثر اور تھامسن سول انجینئرنگ کالج، رُڑکی: مختصر تعارف

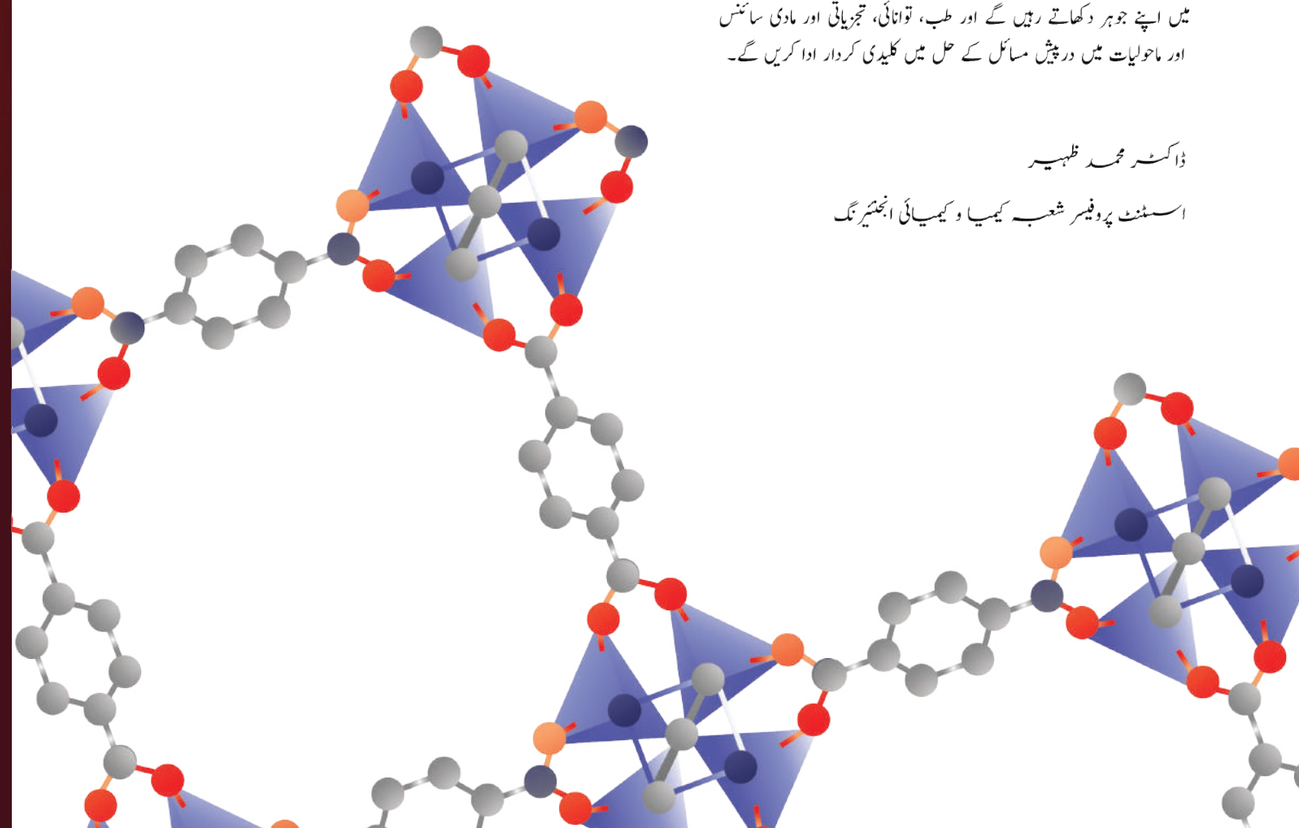
James Thomason
Lieut. Governor N.W. Provinces

ساجد صدیق نظامی
اسسٹنٹ پروفیسر، گورنمنٹ ایم۔ اے۔ او۔ کالج، لاہور

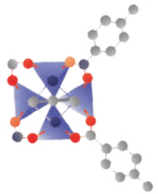
موفس کے دھاتی اجزا عمل انگیز کے طور پر بھی کام کر سکتے ہیں۔ ان دھاتی اجزا کی یکساں ساخت اور تکثیر، موفس کی عمل انگیز ی کے طور پر فعالیت کو بے انتہا بڑھا سکتی ہے۔ ٹھوس ہونے کی وجہ سے ایسے عمل انگیز دوبارہ بھی استعمال کیے جا سکتے ہیں۔ حال ہی میں شعبہ کیمیاء اور کیمیائی انجینئرنگ میں پی-ایچ-ڈی کی طالبہ(بشریٰ اقبال) نے ایک موف کی ساخت میں کوئی تبدیلی لائے بغیر ایک دھات کو دوسری دھات سے بدل کر ایک غیر فعال موف کو ایک فعال عمل انگیز میں بدلا ہے۔ یہ بھی نینو انجینئرنگ کا ایک کمال ہے کہ یوں بننے والے موف میں دھاتوں کے تناسب کو اَدل بَدل کیا جا سکتا ہے۔ موفس عمل انگیز کے طور پر پانی کی برق پاشیدگی، فاسد مادوں سے ایندھن کی تیاری، نامیاتی مرکبات کی تیاری، فصلوں کی باقیات سے کیمیائی مرکبات کی تیاری اور زرعی ادویات کی تیاری میں استعمال کیے جا چکے ہیں۔

موفس کے نت نئے استعمالات کی کھوج ایک سرگرم تحقیقی میدان ہے یہی وجہ ہے کہ آئے روز شائع ہونے والے تحقیقی مقالے موفس کے منفرد اطلاق کو زیرِ بحث لاتے ہیں۔ امید ہے کہ یہ مسام دار قلمی مادے اپنی ساختی لچک اور خصوصیات کی وسعت کی بنا پر سائنس اور تحقیق کے میدان میں اپنے جوہر دکھاتے رہیں گے اور طب، توانائی، تجزیاتی اور مادی سائنس اور ماحولیات میں درپیش مسائل کے حل میں کلیدی کردار ادا کریں گے۔

ڈاکٹر محمد ظہیر
اسسٹنٹ پروفیسر شعبہ کیمیا و کیمیائی انجینئرنگ



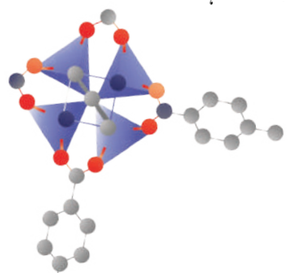
قلمی اسفنج:
حیرت انگیز کمالات کے حامل انوکھے مسام دار مادے



تصور کیجئے ایسے کرشماتی مادوں کا جو ایک اسفنج کی مانند ہوا سے نمی جذب کر کے، روزانہ کئی گیلن پینے کا پانی مہیا کر دیں۔ کیا ہی خوب ہو کہ ایسے مادوں سے کھاری پانی گزرے تو منٹوں میں پینے کے قابل بن جائے۔ اسی پر موقوف نہیں بلکہ سی این جی گاڑیوں میں ان مادوں کو کے ذخیرے کے لیے استعمال کرنا بھی ممکن ہو۔ آپ کی آتش شوق کو مزید ہوا دیے بغیر آپ کو بتا تا چلوں کہ عملاً ایسے جادوئی مادے اپنا وجود رکھتے ہیں اور میٹل آرگینک فریمورکس (ایم او ایف) کے نام سے جانے جاتے ہیں۔ مندرجہ بالامثالیں ان کے بے شمار استعمالات کی صرف ایک جھلک ہیں۔

موفس ایسے قلمی مادے ہیں جن میں انتہائی ننھے مسام ایک حسن ترتیب سے پائے جاتے ہیں۔ ان مساموں کا قطر چند نینو میٹر ہوتا ہے اور یہ کتنی چھوٹی اکائی ہے اس بات کا اندازہ اس سے کر لیجیے کہ ایک انسانی بال اسی ہزار سے ایک لکھ نینو میٹر چوڑا ہوتا ہے۔ جبکہ حال ہی میں زیریں نظام تنفس کو متاثر کرنے والا کورونا وائرس تقریباً دو سو نینو میٹر جسامت رکھتا ہے۔ سوال یہ پیدا ہوتا ہے کہ موفس میں موجود یہ یکساں جسامت کے مسام کیسے جنم لیتے ہیں۔

موفس نینو انجنیئرنگ کا ایک شاہکار ہیں۔ یہ ایسے دوغلے مادے ہیں جن میں نامیاتی اور غیر نامیاتی دونوں اجزا پائے جاتے ہیں۔ غیر نامیاتی جزو دھاتوں پر مشتمل ہوتا ہے جب کہ نامیاتی جزو ایسے مرکبات ہیں جو کم از کم دو سروں سے تعامل کر سکتے ہیں۔ ہم دھاتی جزو کو ایک گیند اور نامیاتی جزو کو ایک چھڑی تصور کر لیتے ہیں۔ ایک چھڑی کی مدد سے گیندوں کو آپس میں جوڑتے ہوئے ہم سہہ جہتی مربعوں کا ایک جال بن سکتے ہیں۔ جس میں یکساں جسامت کے چوکور مسام ہوں گے۔ لیجیے آپ نے ایک موف بنا لیا جو ساخت کے لحاظ سے عمارتوں کی تعمیر میں استعمال ہونے والی مچان سے مشابہت رکھتا ہے۔



والے ایسے موفس تیار کیے جن کے مساموں کا حجم ۱.۸ سے ۲۰ نینو میٹر تک تھا۔ مرکبات اور مادوں کی تیاری کے اس عمل کو آئسوریٹی کیولر سین تھیسس کا نام دیا گیا ہے۔ یہ مسام حجم کی بنیاد پر، ساخت میں مماثل مرکبات کو ایک دوسرے سے الگ کر سکتے ہیں ۔ یوں انہیں نینو چھلنیاں بھی کہا جاسکتا ہے اور تیل کے کارخانوں میں یہ ہائیڈرکاربنز (کاربن اور ہائیڈروجن کے مرکبات) کی علیحدگی میں مستعمل ہیں۔

موفس کی ساخت کو سالمی سطح پر بدل کر ہم ان مادوں کی خصوصیات کو ان کے ممکنہ استعمال کے مطابق ڈھال سکتے ہیں۔ اجزا کے حجم، جیومیٹری اور فعالیت کے تغیر کی بدولت بیس ہزار سے زائد اقسام کے موفس بنائے جا چکے ہیں۔ یہی وجہ ہے کہ یہ مادے کثیر المقصدی استعمال رکھتے ہیں جن میں سے چند نمائندہ خصوصیات کا ذکر ہم اس مضمون کے آغاز میں کر چکے ہیں۔ دیگر استعمالات میں ادویات کا بدن میں انتقال، ہوا سے ذرّاتی مادوں اور گیسوں کے انجذاب، صنعتی آمیزوں کی علیحدگی، طبی عکس بندی، اور عمل انگیزی شامل ہیں۔

