SCIENTIA SPECTRUM

2024 EDITION : A NEXUS OF SCIENCE FOR THE CURIOUS MINDS

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FOREWORD BY VICE CHANCELLOR

It is an honor to be at the helm of this institution, the University of Engineering and Technology (UET) Lahore, a university with a rich history of producing skilled professionals who contribute significantly to the advancement of science, technology, and engineering on both national and global fronts.

Among the many contributors of UET, I would like to congratulate the UET Science Society for their impressive work and contributions to the university. I can already see how much this society has achieved over the years, by offering students great opportunities to explore science through events like STEM and SNYES.

Scientia Spectrum magazine is another important accomplishment. It provides UET students a platform to share their research and passion for science, highlighting the talent and hard work of our students. I truly appreciate the efforts of them in creating a space for students to learn and succeed.

As they launch the new edition of Scientia Spectrum, I wish the entire team and all contributors the best of luck. May this magazine continue to be a source of knowledge and inspiration for the students.

Prof. Dr. Shahid Munir
VICE CHANCELLOR UET LAHORE

FOREWORD BY ADVISOR

It has been an incredible journey since 2014 when UET Science Society was first established, and I've had the privilege of serving as its advisor since then. Over the years, I have watched this society grow, taking on new challenges and achieving remarkable success through events like STEM, SNYES, and various outreach programs. These initiatives have provided our students with exceptional opportunities to explore, learn, and innovate on a grand scale.

Last year, we took a significant step forward with the launch of Scientia Spectrum, a magazine that highlights the UET's scientific community. I am proud to see the second edition of this publication, marking yet another milestone in the society's ongoing growth. I extend my heartfelt best wishes to the entire team of UET Science Society. I am confident that they will continue to make milestones in the coming years and inspire the next generation of innovators.

Prof. Dr. Muhammad Shahid Rafique
ADVISOR UET SCIENCE SOCIETY

UNIVERSITY OF ENGINEERING & TECHNOLOGY LAHORE

University of Engineering and Technology, Lahore, stands as a beacon of educational excellence, with a legacy that spans over a century, dating back to 1921. As one of the oldest and most prestigious educational institute in Pakistan, UET has consistently cultivated generations of leading engineers, scientists, and leaders, who have gone on to make a profound impact in their respective fields. Over the years, the university has undergone significant expansion, with the establishment of new departments and research centers, offering a diverse range of engineering fields and enhancing the quality of education. This growth has enabled UET to stay at the forefront of innovation, providing students with a comprehensive education that prepares them for the challenges of the modern world. With its motto "Read in the name of thy Lord Who created!" UET develops a culture of academic excellence, extracurricular activities, and personal growth, nurturing its students to become well-rounded individuals.

UET SCIENCE SOCIETY

The UET Science Society, established in 2014, is a student-run organization that plays a vital role in encouraging research and innovation among students. The society aims to integrate science and technology knowledge, providing a platform for students to showcase their inner talents. Through a wide range of engaging activities, discussions, encouraging research, expert talks, captivating workshops, and many interesting events - UET Science Society creates opportunities for comprehensive scientific exploration.

The society’s collaboration with over 30 student bodies from diverse universities has established a strong network, enriching its knowledge-sharing potential and significantly contributing to this magazine. Number of recognitions underscore the UET Science Society's significant contributions to science over the decade. As society continues to grow and evolve, it remains committed to inspiring future generations of scientists, engineers, and leaders while promoting scientific excellence in Pakistan and beyond.

SCIENTIA SPECTRUM

Introducing "SCIENTIA SPECTRUM" - a captivating and comprehensive magazine that delves into the vast expanse of scientific topics. This publication is a rich source of knowledge, presenting an array of sections that span the entire spectrum of science. Whether you're a curious student, a seasoned researcher, or simply a science enthusiast, this magazine is tailored to satiate your intellectual curiosity. With its diverse range of sections, SCIENTIA SPECTRUM is the perfect companion for anyone passionate about science. It's in fact more than just a publication; it's a gateway to the latest technological advancements and innovative research shaping our future.

The 2023 edition of SCIENTIA SPECTRUM set a high standard with its carefully curated sections, which included Science Rhymes, Reviews & Articles, Science Legends, and Inventions of This Era. The content was designed to be accessible to everyone, turning complex topics into interesting and understandable material.

This time around Edition 2024 of SCIENTIA SPECTRUM introduces even more sections, expanding its reach and relevance. In addition to the sections from 2023, this year's edition features new and exciting content areas. Readers can gain insights into Industrial Manufacturing Processes, understanding the major operations in industries. The magazine also features Islamic Golden Era, highlighting the scientific achievements of muslim scientists, and also the contributions of Pakistani Scientists who have made significant impacts in their fields.