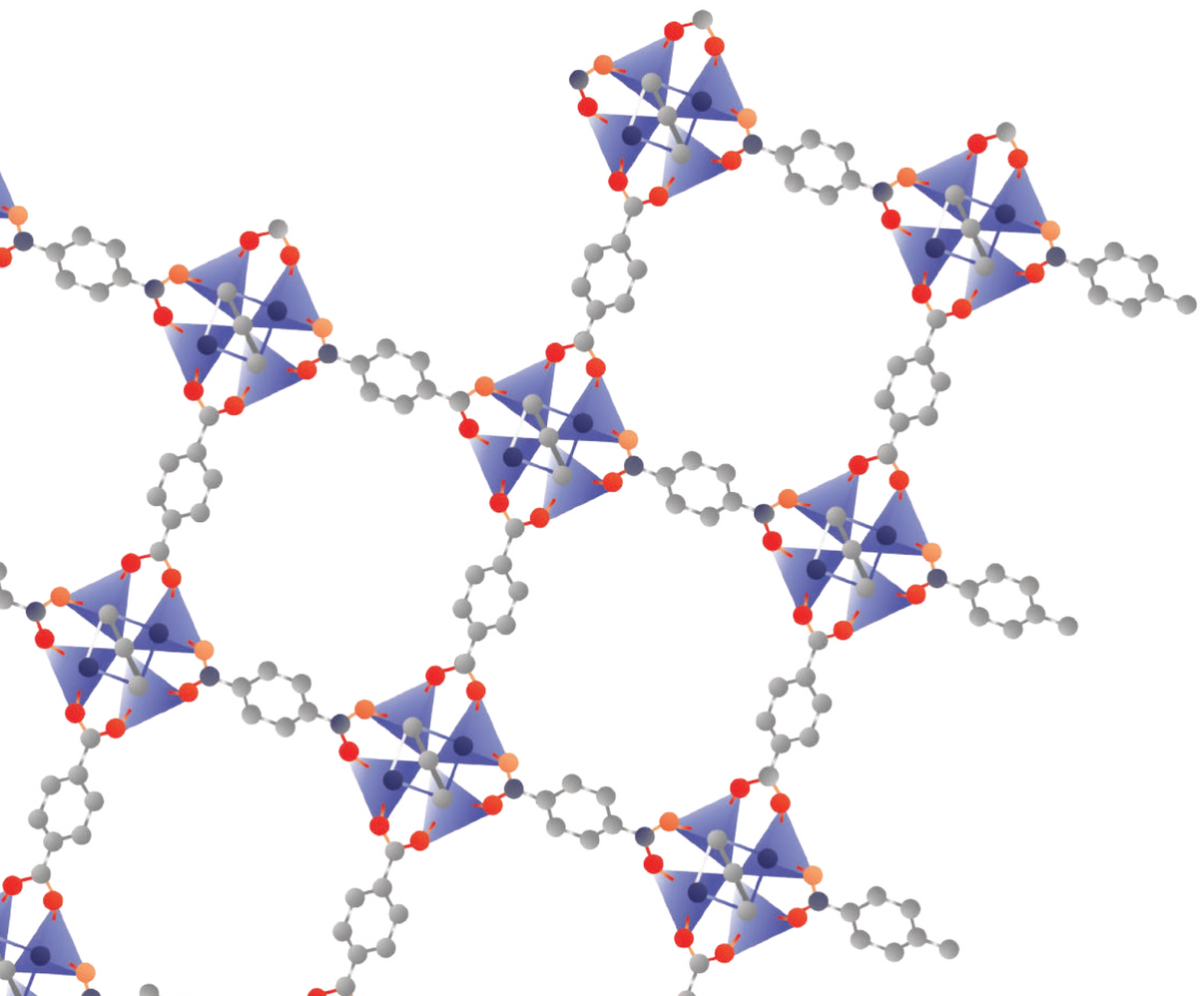
موفس کی سب سے نمایاں خصوصیات ان کا غیر معمولی سطحی رقبہ ہے جو کسی بھی دوسرے معروف مادے (کاربن، زیولائٹ، سیلیکا وغیرہ) سے زیادہ ہے۔مثلاً موفس کی ایک قسم کا ایک گرام ، دس ہزار مربع میٹر رقبہ رکھتا ہے۔ دوسرے لفظوں میں اس مادے کے ایک گرام میں ڈیڑھ فٹ بال کے میدانوں کے برابر خالی جگہ دستیاب ہے۔ یہی وجہ ہے کہ یہ مادے ہوا سے پانی کے انجذاب اور گیسوں کے ذخیرے کے لیے نہایت موزوں ہیں۔

موفس نوّے کی دہائی میں امریکی کیمیاء دان عمر یاغی اور دیگر سائنس دانوں کی تحقیق سے منظرعام پر آئے۔ جب ۱۹۹۹ء میں ۲۳۰۰ مربع میٹر/گرام سطحی رقبہ رکھنے والا موف-۵ سامنے آیا تو کیمیکل بنانے والی کمپنی BASF نے رقبے کی اس مقدار کو کتابت کی غلطی سمجھا۔ کیوں کہ تب تک اتنا زیادہ سطحی رقبہ رکھنے والا کوئی مادہ موجود نہیں تھا۔ یہی کمپنی BASF اب مختلف استعمالات کے لیے صنعتی آزمائشی بنیادوں پر موفس کی تیاری کا کام کرتی ہے۔ مثلاً گاڑیوں کی ایندھن کی ٹینکی میں موفس کا استعمال کیا گیا

ہے۔ کمپنی BASF کے مطابق ایسی گاڑیاں عام گاڑیوں کی نسبت دوگنا اور تین گنا زیادہ قدرتی گیس ذخیرہ کر سکتی ہیں۔ تاہم رکازی ایندھن کی گرتی ہوئی قیمتوں کی وجہ سے قدرتی گیس کا گاڑیوں میں ایندھن کے طور پر استعمال پُر کشش نہیں رہا۔ یہی وجہ ہے کہ یہ منصوبہ فی الحال التوا کا شکار ہے۔

۲۰۱۷ء میں پروفیسر یاغی ایک موف (موف -۸۰۱) اور شمسی توانائی کی مدد سے ہوا سے پانی اکٹھا کرنے میں کامیاب ہوئے۔ موف-۸۰۱ کا ایک کلو گرام، صرف بیس فیصد نمی رکھنے والی ہوا سے ڈھائی لیٹر پانی جذب کرتا ہے۔ تجارتی بنیادوں پر اس عمل کو کم خرچ بنانے کے لیے موف میں زرکونیم کی بجائے اب ایلومینیم کا استعمال کیا گیا ہے۔ اس عمل کی خوبی یہ ہے کہ پانی کے انجذاب اور وصولی کے لیے کسی بیرونی توانائی کی ضرورت نہیں پیش آتی۔ اس آلے کو تجربہ گاہ کے علاوہ صحرا میں بھی استعمال کر کے دیکھا گیا ہے اور نتائج حوصلہ افزا ہیں۔

حال ہی میں شائع ہونے والی ایک تحقیق میں موفس کو سمندری کھاری پانی کو پینے کے قابل بنانے کے لیے، کامیابی سے استعمال کیا گیا ہے۔ پانی سے نمک الگ کرنے کے رائج طریقہ ہائے کار جیسے ریورس اوسموسس، میں توانائی کا خرچ بہت زیادہ ہے۔ موف سے پانی کی تطہیر کشش ثقل پر کام کرتی ہے اور یوں بیرونی توانائی کی محتاج نہیں۔ دلچسپ بات یہ ہے کہ یہ عمل تیز رفتار ہے اور صرف آدھے گھنٹے میں پانی کو قابلِ استعمال بنا دیتا ہے۔ سائنس دانوں کے مطابق موف کا ایک کلو گرام ایک دن میں تقریباً ۱۴۰ لیٹر پانی کو صاف کر سکتا ہے۔

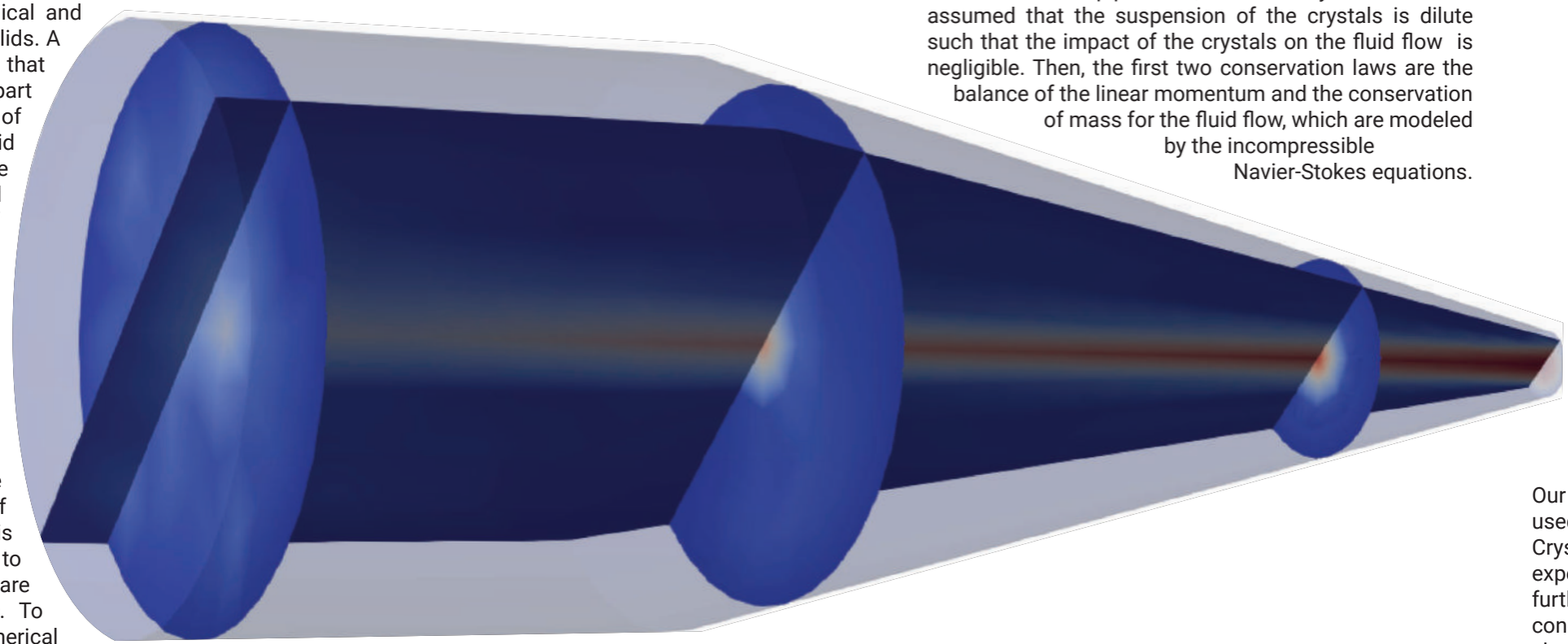


It Cures Headache: Innovation In Fluidised Bed Crystallisers

Dr. Zahra Lakdawala

This article is a distilled version of a book chapter: R Ahrens, Z Lakdawala, A Voigt, V Wiedmeyer, V John, Sabine Le Borne, Kai Sundmacher, "Numerical methods for coupled population balance systems applied to the dynamical simulation of crystallisation processes," in *Dynamic Flowsheet Simulation of Solids Processes (2020).*

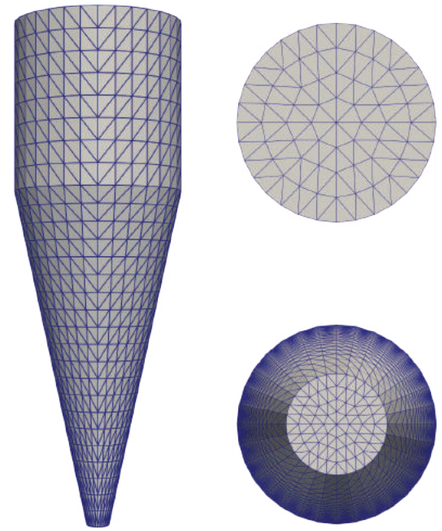
Crystalline solid products are around us everywhere—they are central to industrially-relevant production as 70% of the products of the chemical and pharmaceutical industry are sold as solids. A prominent example is an aspirin tablet that we take for a headache. An important part in designing a crystallisation process of getting solid materials from liquid solutions is to control the size and shape of the crystals. Fundamental and applied research in this area of crystallisation leads to improved process performance with less energy consumption as well as more efficient material utilisation



Such solid-liquid systems are complex and challenging in many ways and fluid flow and particles interact in a variety of fashions. In the lab setup, the evolution of the crystal size and shape distribution is tracked by means of image-based shape estimation. This information is then in turn exploited to obtain the crystallisation kinetics that are governing the crystallisation process. To incorporate these complexities, the numerical methods have been extended and new tools are developed to simulate crystallisation in a better way. Our focus has been on relevant phenomena of crystal growth of multi-faceted crystals as well as on crystal agglomeration with specifically-developed model experiments working with selected and well-understood model substances .Experiments and flow field simulations

serve to parameterise a coupled population balance equation system. This equation system allows predicting the dynamic evolution of the crystal size and shape distribution. Crystal agglomeration is a major phenomenon of crystal size enlargement. Our research concentrates on the understanding and modeling of this phenomenon. The crystal growth and agglomeration can be combined where the main control variables are temperature profiles and flow rates. Crystals can be separated by size and withdrawn at a varying crystalliser height. The size separation is again controlled by the flow rates.