The magazine's expert contributors and editors have ensured that each topic is presented in a way that's engaging, accessible, and authoritative, making it easy for readers from all disciplines to grasp.

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OUR EVENTS

Project Breathe:

An environmental initiative aimed at raising awareness about air pollution, Project Breathe encourages students to develop innovative solutions for cleaner air and a healthier planet, by increasing the plantation rate.




Magazine Launch:

The UET Science Society's magazine launch features articles, research, and creative content from students and faculty, showcasing the latest in scientific thought and innovation within the university.




Outreach Programs:

Through its outreach programs, the UET Science Society connects with local schools and communities, promoting science education and inspiring the next generation of scientists.




Project Competitions:

These competitions challenge students to develop practical solutions to real-world problems, fostering creativity, teamwork, and technical expertise among participants.




SNYES:

SNYES brings together young minds and experts in various fields to discuss pressing scientific issues, offering a platform for knowledge sharing and networking.

STEM:

In this event, students from across Pakistan are invited to showcase their science projects, with industrialists serving as judges. It offers a platform for presenting STEM knowledge through innovative experiments, gadgets, and impactful projects.

PSI MEET:

PSI MEET encourages students to apply scientific laws in practical, fun-filled modules like “Tall of the Tallest” (creating the tallest stable structure), “Science Kasoti” (a quiz-style test of scientific knowledge), and “Sci-tee” (painting T-shirts with scientific themes).

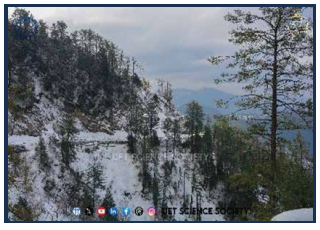

Sports Week:

Sports Week blends physical activity with science, offering a fun and competitive environment where students can unwind and build camaraderie through various sports events.


Science Society Tours:

These tours provide students with the opportunity of exploring the beauty of nature with educational experiences. These tours also offer students a refreshing break while exploring scientific and cultural landmarks, fostering a sense of community and a deeper appreciation of the world around them.






Welcome and Alumni Reunion:

Welcome and Alumni Reunion is a combined event aimed at bridging the gap between the society's current members and its alumni. The event begins with a welcome ceremony for new members, introducing them to the society's culture, goals, and ongoing projects. This is followed by a reunion segment where alumni return to share their experiences, insights, and advice. This blend of welcoming new members and reuniting with alumni not only helps in building a strong network but also fosters mentorship and a sense of belonging among all participants, past and present.




Scientist of the Month:

Month Competition is an exciting contest designed to test participants' knowledge and problem-solving skills across diverse scientific and technological fields. The event features a series of questions in categories like biology, physics, chemistry, engineering, and computer science. Participants face challenges in different formats, such as rapid-fire questions, real-world problem scenarios, and team-based tasks. The goal is to encourage a spirit of inquiry and innovation, with the top-scoring participant earning the distinguished title of Scientist of the Month.



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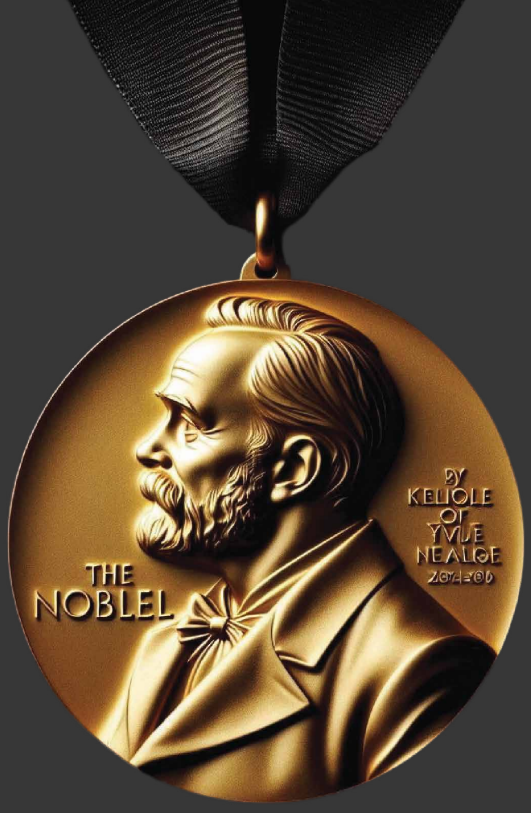
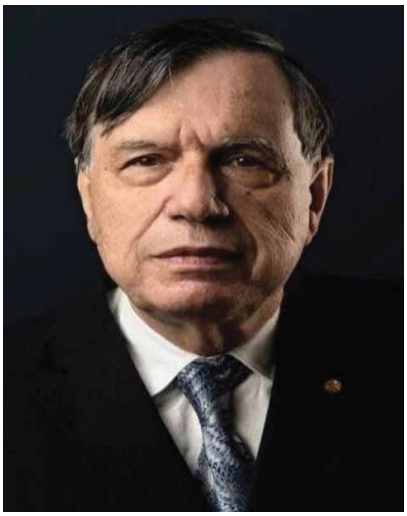