Crystallisation processes are often modeled in terms of a crystal population instead of considering the behaviour of each individual crystal. Utilising macroscopic conservation laws, one derives a system of coupled equations for the population, a so-called Population Balance System (PBS) that describes an averaged behaviour of the crystals. The crystallisation process within a moving incompressible fluid is modeled—the movement is in pipes and/or batch crystallisers. It is assumed that the suspension of the crystals is dilute such that the impact of the crystals on the fluid flow is negligible. Then, the first two conservation laws are the balance of the linear momentum and the conservation of mass for the fluid flow, which are modeled by the incompressible Navier-Stokes equations.



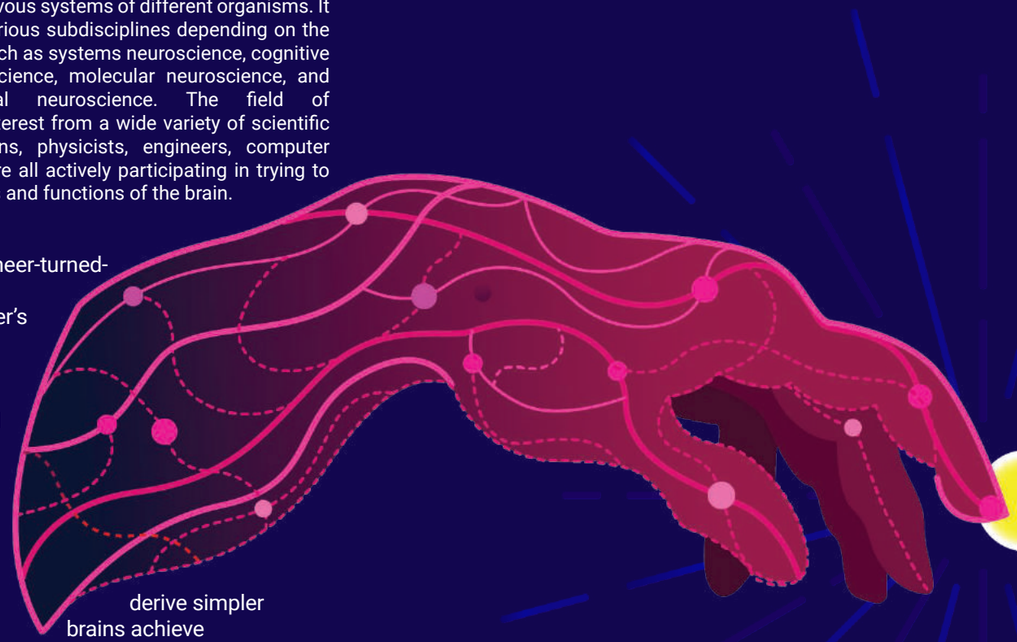
Our study shows that the simulations can indeed be used to model the processes in Fluidized Bed Crystallisers. There is a good agreement between experimental and simulation results. These can be further tested virtually using different operating conditions and settings and this paves the way for cheaper, faster, and informed design and innovation of future fluidised bed crystalliser.

Dr. Zahra Lakdawala is Assistant Professor of Mathematics, SBASSE.

From Electrical Engineering to Neuroscience

Muhammad Furqan Afzal

Neuroscience is an interdisciplinary research area which involves studying the nervous systems of different organisms. It is further divided into various subdisciplines depending on the scale of investigation, such as systems neuroscience, cognitive and behavioural neuroscience, molecular neuroscience, and theoretical/computational neuroscience. The field of neuroscience attracts interest from a wide variety of scientific domains. Mathematicians, physicists, engineers, computer scientists and the like are all actively participating in trying to uncover the mechanisms and functions of the brain.



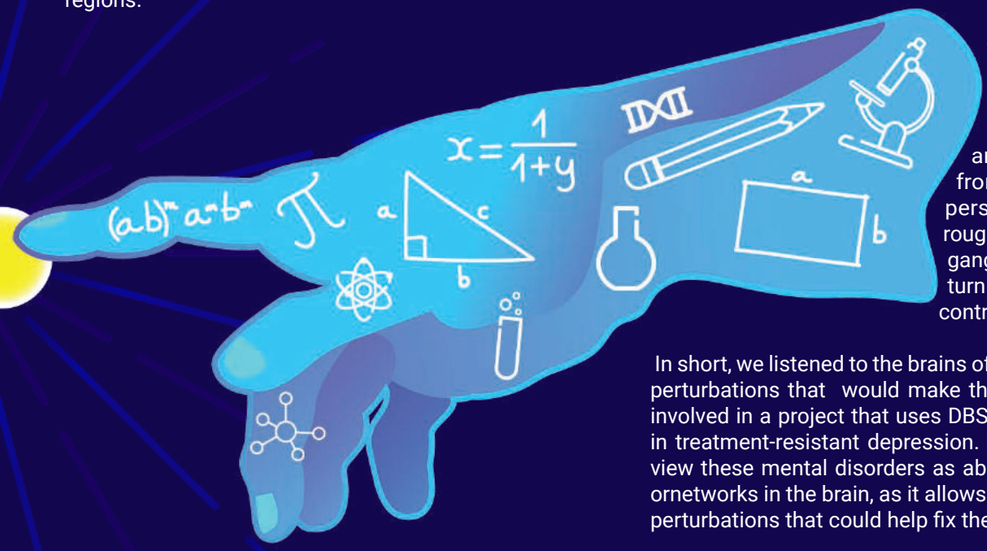
I am an electrical engineer-turned-neuroscientist. With a Bachelor's and a Master's degree in electrical engineering, I was still unsure about the research area I wanted to pursue. I was really inspired by the field of computational neuroscienc which builds computional models that can help us understand and derive simpler explanations of how brains achieve complex functionaity. To get a little flavour, I started working on building some computational models (recurrent neural networks to be precise) to understand how brains achieve volitional motor control abstractly.

The different types of movements that we are able to generate as humans are ultimately encoded as spatiotemporal patterns of neural activity within different brain regions. It is important to understand how such spatiotemporally-varying patterns of neural activity could drive muscles and in turn generate desired movements and behaviours. In our experiments, we were able to embed such spatiotemporal activity patterns in the recurrent networks, which were stimulus-specific, robust, and could be recalled efficiently. We argued that the abstract model provided many of the desired characteristics for flexible generation and recall of complex movements. Thus, we were able to derive a simple explanation of how voluntary motor control could be achieved with a system having certain desired properties. As one can imagine, research of this kind in computational neuroscience could have crucial ramifications for artificial intelligence (AI) as well.

This was my first foray into neuroscience. I often had this uneasy feeling that I was only doing work in silico and was not able to conduct experiments and study biological brains directly. To this end, I was fortunate to work as a research engineer at the Stanford Medicine in a Movement Disorders Center for a couple of years. It was exciting to be able to study movements in human patients and potentially test my computational models on real movement data. This was also my first experience in clinical/motor neuroscience which studies a variety of brain functions and their disorders, including the Parkinson's disease.

The Parkinson's disease is a debilitating neurological disorder with a prevalence of around 0.5-1% in Pakistan. It is a movement disorder where patients are unable to generate desired movements and suffer from tremor, bradykinesia (slowness of movement), and freezing of gait among other symptoms. Our centre used a surgical procedure called Deep Brain Stimulation (DBS) to improve quality of lives of these patients. In DBS, electrodes implanted within certain brain regions of the patients provide electrical stimulation to thoseregions and it often leads to a drastic reduction in symptoms such as tremor and bradykinesia.

There are different theories about the mechanisms through which DBS works but a lot is still unknown and this is an active and a relatively-new re search area. The electrodes which are implanted and internalised for stimulation sometimes also have the ability to record brain waves (local field potentials) from those brain regions.



This is how we get an interdisciplinary field of research where engineers and computer scientists try to make sense of these brain waves and derive some of the mechanism underlying disease pathophysiology. I worked on some projects where I used signal processing and machine learning (ML) techniques to find neural biomarkers related to different symptoms of the disease.

I also had the opportunity of working on a project that involved closed-loop control of symptoms in these patients. Simply: find a neural biomarker related to a symptom (say elevated power in beta rhythm), define a control algorithm to maintain the biomarker in some desired state, record neural activity from the brain region, let the control algorithm determine if the biomarker (brain waves) is aberrant, and perform stimulation algorithmically to maintain the biomarker in a particular state and ultimately improve the symptoms—all in real-time. Such closed-loop control has proved to be more efficient than the open-loop versions with respect to side effects and other aspects. It is fascinating to see that we can manipulate brain circuits in real-time to achieve some desired functionality and improve symptoms in human patients, much like an electrical engineer manipulates electrical circuitry to achieve the desired performance in a system.

We recorded and stimulated in the subthalamic nuclei of these patients, an important detail from a neuroscience perspective, which are roughly part of the basal ganglia network, which in turn is involved in motor control.

In short, we listened to the brains of the patients to do the perturbations that would make them better. I am also involved in a project that uses DBS to control symptoms in treatment-resistant depression. It is very insightful to view these mental disorders as abnormalities in circuits ornetworks in the brain, as it allows us to perform precise perturbations that could help fix them.

For a country where neurological disorders like the Parkinson's are on the rise, it is disappointing to note the lack of neuroscience research in Pakistan. It is definitely time that we set up such interdisciplinary research and education centres in Pakistan where people can work on different subdomains and add to the growing knowledge in these areas. This new appreciation of the potential of neuroscience might also help reduce the stigma associated with certain mental disorders in our society, such as depression.

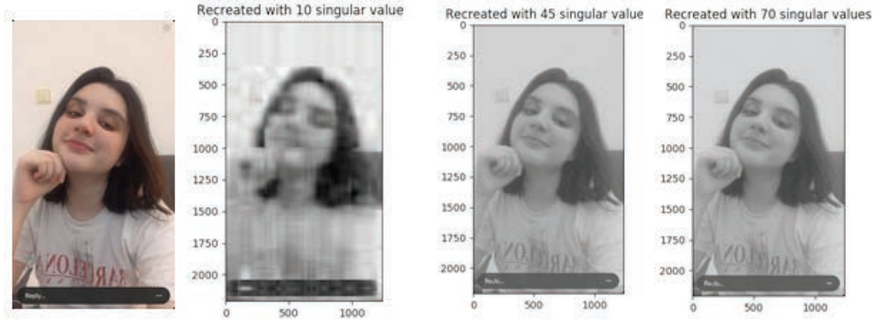
Muhammad Furqan Afzal is a LUMS SSE 2014 graduate (Electrical Engineering).

DISTINCT

ممتاز

Seeing Is Believing—*Or, Is It?*

Dr. Zahra Lakdawala



I would like to share the story of an assignment for the course of Applied/Numerical Linear Algebra that has intrigued several of my students. The purpose of this assignment was to make it more enjoyable for students the basis of any numerical algorithm for solving a linear system of equations—and simultaneously add a fun element to learning the aspects of matrix rank and dimensionality reduction. The application chosen was that of image compression.

Here is how it began: students took their own selfie images (now carefully preserved for posterity) and converted them as a matrix of coefficients using Python packages. Face features and peculiarities are defined by their face contours, intensity, and size. Some have complex 'stark' features and some have 'flat' features. The complexity of each face is reflected in the extent to which the dimensions of the image matrix can be reduced using underlying concepts of rank reductions and compression of an image. Every artistic touch or the complexity of each face will increase the rank vis-à-vis the complexity of their face matrix. Here is a visual of what one of the students got.

I asked them to compare the features using reduced rank/dimensions and define a parametric understanding to link the two together (using a numerical method, such as singular value decomposition).

Our curiosity extended beyond the content that was covered in class. We asked ourselves: Can we see human and animal feature complexity with the same lens of numerical linear algebra? Why not? After all, numbers are numbers. And an image is a projected version of 3D space into a 2D space. The gray values give the image its depth/shape. For comparison, I used an image of my feathered friend with seemingly complex shades of gray in its furry feathered pattern. It turned out that the rank/dimensionality was also reduced by a factor 10 until which the original and compressed image looked the same to the human eye.

Homework, assignments, and assessments—the words are enough to make a student 'yawn' and feel as if they're going through torture. Certainly not the case when students reconstruct their faces bit by bit until they recreate a compressed version of themselves. They now understand that what they see in the mirror is nothing but a projection of themselves and not their entire true self. Reality is truly different from how we perceive it to be, and there are many instances when we can smartly get rid of excess data.

Analysing data as coefficient matrices of real number and the formal methods to smartly arrange and get rid of unnecessary data is what we learn in a class of applied linear algebra. Is mathematics really around us in ways we never imagined? Each time we try to understand the world and our existence, we hear a Gaussian whisper in our ears: *'See, I told you so'*.

Dr. Zahra Lakdawala is Assistant Professor at the Department of Mathematics, SBASSE.

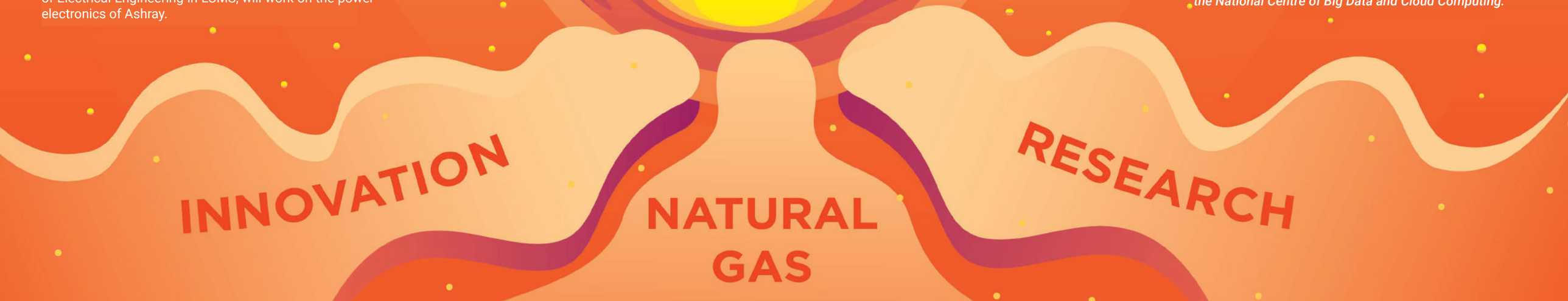
WINTER IS COMING

Pakistan's Need for Smart Geysers

Samoon Iftikhar

Pakistan is currently producing only about 40% of the gas it needs. The natural gas crisis in Pakistan behooves us to find innovative ways to improve consumption efficiency. In light of this, Dr. Hamad Alizai, Assistant Professor and head of the Internet of Things (IoT) lab at LUMS, is working with a dedicated team of researchers to develop natural gas-saving devices and technologies. The IoT lab is part of the National Centre of Big Data and Cloud Computing (NCBC) which focuses on innovation and technology to bring about economic changes in Pakistan.

In winters, water-heating geysers start consuming about half of the gas supplied to homes. While a typical household uses warm water for approximately four hours a day, these geysers, which are equipped with manual thermostats, operate 24/7 and that too at their highest operating point, needlessly wasting gas for heating water that remains unused for larger periods. To address this problem, Dr. Hamad has joined forces with Dr. Nouman Ahmed Zaffar and Zaheen Machines to introduce the concept of a smart geyser called Ashray. Dr. Nouman Ahmed Zaffar, who is currently Associate Professor and Director of Energy and Power Systems at the Department of Electrical Engineering in LUMS, will work on the power electronics of Ashray.

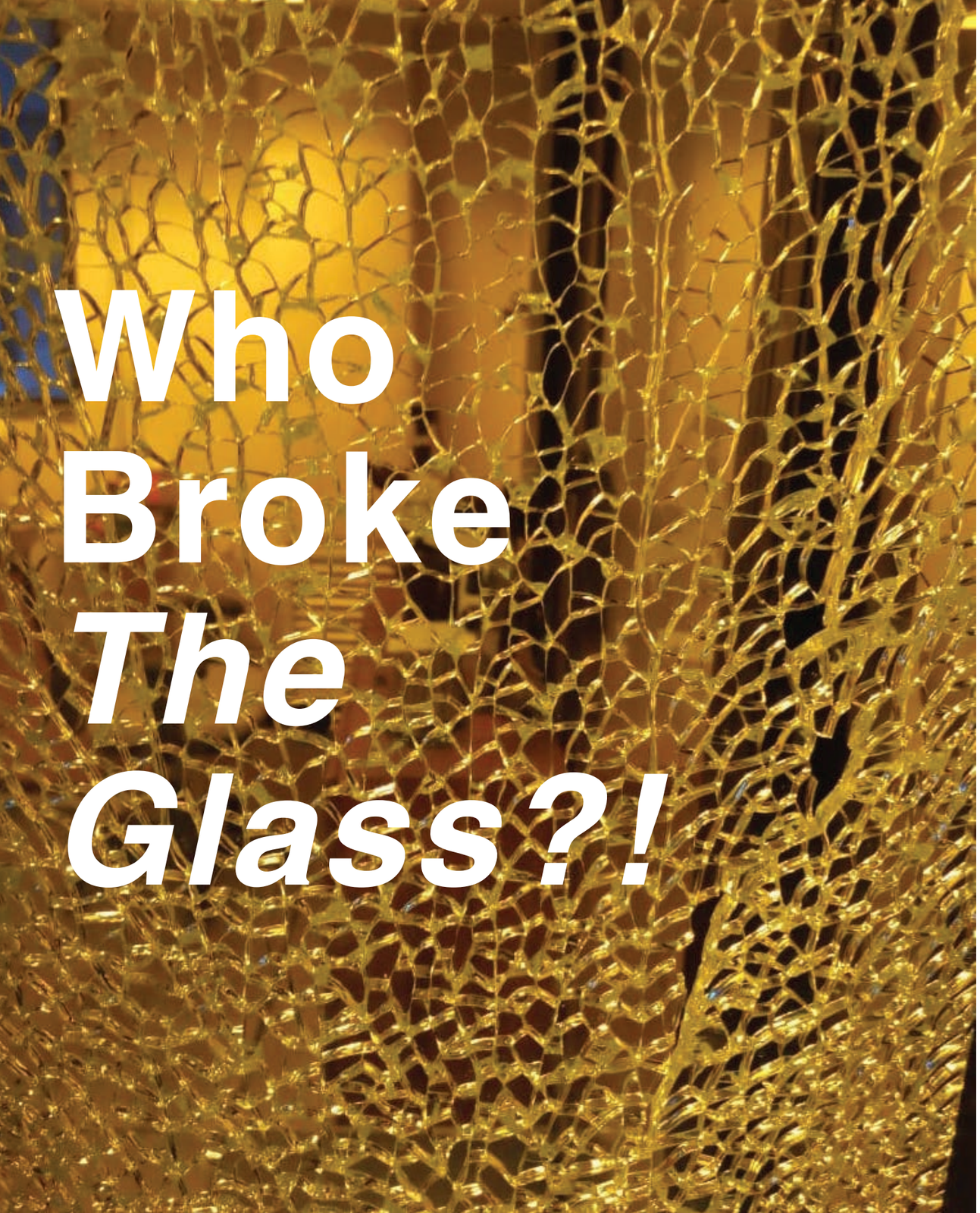


Ashray is the extension of an existing product of Zaheen Machines known as *Jul Bujh*; a programmable geyser thermostat which allows users to control temperature settings of the geysers through a smartphone app. One of the main aims behind the design of Ashray is to minimise gas wastage which will help us save millions of rupees in foreign exchange that are otherwise spent on the import of liquid gas. Ashray will be equipped with smart sensors to detect the usage of hot water in a house so that the temperature of the water changes as per the requirement of the user. The smart sensors will limit the gas usage at times when the user does not require the water to be warm.

Ashray's power and energy efficiency relies on smart power electronics. One of Ashray's features is the automatic ignition of a geyser's pilot. Apart from being a hassle, turning on the pilot comes with the risk of a user's face being burnt in case of a gas leakage. The automation of pilot ignition provides users with both safety and ease. Through these enhancements, Ashray aims to increase a geyser's efficiency by 35%.

With the huge success of its predecessor *Jul Bujh*, Ashray is all set to be commercialised for the winter season in 2021. Ashray will increase the comfort in our daily lives and on a lighter note make our winters much cozier.

Samoon Iftikhar is Business Development Manager for the National Centre of Big Data and Cloud Computing.



Who Broke The Glass?!

A panel of tempered glass in SBASSE's Central Lab mysteriously shattered, creating a mesmerising pattern. The exact reason for the shattering of the glass, leading to the formation of this beautiful pattern is still under investigation.

For the first, the act of shattering, we are hoping to hire the best independent investigator in the country and promise the LUMS community that the perpetrator of this menial and largely inconsequential act will be brought to justice—perhaps even rewarded for creating this pattern, deliberately or otherwise. For the second, the creation of the pattern, we will continue to admire and study it and will share some results in the coming months.

Glass is glass—and yes, sometimes it breaks (did you see that video of two guys transporting a huge sheet of glass when someone on a bike hit it and it broke?). Yikes!