NOBEL PRIZES (2021-2023)

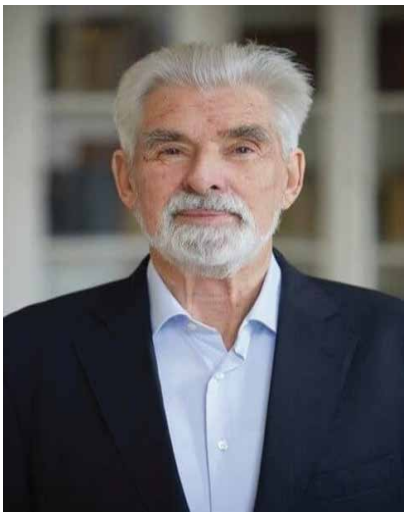
NOBEL PRIZE IN PHYSICS 2021

Nobel Prize in Physics 2021 was jointly awarded to Syukuro Manabe, Klaus Hasselmann and Giorgio Parisi.



Giorgio Parisi

Born:
4 August 1948,
Rome, Italy
Affiliation at the time of the award:
Sapienza University of Rome, Rome, Italy



Klaus Hasselmann

Born:
25 October 1931,
Hamburg, Germany
Affiliation at the time of the award:
Max Planck Institute for Meteorology, Hamburg, Germany

Syukuro Manabe

Born:
21 September 1931,
Shingu, Ehime, Japan.
Affiliation at the time of the award:
Princeton University, Princeton, NJ, USA

Working:

For their contributions to our understanding of complex physical systems with one half jointly to Syukuro Manabe and Klaus Hasselmann for the physical modelling of Earth's climate, quantifying variability and reliably predicting global warming and the other half to Giorgio Parisi for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales.

NOBEL PRIZE IN CHEMISTRY 2021

Nobel Prize in Chemistry 2021 was jointly awarded to Benjamin List and David MacMillan.

Benjamin List

Born:
11 January 1968, Frankfurt-on-the-Main, Germany
Affiliation at the time of the award:
Max- Planck-Institut für Kohlenforschung, Mulheim an der Ruhr, Germany

David MacMillan

Born:
16 March,1968 in Bellshill, United Kingdom
Affiliation at the time of the award:
Princeton University, Princeton, NJ, USA

Working:

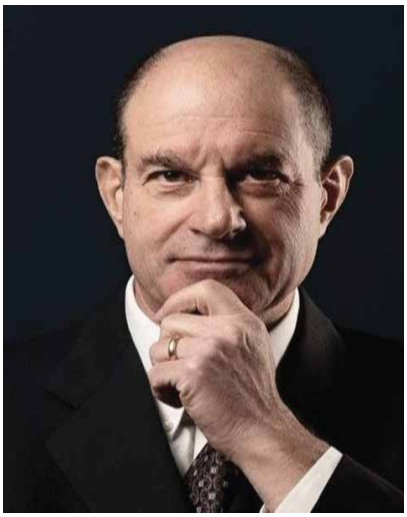
For their contributions to the field of chemistry, the Nobel Prize was awarded jointly to Benjamin List and David MacMillan for their development of a new and ingenious tool for molecule building: Organocatalysis. Chemists can create new molecules by linking together small chemical building blocks, but controlling invisible substances so they bond in the desired way is difficult. This innovation has applications in research into new pharmaceuticals and has contributed to making chemistry more environmentally friendly.

NOBEL PRIZE IN MEDICINE 2021

The Nobel Prize in Physiology or Medicine 2021 was awarded jointly to David Julius and Ardem Patapoutian.

Ardem Patapoutian

Born:
2 October 1967,
Beirut, Lebanon
Affiliation at the time of the award:
Scripps Research, La Jolla, CA, USA;
Howard Hughes Medical Institute, USA



David Julius

Born:
14 November 1955,
New York, NY, USA
Affiliation at the time of the award:
University of California, San Francisco, CA, USA

Working:

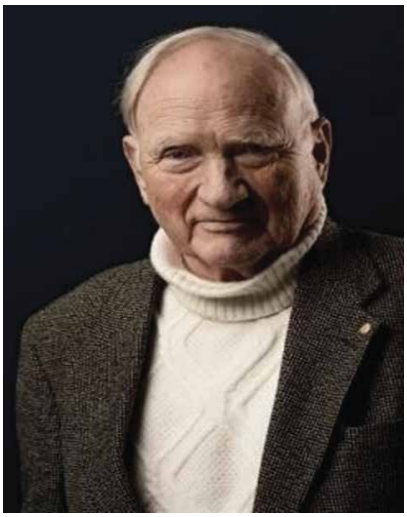
The discoveries of the TRPV1, TRPM8, and PIEZO channels by the 2021 Nobel Prize laureates have enabled us to understand how heat, cold, and mechanical force are sensed and transformed into nervous impulses, allowing us to perceive and adapt to the world around us.
The TRP channels are essential for our ability to perceive temperature, while the PIEZO2 channel endows us with touch and proprioception. Intensive ongoing research stemming from these Nobel Prize-winning discoveries is focused on elucidating the roles of these receptors in various physiological processes and developing treatments for a wide range of conditions, including chronic pain.

NOBEL PRIZE IN PHYSICS 2022

The Nobel Prize in Physics 2022 was awarded jointly to Alain Aspect, John F.Clauser, and Anton Zeilinger.

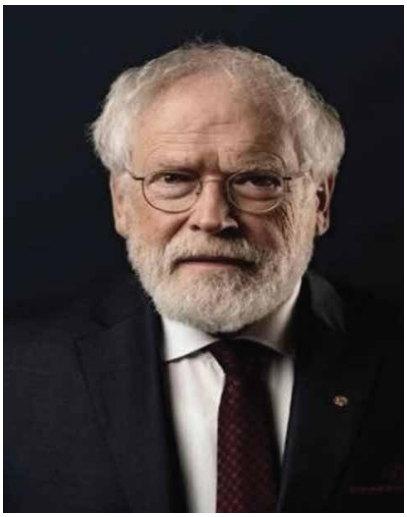
Alain Aspect

Born:
15 June 1947, Agen, France
Affiliation at the time of the award:
Institute d'Optique Graduate School – Université Paris-Saclay, Paris, France; École Polytechnique, Palaiseau, France



John F.Clauser

Born:
1 December 1942, Pasadena, CA, USA
Affiliation at the time of the award:
J.F.Clauser & Assoc., Walnut Creek, CA, USA



Anton Zeilinger

Born:
20 May 1945, Ried im Innkreis, Austria
Affiliation at the time of the award:
University of Vienna, Austria; Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, Vienna, Austria

Working:

Their pioneering experiments with entangled photons demonstrated the violation of Bell inequalities and advanced quantum information science. Their work showed that the state of one particle in an entangled pair directly influences the other, even across vast distances, strongly supporting quantum mechanics over classical physics. Their development of experimental tools has laid the groundwork for a new era of quantum technology, including quantum computing, cryptography, and advanced communication systems.

NOBEL PRIZE IN CHEMISTRY 2022

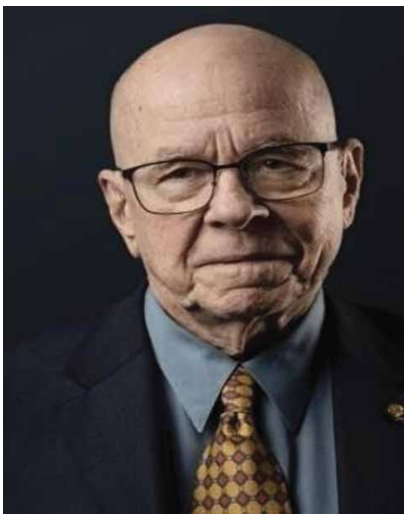
The Nobel Prize in Chemistry 2022 was awarded jointly to Carolyn R. Bertozzi, Morten Meldal, and K. Barry Sharpless.

Carolyn R. Bertozzi

Born:
10 October 1966, Boston, MA, USA
Affiliation at the time of the award:
Stanford University, Stanford, CA, USA; Howard Hughes Medical Institute, USA

Morten Meldal

Born:
16 January 1954, Copenhagen, Denmark
Affiliation at the time of the award:
University of Copenhagen, Copenhagen, Denmark



K. Barry Sharpless

Born:
28 April 1941, Philadelphia, USA
Affiliation at the time of the award:
Scripps Research, La Jolla, CA, USA

Working:

The Nobel Prize in Chemistry 2022 was awarded jointly to Carolyn R. Bertozzi, Morten Meldal, and K. Barry Sharpless for the development of click chemistry and Bioorthogonal chemistry. Using groundbreaking techniques, Carolyn R. Bertozzi, Morten Meldal, and K. Barry Sharpless have demonstrated the potential to perform chemical reactions with high precision.
Click chemistry allows molecules to snap together quickly, akin to a seatbelt buckle, forming desired products without byproducts. Bioorthogonal chemistry, pioneered by Bertozzi, enables chemical reactions to occur inside living organisms without interfering with natural biochemical processes. The laureates' innovative methods have revolutionized the field of chemistry.