There is some appetite for the notion that tempered glass is unbreakable. That is simply incorrect. Tempered glass is created by special heating and cooling processes that induce internal stresses which are released suddenly in the presence of triggers such as micro-cracks. Unlike regular glass, tempered glass breaks into small chunks which are relatively harmless, compared to the long, jagged splinters of the regular kind that can cause serious injury.

Is it not wonderful that seemingly blind laws of nature that choreographed this shatter pattern have also birth forth the formation of the human eye, brain, and the associated neural network which help us look back at nature in awe of its raw beauty, even in chaos?!

Story Writer: *Syed Roshaan Bukhari*
Photograph by: *Hafiz Muhammad Noman, Senior Lab Engineer, Central Lab.*

DISCOVERY

دریافت

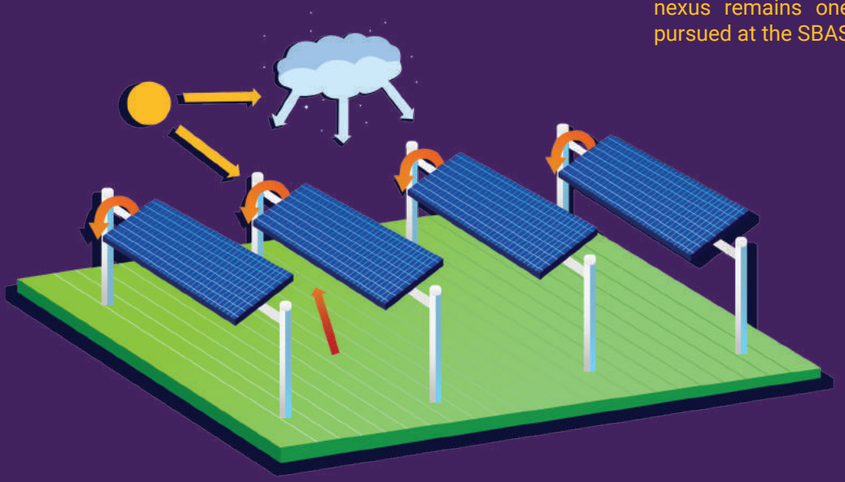
The Power of Agrivoltaics

When the Bond movie *Die Another Day* came up with the concept of a satellite that could be positioned anywhere around the globe and could harness solar light and target it on fields and crops that needed it, it may have seemed a little far-fetched. And while the satellite model is not exactly what has so far been replicated, there have been some wonderful advancements in the field of photovoltaics and how it can be used to improve agricultural produce. SBASSE's own Dr. Nauman Zaffar Butt has been at the forefront of this work.

The field of photovoltaics has now crossed over into the realm of agriculture to produce the budding field of agrivoltaics. Powering agricultural farms through solar energy requires creative designs in both the solar cells as well as how solar cells will be integrated into a solar system that can power agri-farms.

Dr. Butt's PhD student Hassan Imran has now produced an amazing body of work that helps achieve both of these tasks. Novel materials, novel designs of the heterofacial structure of solar cells, and the employment of two-dimensional layers of graphene or carbon nano-tubes can boost the performance of solar cells, achieving almost thermodynamically maximum efficiencies. Creative ways to interface silicon-based and organic-inorganic solar cell technologies helps achieve the best of both worlds.

Finally, Hassan has mathematically modeled the role of soil and orientation of solar panels in achieving high efficiency crop yield from solar enhanced farmlands. This work has immense implications for the country which calls for innovative solutions to address critical problems at the food-energy-water confluence. The quality of his work is evidenced by the articles he has published "along with several conference proceedings"in the world's leading journals on this topic: *the IEEE Transactions on Electron Devices; the IEEE Journal of Photovoltaics; Solar Energy; and Renewable Energy.* The Water-Food-Energy nexus remains one of the six forefront areas being pursued at the SBASSE.



Asad Ullah, Hassan Imran, Zaki Maqsood, Nauman Zafar Butt, Investigation of optimal tilt angles and effects of soiling on PV energy production in Pakistan, Renewable Energy, Volume 139, 2019, Pages 830-843, ISSN 0960-1481, https://doi.org/10.1016/j.renene.2019.02.114.

Dr. Nauman Zaffar Butt is Associate Professor at the Department of Electrical Engineering, SBASSE, LUMS.

Brain Waves: Neurological Disorders And Efficient Hardware

Dr. Awais Bin Altaf, and his PhD student Abdul Rehman Aslam, at the SBASSE Department of Electrical Engineering, have recently published their research in IEEE Transactions on Biomedical Circuits and Systems, one of the leading journals in the field.

The team came up with an idea of developing efficient hardware for the classification of Chronic Neurological Disorders (CND's) in a non-invasive fashion. The method involves long term continuous monitoring with neuro-feedback of human emotions for patients with CND's to mitigate its harmful effect. This work presents hardware-efficient and dedicated human emotion classification processor for CND's.

The scalp Electroencephalogram (EEG), also known in common parlance as a "brain wave," is used for the emotion's classification using the valence and arousal scales. A machine learning classifier is used along with carefully selected temporal and spectral features suitable for a wearable non-invasive classification system.

This work is among one of the first digital integrated circuit (IC) processor designed and implemented in Pakistan with indigenous grant and the results are based on actual silicon measurement after fabrication. The team first presented the initial idea of the system at the IEEE International Symposium on Circuits and Systems organised in Japan in 2019 on a field programming gate array (FPGA).

The research team is now working on the second generation of the system and plans to integrate the processor with an analog front end making the overall system miniaturised to fit onto a patch sensor for long term continuous monitoring, recording, and neuro feedback onto a single chip and performing a real-time measurement on CND patients.

A. R. Aslam, T. Iqbal, M. Aftab, W. Saadeh and M. A. Bin Altaf, "A10.13uJ/classification 2-channel Deep Neural Network-based SoC for Emotion Detection of Autistic Children," 2020 IEEE Custom Integrated Circuits Conference (CICC), Boston, MA, USA, 2020, pp. 1-4, doi: 10.1109/CICC48029.2020.9075952.

Dr. Awais Bin Altaf is Assistant Professor at the Department of Electrical Engineering, SBASSE, LUMS.

The Particle by SBASSE

Identification Of Genome-Wide Transcriptional Change

Story adapted from Dr. Rahim Ullah's thesis

Researchers from the Department of Biology at SBASSE have identified genome-wide transcriptional changes during trophoblast stem cell differentiation, a key event during placental development. This work from Dr. Rahim Ullah's PhD thesis was carried out under the supervision of Dr. Amir Faisal and has been published in BMC's Stem Cell Research and Therapy. This multidisciplinary research highlights collaborative efforts between various groups in Biology, including those of Dr. Aziz Mithani and Dr. Muhammad Tariq.

Differentiation of mouse trophoblast stem cells (TSCs) to trophoblast giant cells (TGCs) has been widely used as a model system to study placental development and function. While several differentially expressed genes, including regulators of TSC differentiation, have been identified, a comprehensive analysis of the global expression of genes and splice variants in the two cell types has not been reported.

The paper reports ~7800 differentially expressed genes in TGCs compared to TSCs which include regulators of the cell cycle, apoptosis, cytoskeleton, cell mobility, embryo implantation, metabolism, and various signaling pathways. It shows that several mitotic proteins, including Aurora A kinase, were downregulated in TGCs and that the activity of Aurora A kinase is required for the maintenance of TSCs. The paper also identifies hitherto undiscovered, cell-type-specific alternative splicing events in 31 genes in the two cell types. Finally, we also report 19 novel exons in 12 genes which are expressed in both TSCs and TGCs.

The data reported in this paper point to transcriptional diversity and differential transcriptome in mouse TSCs and TGCs that was not known previously. Differential expression of some of these genes indicates a shift in the functional properties of TGCs as they differentiate from TSCs. Functional validation of these genes will not only enhance our understanding of mammalian development but could also lead to finding ways to treat placental abnormalities and diseases which often lead to premature childbirth.

Ullah, R., Naz, A., Akram, H.S. et al. Transcriptomic analysis reveals differential gene expression, alternative splicing, and novel exons during mouse trophoblast stem cell differentiation. Stem Cell Res Ther 11, 342 (2020). https://doi.org/10.1186/s13287-020-01848-8.

EVENTS & FEATURES

نمایاں تقریبات

Syed Babar Ali Research Awards 2020

SBASSE is pleased to share the inaugural winners of the Syed Babar Ali Research Awards set up through a generous gift from the Babar Ali Foundation. The awards are aimed at recognising the most potentially high-impact work being carried out by our current PhD students.

Dean's Testimonial

It brings me delight to announce the initiation of the Syed Babar Ali Research Awards for PhD students who have already defended their proposals. The Awards will celebrate at least five scholars every year, called the Syed Babar Ali Fellows, who will be selected for the novelty of their research work and the potential for lasting impact on their disciplines and the society. PhD students wishing to apply for these Awards will be required to apply through a prescribed format and selection will be done by the School's graduate council.

This prestigious award carries a scholarship amount. Fellows will also have access to a Syed Babar Ali Research Fund for which they will need to apply separately. Following approval, this fund can be used to support the awardees' research needs such as materials and supplies, small equipment, travel for research or training, and article processing charges in top journals.

I thank the Babar Ali Foundation for this generous support to our PhD program and in bolstering student-led research. Research and creation or synthesis of knowledge is our mainstay and I can say on behalf of all our faculty that we will continue to facilitate the route to discovery and innovation. The creation of SBARA is one important milestone. Needless to say, the Foundation will be acknowledged in all work emanating from this Award.

Best wishes,
Muhammad Sabieh Anwar
Ahmad Dawood Chair and Dean, SBASSE

Faiza Iftikhar (Electrical Engineering): Lab testing at home with optical cavities
PhD advisor: Dr. Imran Cheema (Electrical Engineering)

You've been there. We've all been there. Medical tests! How amazing would it be if you could have your medical tests conducted with great reliability and at a very low cost? Would you be interested? Say hello to Faiza Iftikhar, PhD student in the Electrical Engineering Department, who is working on the technology that can make this happen! The key technology is optical and employs cavities with highly reflective mirrors on both ends. Such a cavity is called a Fabry-Perot etalon and the idea is to use these microdevices for detecting analytes with remarkable sensitivity and ultra-high resolution.

Abdul Rehman Aslam (Electrical Engineering): Tracking emotions—a potential breakthrough!
PhD advisor: Dr. Awais bin Altaf (Electrical Engineering)

All children deserve to achieve their full potential and responsible members of the society need to help them deal with difficulties and barriers during this process. One of these barriers is ASD—Autism Spectrum Disorder—which manifests itself in more children in Pakistan than we would be comfortable knowing, and one such responsible member of the society is Abdul Rehman Aslam. Rehman wants to use cutting edge technology to sense early symptoms of ASD by monitoring brain activity of the impacted child using a child-friendly headband and gauging emotional states during learning periods. This method will bypass extensive child and parent interviewing and behavioural monitoring which can be a psychologically tiring for both. We cautiously think that this will be the world's first ASD assistance technology that might become a breakthrough for ASD diagnostics.

Adeem Aslam (Electrical Engineering): Music, Wi-Fi, and 'The Big Bang'
PhD advisor: Dr. Zubair Khalid (Electrical Engineering)

We humans love to make sense of stuff around us—and we want our machines to do the same for us. When acoustic signals start making sense, we can listen to beautiful music; when wireless signals make sense, we get hooked to high-speed internet; and when signals from the big bang start making sense, we end up contemplating our very existence. What a wonderful connection between signal and interpretation! Just as you cannot accurately tell the exact 3D build and structure of a human by just looking at their 2D shadow, we lose information when we lose a dimension. Imagine how much more can be understood about a phenomenon if we can understand signals in 3D? This is what Adeem Aslam wants to find out: about music, Wi-Fi, and 'The Big Bang.'