NOBEL PRIZE IN MEDICINE 2022

The 2022 Nobel Prize in Physiology or Medicine was awarded to Svante Pääbo.

Svante Pääbo

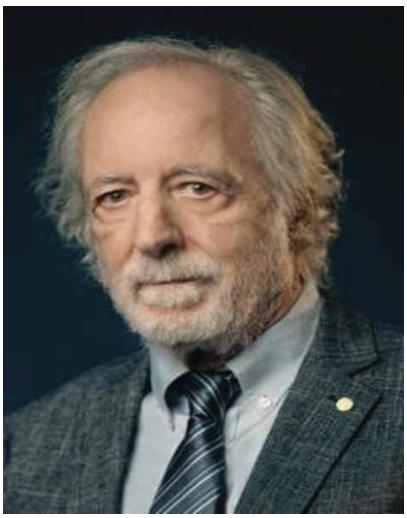
Born:
20 April 1955, Stockholm, Sweden
Affiliation at the time of the award:
Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany; Okinawa Institute of Science and Technology, Okinawa, Japan

Working:

The Nobel Prize in Physiology or Medicine 2022 was awarded to Svante Pääbo for his discoveries concerning the genomes of extinct hominins and human evolution. Svante Pääbo has uncovered the genetic secrets of extinct hominins, such as Neanderthals and Denisovans, by sequencing their genomes. His pioneering work has revealed the genetic differences and similarities between these ancient relatives and modern humans, providing profound insights into human evolution and the migrations of early human populations. Pääbo's discoveries have revolutionized our understanding of human ancestry and opened new avenues for studying how genes influence health and disease, shaping the field of evolutionary genetics.

NOBEL PRIZE IN PHYSICS 2023

The Nobel Prize in Physics 2023 was jointly awarded to Pierre Agostini, Ferenc Krausz and Anne L'Huillier.



Pierre Agostini

Born:
23 July 1941, Tunis, French protectorate of Tunisia
Affiliation at the time of the award:
The Ohio State University, Columbus, OH, USA

Ferenc Krausz

Born:
17 May 1962, Mór, Hungary
Affiliation at the time of the award:
Max Planck Institute of Quantum Optics, Garching, Germany;

Anne L'Huillier

Born:
16 August 1958, Paris, France
Affiliation at the time of the award:
Lund University, Lund, Sweden

Working:

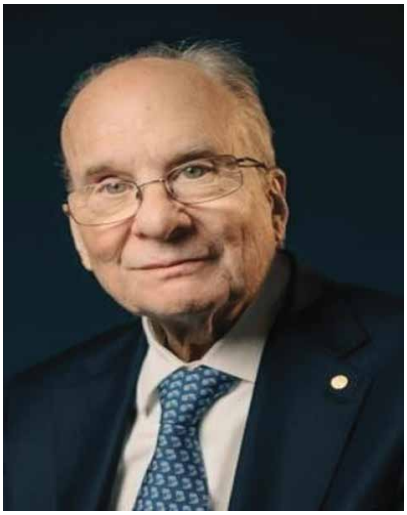
For experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter. They have developed methods to generate attosecond pulses of light, which are incredibly brief flashes that allow scientists to observe and study the ultra-fast movements of electrons within atoms and molecules. Their pioneering work has opened a new window into the world of electron dynamics, providing insights into fundamental processes that occur on extremely short timescales. The laureates' contributions have significantly advanced the field of ultrafast laser science, enabling new experiments and potential applications in physics, chemistry, and materials science.

NOBEL PRIZE IN CHEMISTRY 2023

The Nobel Prize in Chemistry 2023 was awarded jointly to Moungi G. Bawendi, Louis E. Brus and Aleksey Yekimov.

Moungi G. Bawendi

Born:
15 March 1961,
Paris, France
Affiliation at the time of the award:
Massachusetts Institute of Technology (MIT), Cambridge, MA, USA



Louis E. Brus

Born:
10 August 1943, Cleveland, OH, USA
Affiliation at the time of the award:
Columbia University, New York, NY, USA

Aleksey Yekimov

Born:
28 February 1945, Leningrad, Russia
Affiliation at the time of the award:
Nanocrystals Technology Inc., New York, NY, USA

Working:

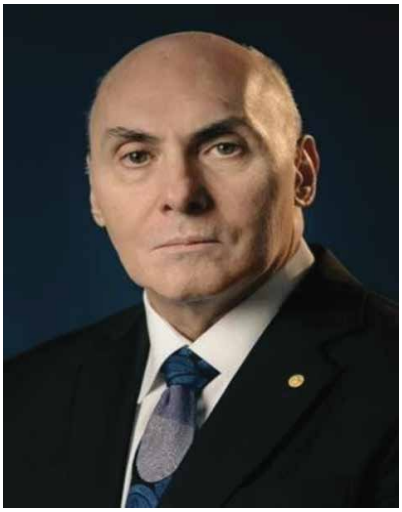
They developed methods for the discovery and synthesis of quantum dots, which are tiny semiconductor particles that exhibit unique optical and electronic properties due to their nanoscale size. Their pioneering work has enabled precise control over the size and composition of quantum dots, leading to applications in various fields such as medical imaging, display technologies, and solar cells. The laureates' contributions have significantly advanced nanotechnology and materials science, opening up new possibilities for innovative research and practical applications.

NOBEL PRIZE IN MEDICINE 2023

The Nobel Prize in Physiology or Medicine 2023 was awarded jointly to Katalin Karikó and Drew Weissman.

Katalin Karikó

Born:
17 January 1955, Szolnok, Hungary
Affiliation at the time of the award:
Szeged University, Szeged, Hungary; University of Pennsylvania, Philadelphia, PA, USA



Drew Weissman

Born:
7 September 1959, Lexington, MA,USA
Affiliation at the time of the award:
Penn Institute for RNA Innovations, University of Pennsylvania, Philadelphia, PA, USA

Working:

For their discoveries concerning modified nucleosides that enabled the development of effective mRNA vaccines. Through their groundbreaking research, Katalin Karikó and Drew Weissman have made significant advancements in the field of mRNA technology. Their pioneering work laid the foundation for the development of safe and effective mRNA vaccines, which have played a crucial role in combating the COVID-19 pandemic. The laureates' contributions have transformed vaccine development and have opened new avenues for treating a wide range of diseases, including cancer and genetic disorders, fundamentally changing the landscape of modern medicine.

INVENTIONS OF THIS ERA

Antora Thermal Battery

Andrew Ponec, Co-Founder and CEO of Antora Energy along with Antora employs created renewable electricity to heat blocks of solid carbon to extremely high temperatures within an insulated module. This stored heat is then supplied at the scale and temperatures required by large industrial operations. Additionally, Antora's thermal battery can generate electricity with remarkable efficiency using their advanced heat-to-power thermophotovoltaic (TPV) technology.

Ember Cube

In 2023 Clay Alexander, an American scientist with a remarkable achievement of 100 patents under his name created the Ember Cube which is a reusable, vacuum insulated shipper capable of maintaining a precise 2-8 C range for 72 hours with both location and temperature tracking built-in, as well as an onboard cooling system that both re-charges the thermal ‘ice packs’ between shipments and can be used as an intervention to prevent payloads from exceeding temperature limits when delayed in shipment.

Vibrant System

In 2023 John Schell horn, a med tech and team leader at Vibrant Gastro incorporation created a non-pharmacological capsule designed to vibrate in the large intestine, stimulating nerve cells involved in peristalsis. It helps alleviate constipation without side effects.
Effect: Nearly 40% of patients experienced additional bowel movements per week compared to their baseline.

RSV Vaccines

In 2023 Jason McLellan, a structural biologist invented a RSV Vaccines.
Arexy (GSK): Approved for adults over age 60.
Abrysvo (Pfizer): Also approved for the same age group. Pfizer vaccine approved to protect newborns.
Sanofi Pasteur's Beyfortus: A one-time injected antibody therapy, now available for kids under age two. Beyfortus has improved since previous treatments, requiring fewer shots throughout the winter season.

Clean Earth Magnet

In 2023 Jian-Ping Wang, a professor in Electrical and Computer Engineering, Department of University of Minnesota created a high magnetic field strength and enhanced temperature range, cost-stable input materials and scalable manufacturing processes, clean, abundant input materials minimize environmental impact and globally available, geopolitically secure supply.

Cision Vision Invision

In 2023 Jeremy Li, an imaging scientist and an entrepreneur created a first-of-its-kind microscope that uses shortwave infrared technology to show lymph nodes contrasted against surrounding fat tissue. By enabling more accurate cancer staging, the tool could save lives.