Amina Qadir (Biology): Defeating Hepatitis C, one N-S-5-b at a time!
PhD advisor: Dr. Syed Shahzad ul Hussan (Biology)

Virus—we have all probably heard enough of this word already, but one word we have probably not heard of is NS5b (pronounced: Enn-Ess-Five-Bee). This protein found on the hepatitis C virus (HCV) and its variants is a prominent target for therapy. The work aims at studying the NS5 with the hope of actually putting a stop to unwanted comebacks from this terrible infection in humans.

Seminar Series: Recent Developments in Radar Systems and Status of Radar Development in Pakistan

The Department of Electrical Engineering, LUMS, Microwave Antennas and Circuits (MAC) Lab, LUMS, and IEEE LUMS student chapter have jointly organised a Seminar Series on "Recent Developments in Radar Systems and Status of Radar Development in Pakistan."

The seminar series will have around 20 online talks over the next 3–4 months by renowned national and international experts in the field. The primary objective of organising these talks is to inspire students and researchers about the importance and applications of Radar Systems in different domains and to apprise them of the roadmap of radar development in the future and indigenous radar development efforts made over the last many years.

Portable Lab Kits— A Commitment To Continued Learning

Story Writer: Roshaan Bukhari

Surely one cannot provide students with meaningful hands-on learning experience through packets of information sent over the internet, processed in a server and received on a computer. Some things in life are meant to work best when tangible. One such thing is learning enabled by the laboratory.

Worried by this barrier in hands-on learning, Dr. Jahangir Ikram of SBASSE and his team, with support from the Chair of the Department of Electrical Engineering, worked hard to successfully develop low-cost kits for students, to continue learning even outside of the lab from the comfort of their homes. It is fair to say that Dr. Jahangir and team made the lab come to the students rather than vice versa.

Each kit contains a variety of necessary tools including micro controllers, LED matrix, programmable chips, digital to analog converter, an oscilloscope, power distribution core, a complete tool set, multimeter, speed controllers, and motors. The oscilloscopes had to be imported from China to meet the goal of making the kit cheaper and therefore more affordable.

In the heat and humidity of the past three months, 50 kits were successfully developed and Dr. Jahangir's team had gone to lengths ensuring no compromise was made in quality and effectiveness of the kits. The kits will be used for the EE 324 course that focuses on micro controllers interfacing and assembly language program.

We congratulate Dr. Jahangir and his department on leading this initiative and appreciate his interest in extending technical support to other universities in case they would like to replicate this project.

Colloquium: Molecular Cellular Biology— *Live Zoom Sessions*

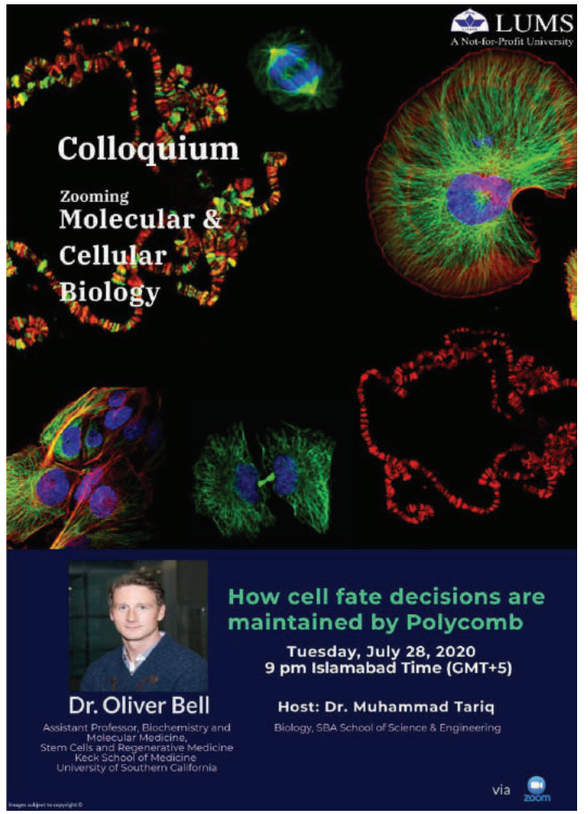
Muhammad Abdullah Jauhar

One of the easiest and quickest ways to stay abreast with cutting-edge research, especially in the natural sciences, is to attend scientific conferences and seminars. Unfortunately, due to the security situation in our country and financial constraints, our students and faculty rarely get an opportunity to attend conferences and seminars where leading researchers present their findings. The disruptions caused by COVID-19, however, served as a blessing in disguise for institutions in Pakistan since they could now host Zoom sessions instead of funding expensive travel grants.

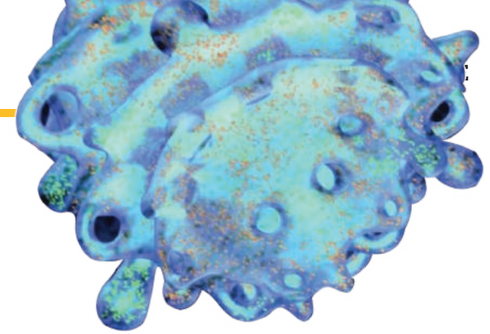
The Tariq Lab at SBASSE Biology made full use of this oportunity and took an initiative to organise Molecular and Cellular Biology colloquium by regularly inviting leading scientists from around the world to present their latest research work in a virtual seminar. At the Tariq Lab we were able to reach out to several experts from all around the globe for our virtual seminars. The seminars were carried out via Zoom where the LUMS community joined in; the sessions were also live-streamed on the SBASSE Facebook page for the scientific community and students around the world. A 50-minute talk followed by Q&A from the attendees constituted the virtual seminar series. We were delighted to see the response from our audience who actively participated in the discussion and raised intriguing questions on the topics being addressed.

Our inaugural speaker Dr. Oliver Bell, who is an Assistant Professor at the Kech School of Medicine, University of Southern California, focused on how cell fates are maintained by regulating cell type-specific gene expression patterns. Dr. Bell presented his latest research about "How cell fate decisions are maintained by Polycomb Repressive Complexes" in mouse model.

Since all the work presented in Professor Gasser's talk was carried out in nematode (C. elegans), it was certainly interesting to see how knowledge generated in this model organism is helpful to understand gene regulation in higher eukaryotes. By the end of her talk, she also shared her life experience of how she grew as the first female professor in Switzerland and the challenges faced by women for a career in science.



Our third speaker was Dr. Stefan Schoenfelder from the Babraham Institute in Cambridge, UK. He talked about the significance of three-dimensional organisation of the genome, i.e., chromosomes in the nucleus of a cell, and



such 3D organisation may influence cell fate of different cell types in our body. Dr. Schoenfelder not only shared his latest research but also informed the audience about the current debates in the field along with tools used to study long-distance chromosomal interactions important for the regulation of gene expression. He also explained the significance of many open questions in the field followed by an extensive Q&A session.

Our last speaker, was Prof. Peter Becker who is one of the finest biochemists in the field of chromosome biology and gene regulation. Presently, he is serving as Chair of the Biomedical Centre at LMU, Munich. He discussed the "Genetic and Epigenetic Mechanisms of X Chromosome Activation is Drosophila Melanogaster". As compared to females who carry two X chromosomes, males have only one X and a Y chromosome. Prof. Becker explained how genes on the single X chromosome in male flies are activated to equalise dosage of genes from the two X chromosomes in females, something which is crucial for the survival of organisms. In humans, males also carry a single X chromosome as compared to two X chromosomes in females, and equalising expression dosage of genes residing on X chromosomes is crucial for the survival because defects in the regulation of genes residing on X chromosomes lead to lethal consequences. In humans, gene dosage is achieved by the transcriptional silencing of one of the two X chromosomes in females and is known as X chromosome inactivation. Peter also shared latest advances in his lab to assemble the complete embryonic chromatin in a test tube to mimic early-staged embryonic stage, which is certainly an accomplishment in the field of biology.

The surprising and yet unfortunate fact was that the highly accomplished scientists like Prof. Gasser and Prof. Becker had never interacted with any scientist and/or scientific event in Pakistan.

They were amazed and excited to learn about our inspiring journey at Syed Babar Ali School of Science & Engineering and how much we had accomplished with scarce resources.

We will be having several more distinguished guests in our virtual colloquium series in the coming months. All recorded talks are and will be available on the SBASSE Facebook Page as well as the SBASSE YouTube page.

Muhammad Abdullah Jauhar is a Biology Junior and member of Epigenetics group (Tariq Lab) who coordinates all seminars in zooming MCB series.

Training Workshop on Earth Observation Applications in Agriculture & Forestry

The NCRA Agricultural Robotics Lab and the Center for Water Informatics and Technology (WIT), LUMS, in collaboration with the Institute of Space and Technology (IST), organized a four-week training workshop on "Earth Observation Applications in Agriculture and Forestry".

The workshop aimed to train professionals from relevant institutions on satellite data analysis for agriculture and forest monitoring. In addition, the training provided knowledge on theoretical foundations of optical remote sensing and microwave Synthetic Aperture Radar (SAR) data analysis, with hands-on practice in relevant satellite data analysis by utilizing Google Earth Engine (GEE) cloud computing platform, ESA Sentinel Applications Platform (SNAP), and other related software. The training was initiated and fostered for further exploration by the workshop participants to promote institutional capacities in the use of Earth Observation technologies for the agriculture and forest sectors.

The training panel was comprised with Dr. Waqas Qazi (Assistant Professor, IST, Islamabad); Dr. Hammad Gilani (Assistant Professor, IST, Islamabad); Salar Saeed (Research Associate, NARL, LUMS); and Muhammad Usman Qadeer (Research Assistant, NARL, LUMS). Two guest talks will also be organized, including one each by Dr. Murtaza Taj (Assistant Professor, LUMS) and Dr. Ahmad Khan (Remote Sensing Scientist, GLAD Lab, USA).