Rain stick Shower

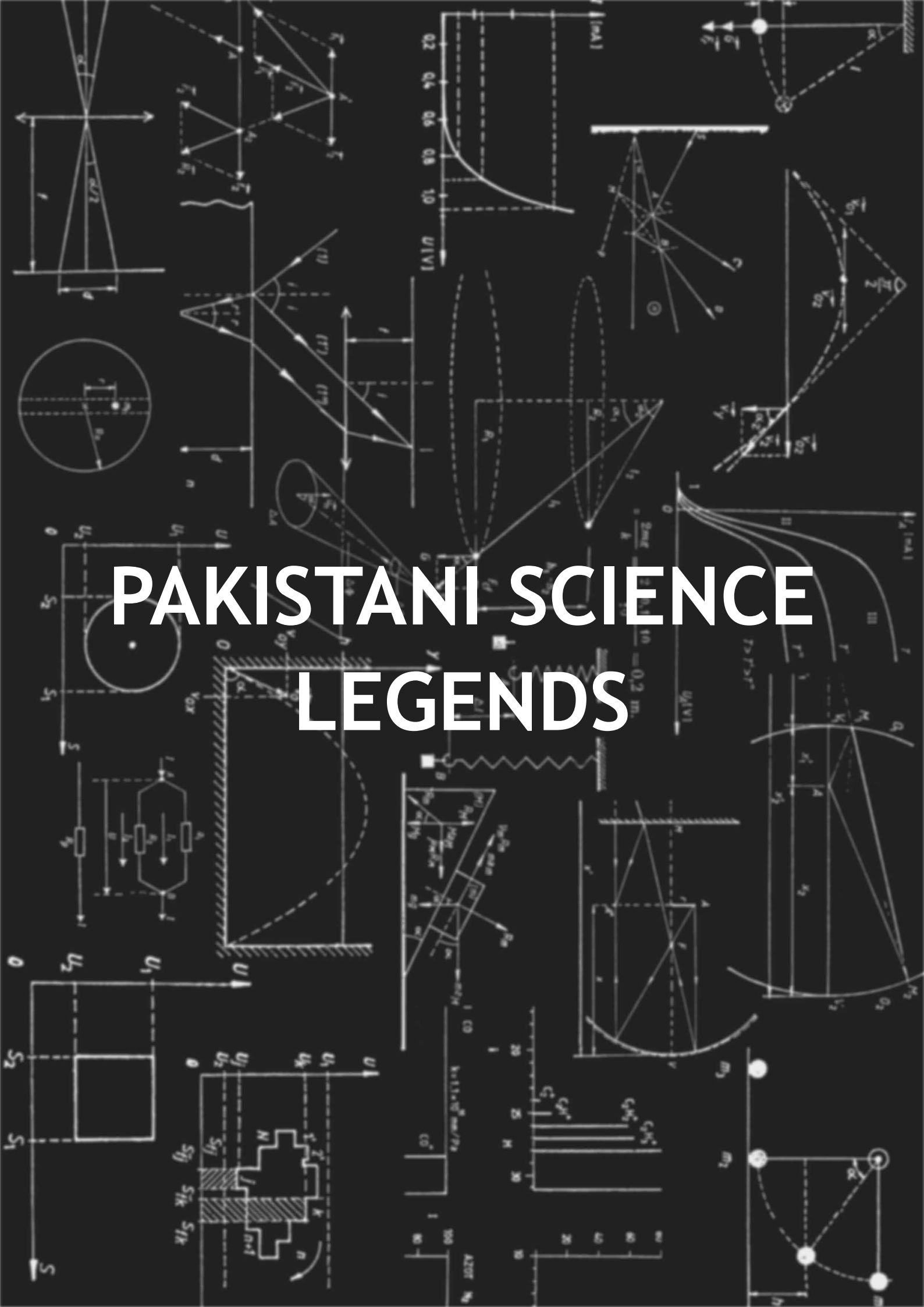
In 2023 Alisha McFetridge became the co- founder and CEO of Rain stick. Conserving water usually comes with a tradeoff: What you get in savings, you lose in water flow. RainStick's tech, however, saves 80% of water while doubling the flow. Through a retrofit of your current shower, each drop of water is captured from the drain, blasted with UV light for sterilization, and then sent upward, where it again falls from the shower head. Each drop is used six times before the device switches to new water. RainStick CEO and co- founder Alisha estimates that in a two-person home, the device annually saves "almost a swimming pool's worth of water.

Invisible Solar Roof Tile

In 2023 Quagliato Giovanni Battista invented Dyaqua Invisible Solar Roof tile. Pompeii has a secret: 223 roof tiles on the House of the Vettii are solar. Started in Vicenza, Italy, Dyaqua makes solar tiles that look like traditional terracotta shingles; though they appear to be opaque clay, each photovoltaic panel has a surface layer that allows light to pass through to the solar cells beneath. Unlike modern-looking glass panels, Dyaqua's enable solar power at sites that couldn't otherwise use them for reasons of historical accuracy or aesthetics.