ڈیجیٹل رسائی، عمدہ پڑھائی

روشان بخاری کی تحریر

ہر مشکل گھڑی اپنے ساتھ سیکھنے کے ڈھیروں مواقع لاتی ہے۔ ایسے ہی ایک موقع سے استفادہ کرتے ہوئے لمز کے اسکول آف سائنس اینڈ انجینئرنگ نے اپنی کلاسز کی ڈیجیٹل فراہمی کا آغاز کیا ہے، جس کی مدد سے طلبہ اپنے گھروں سے با آسانی پڑھائی کا سفر جاری رکھ سکتے ہیں۔

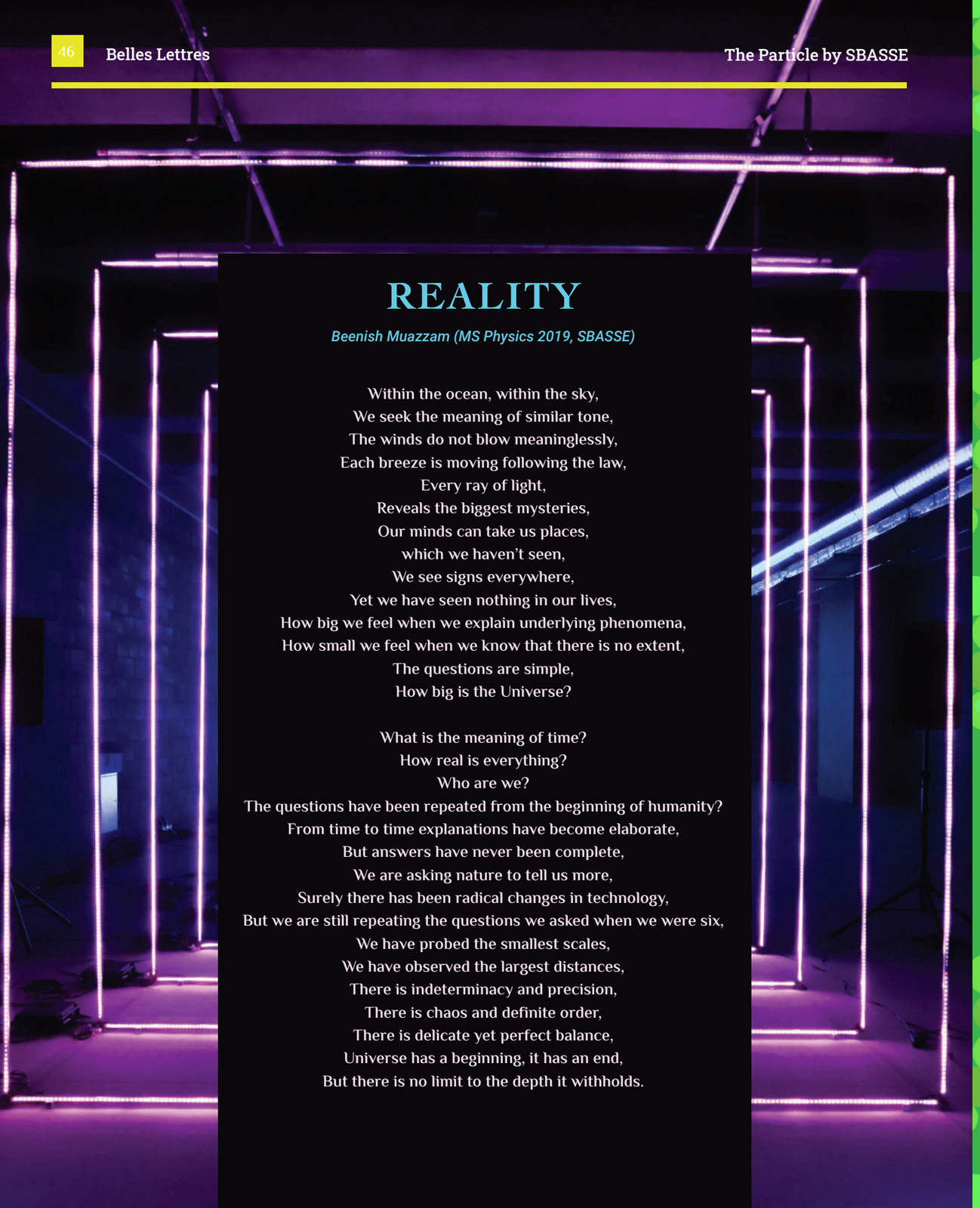
ٹیکنالوجی کی مدد سے علم کی رسائی نہایت آسان ہو چکی ہے۔ انٹرنیٹ اور کمپیوٹر (یا موبائل فون) کے استعمال سے آپ جہاں کہیں بھی ہوں، مجازی طور پر کلاس روم میں بیٹھ سکتے ہیں۔ تو کیوں نہ اس سہولت کو بہترین اساتذہ کے تدریسی تجربے کے ساتھ ضم کر دیا جائے؟

اسکول آف سائنس اینڈ انجینئرنگ میں چار کمرے اس مقصد کے لیے مختص کر دیے گئے ہیں۔ حرکت پذیر، قابلِ زُوم کیمرے، آن لائن شریک طلبہ کی تصویر کو پوری دیوار پر دکھانے والا پروجیکٹر اور لیکچر کو مختلف زاویوں سے ریکارڈ کرنے کی صلاحیت اس کلاس روم کی چند خصوصیات ہیں۔ دیگر تعلیمی ادارے جو اس طرح کے منصوبے نصب کرنا چاہتے ہوں، ہم سے تفصیلات مطلوب کر سکتے ہیں۔

امید ہے اس طرح کم قیمت میں موثر طریقے سے علم کی فراہمی یسّر کی جا سکے گی۔

BELLES LETTRES

تحریر و تصنیف



REALITY

Beenish Muazzam (MS Physics 2019, SBASSE)

Within the ocean, within the sky,
We seek the meaning of similar tone,
The winds do not blow meaninglessly,
Each breeze is moving following the law,
Every ray of light,
Reveals the biggest mysteries,
Our minds can take us places,
which we haven't seen,
We see signs everywhere,
Yet we have seen nothing in our lives,
How big we feel when we explain underlying phenomena,
How small we feel when we know that there is no extent,
The questions are simple,
How big is the Universe?

What is the meaning of time?
How real is everything?
Who are we?
The questions have been repeated from the beginning of humanity?
From time to time explanations have become elaborate,
But answers have never been complete,
We are asking nature to tell us more,
Surely there has been radical changes in technology,
But we are still repeating the questions we asked when we were six,
We have probed the smallest scales,
We have observed the largest distances,
There is indeterminacy and precision,
There is chaos and definite order,
There is delicate yet perfect balance,
Universe has a beginning, it has an end,
But there is no limit to the depth it withholds.

COMMUNITY

ہم لوگ

FACULTY PROMOTION

Dr. Nauman Zafar

Dr. Nauman Zafar has been promoted to Associate Professor and granted tenure at SBASSE. His primary focus in the early years of his career remained silicon-based device modelling. However, he has now forayed into device physics for photovoltaic, agrivoltaic, energy harvesting, and microfluidic applications. Dr. Zafar's interests also lie in using energy harvesting technologies for boosting agricultural produce and novel, water-borne photovoltaics for use in off-urban environments. His device modelling efforts continue to find novel and unique ways of inching upwards the efficiency of solar energy conversion.

Dr. Hassan Abbas Khan

Dr. Hassan Abbas Khan has been promoted and granted tenure as Associate Professor in the Department of Electrical Engineering.

Dr. Khan works on developing indigenous and globally-relevant solutions for off-grid and rural electrification, solar energy devices, energy optimisation, and batteries technologies. He is a co-founder of the LUMS Energy Institute, winner of several significant research grants, and author of highly-cited works in the field's top journals.

Dr. Fareed Zaffar

Dr. Fareed Zaffar has been promoted and granted tenure as Associate Professor in the Department of Computer Science.

An outstanding aspect of Dr. Zaffar's research productivity is his engagement of undergraduates in research work. Another important dimension is his engagement with Pakistan's courts in organising the judicial system as well as with other civil society and public sector organisations on healthcare, education, and accountability. On this count, he leads the Technology for People Initiative at LUMS and a strong research ecosystem in the areas of computer networks and internet security.

Dr. Irshad Hussain

Dr. Irshad Hussain has been promoted to Professor of Chemistry in the Department of Chemistry and Chemical Engineering.

Dr. Hussain is a world-renowned expert in nanomaterials and nanoparticle synthesis and harnesses them in diverse applications in the biomedical, energy, and environmental fields. He is one of the country's most highly-cited scientists and plays a significant role in advancing the fields of chemical and nanotechnology research in Pakistan. With recipient of several national and international awards, and a distinctive record of extra-mural funding, Dr. Irshad was among the founders of the chemistry programme at LUMS which is now blossoming into one of the region's strongest programmes.

WELCOME ABOARD.

Dr. Rafi Ullah

Dr. Rafiullah, an in-silico materials tinkerer, joins SBASSE in the Department of Physics. It is with great pleasure that we welcome him and his passion for computational materials and theoretical condensed matter physics and nanoscience.

During his academic pursuits, Dr. Rafi earned significant grants, various distinctions, and scholarships for his research work, which has been featured in the *European Physical Journal B, the Journal of Physics and Chemistry of Solids, the Journal of Physical Chemistry Letters, and Inorganic Chemistry,* as well as some of the world's top journals in *physics—the Physical Review Letters and the Physical Reviews B.*

He received his PhD with distinction in Computational Condensed Matter Physics from the University of Basque Country, Spain. His interest lies in the quantum simulation of electron dynamics in response to strong non-adiabatic external perturbations in various contexts such as radiation, non-adiabatic coupling of molecular vibrations with the substrate electrons (metal surfaces), defect dynamics, and plasmonics.

He is also interested in studying matter under extreme (temperature and pressure) conditions using first principles molecular dynamics and metadynamics. What stands out is his foundational work in translating physical principles into the creation of new massively parallelisable computer code allowing complete in-silico materials science.

We are excited to have him on board and we wish him a successful career here at SBASSE.

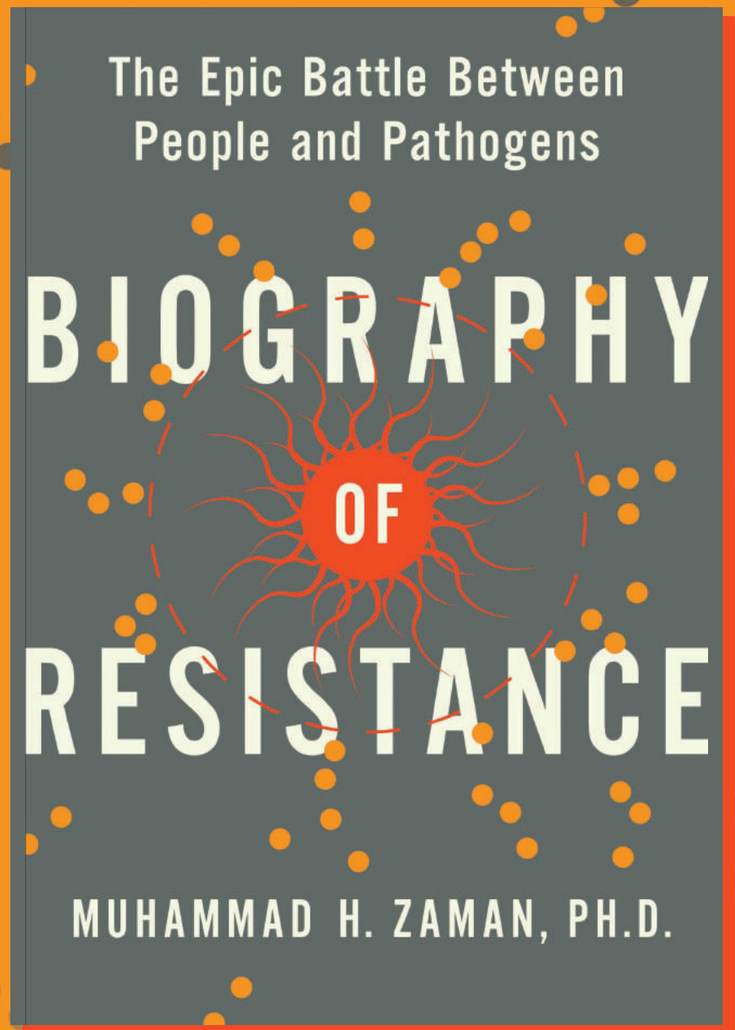
Dr. Rizwan Khalid

The SBASSE family is excited to welcome Dr. Rizwan Khalid to the Department of Physics.

Setting his sight on the bleeding frontier of science, Dr. Khalid enjoys research interests that take him beyond the standard model of physics and into the realm of supersymmetric grand unification theories and even the darkest shades of our universal existence, the dark matter. However, he doesn't stop there! His research has shown ways by which one may obtain information on high energy physics of grand unification theories by studying experiments at the world's biggest man-made experiment, the LHC!

Dr. Khalid has thorough experience with teaching and curriculum development for physics at both the undergraduate and postgraduate levels. Additionally, in his efforts to give back to the community, he has successfully set up a teaching lab for undergraduate physics students at NUST. He is hailed as one of Pakistan's top physics teachers.

His research work has been published in numerous journals including the ***Journal of High Energy Physics, Progress of Theoretical and Experimental Physics, and Nuclear Physics.*** He received his PhD in Theoretical Particle Physics from the University of Delaware in 2011, and completed his MSc Physics from Quaid-i-Azam University, Islamabad.



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Review of Dr. Hamid Zaman's book - John O'Rourke, Editor, BU Today

For the past eight months, the world's attention has been focused on the deadly health crisis caused by the COVID-19 pandemic which has already infected 30 million people and killed more than 950,000.

But in his gripping, highly readable new book, *Biography of Resistance: The Epic Battle Between People and Pathogens* (Harper Wave, 2020), Muhammad Hamid Zaman, a Boston University College of Engineering professor of biomedical engineering and of materials science and engineering, says there is an equally urgent crisis before us—drug-resistant infections.

More than 700,000 people die each year as a result of multidrug-resistant diseases, including at least 35,000 in the United States. And as Zaman, a Howard Hughes Medical Institute Professor, makes clear, the situation is getting more urgent.

Without action, he writes, we are likely to face an unimaginable public health crisis: "It will be like the great plague of the Middle Ages, the influenza pandemic of 1918, the AIDS crisis of the 1990s, and the Ebola epidemic of 2014 all combined into a single threat."

A 2019 report issued by the United Nations Ad Hoc Interagency Coordination Group on Antimicrobial Resistance predicts that drug-resistant diseases could claim as many as 10 million lives a year by 2050.

Zaman notes that bacteria predate humans by 3.5 billion years and that from the beginning, they have proven resilient: "The multilayered bacterial defense mechanism—one of nature's oldest creations, ever-evolving, ever-surprising—has learned to stay a step ahead of us at every single point in our history together."

Chapter by chapter, Zaman, whose research currently focuses on antibiotic resistance in low-income countries and refugee settlements and who was recently awarded a 2020 Guggenheim Fellowship, shows how bacteria have been able to quickly elude our arsenal of increasingly potent antibiotic drugs since the first ones were introduced for widespread use in the 1940s. He illustrates the myriad factors that have contributed to microbial resistance, including the overprescribing of antibiotics, counterfeit drugs that are often of poor quality, the large-scale use of antibiotics in agriculture, and ongoing wars and conflicts, which, he says, "contaminate waterways, destroy infrastructure, and create drug-resistant infections."

The book is full of lively stories of brilliant scientists who have advanced our understanding of bacteria, antibiotics, and antibacterial resistance, from the German microbiologist Robert Koch, credited with discovering germ theory, to Mary Barber, the British bacteriologist who discovered that widespread use of penicillin had led to penicillin-resistant strains of staph, to Tore Midtvedt, the Norwegian researcher who discovered in the 1980s that people in his country were being prescribed 24 tons of antibiotics a year and that salmon were ingesting twice that amount via "antibiotic-enhanced" fish food. But this is no mere hagiography: Zaman reveals the hubris and fierce competition that lies behind many of their stories.

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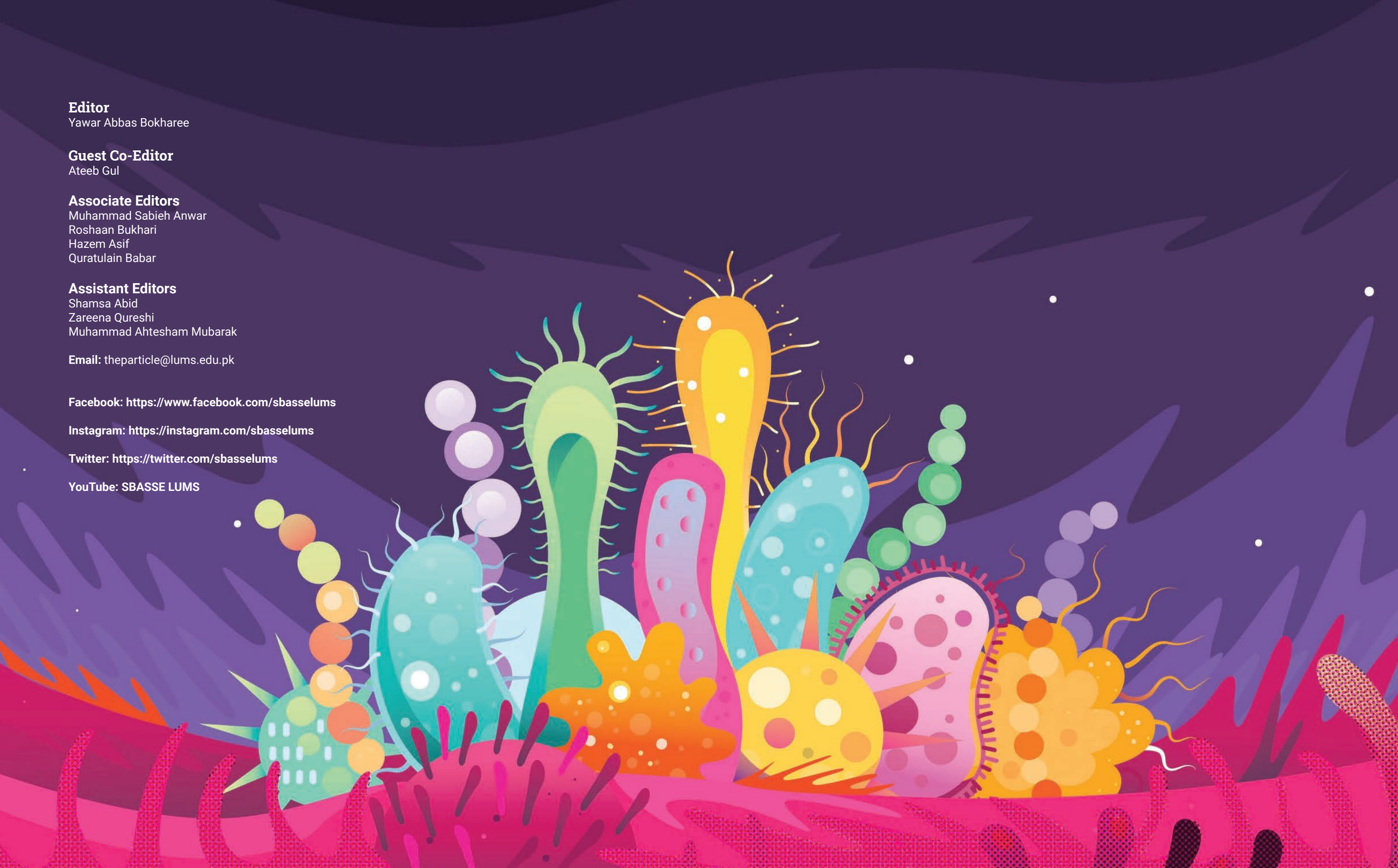

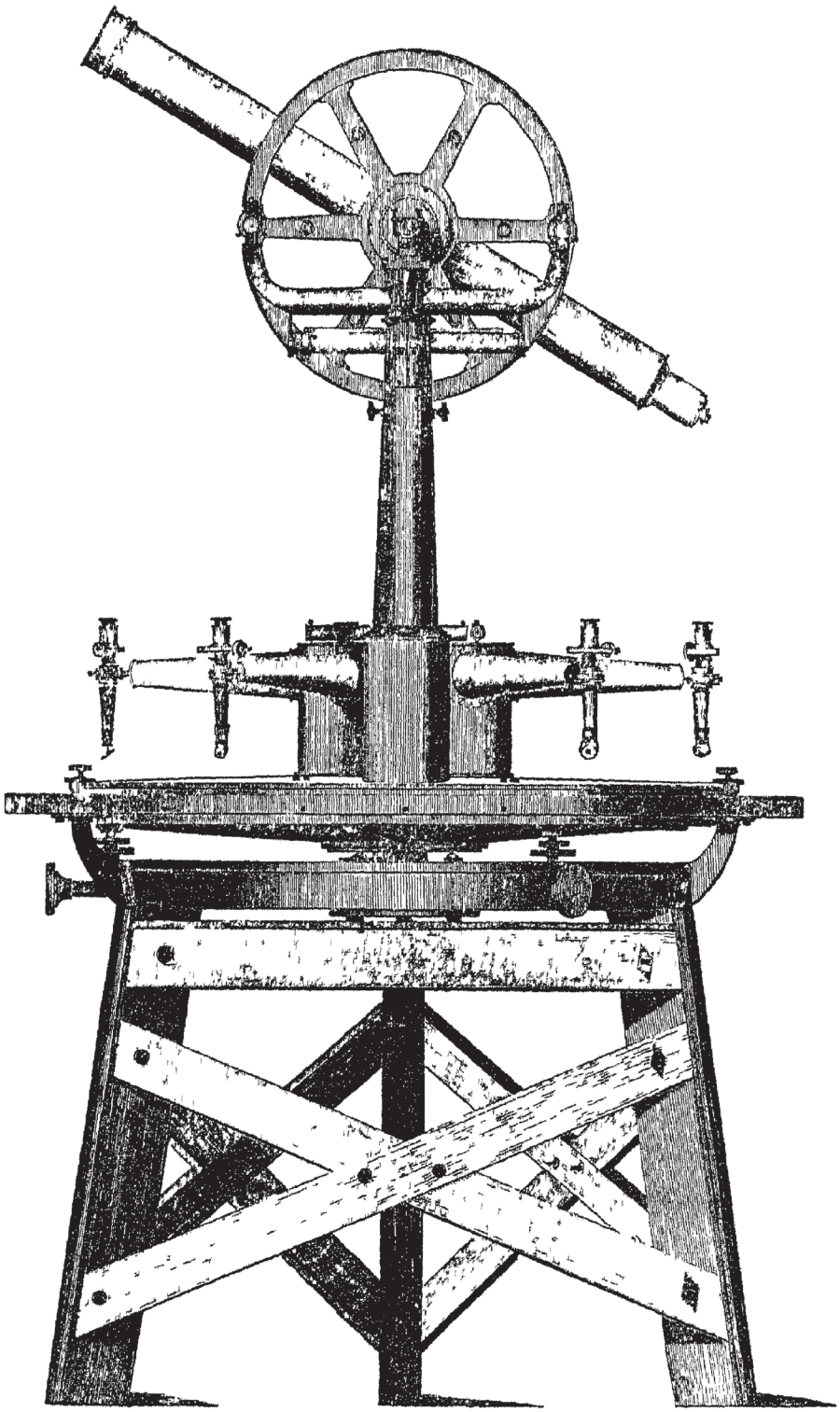

معروف برطانوی تھیوڈولائٹ، جس کی مدد سے برصغیر کا ابتدائی جغرافیائی سروے کیا گیا۔

Troughton & Simms London made Theodolite for surveyors and engineers, a British scientific instrument firm formed in 1826.