Smart Tires

In 2023, Earl Cole invented Smart Tires. At a 2020 NASA program for entrepreneurs, Earl Cole and Brian Yennie learned about an unusual metal alloy called Nitinol, which the agency used to build airless wheels tough enough to roll over the rocky surfaces of the moon or Mars. Intrigued, Cole, now CEO of the SMART Tire Co., and Yennie, its CTO, developed an airless bicycle wheel made from a spiral largely made of Nitinol. The tire, set to ship next year, will never go flat, and "actually could last the life of your vehicle," says Cole, if you replace the cheap rubber tread on the exterior as it wears down.

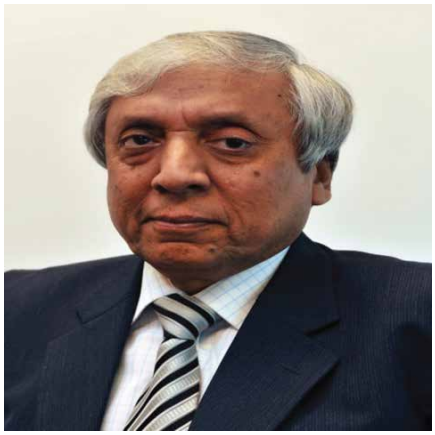


PAKISTANI SCIENCE LEGENDS

Rafi Muhammad Chaudhry (1903 - 1988)

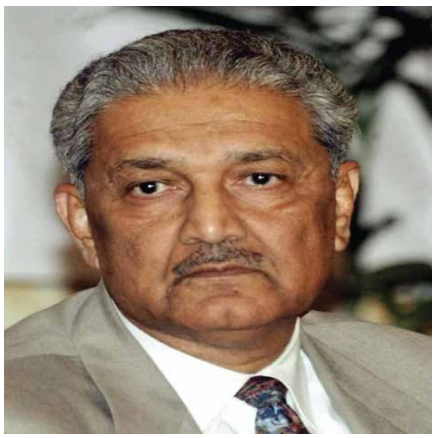
Rafi Muhammad Chaudhry was a pioneer in experimental nuclear physics in Pakistan, establishing the "High Tension Laboratory" in 1952, which eventually evolved into the "Centre for Advanced Studies in Physics" (CASP) at Government College University (GCU) Lahore. During the 1970s, he played a key role, alongside Abdus Salam and Ishrat Hussain Usmani, in founding Pakistan's nuclear weapons research program. Additionally, he served as the first director of the Pakistan Institute of Nuclear Science and Technology (PINSTECH), where he was instrumental in installing the country's first nuclear particle accelerator.

Ansar Pervaiz (1949 - onwards)



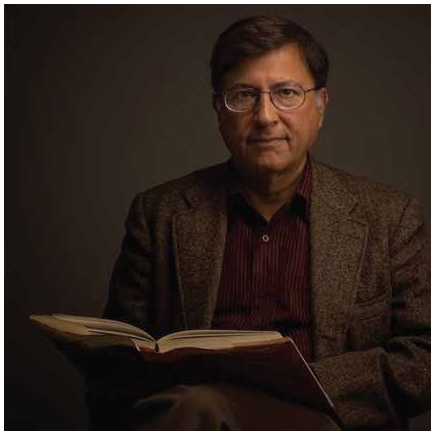
Ansar Pervaiz played a significant role in the Pakistan Atomic Energy Commission (PAEC), serving as its chairman from 2009 to 2015. He worked with fellow nuclear scientists to plan and establish civilian nuclear power plants across the country. As head of the training center at Karachi Nuclear Power Plant (KANUPP), he established a Master's program in nuclear power technology with NED University of Engineering and Technology. At KANUPP, he specialized in nuclear reactor physics, pressure vessels, RTGs, very high-temperature reactors (VHTR), and liquid metal-cooled reactors (LMFR). He also represented Pakistan's nuclear program internationally, enhancing the country's energy security through sustainable nuclear power initiatives.

Abdul Qadeer Khan (1936-2021)



Abdul Qadeer Khan is widely regarded as the father of Pakistan's nuclear program, playing a pivotal role in transforming the country into a nuclear power. He established and led the Uranium Enrichment Program, which was responsible for the development and operation of gas centrifuges for uranium enrichment, a key component in Pakistan's nuclear capabilities. In 1976, Khan founded the Khan Research Laboratories (KRL), which became the primary institution for Pakistan's nuclear weapons program. Over the years, he received numerous accolades for his contributions, including Pakistan's highest civilian honors, the Nishan-e-Imtiaz and the Hilal-e-Imtiaz.

Pervez Hoodbhoy (1950 – onwards)



Pervez Hoodbhoy's PhD research focused on nuclear physics, but much of his later work explored the quark-gluon structure of nuclei, quantum chromodynamics, and particle phenomenology. In the early 1970s, he was involved with the People's Labour Federation and part of an independent Marxist group at Islamabad University led by Professor Faheem Husain. Hoodbhoy became a leading voice against nuclear weapons development in India and Pakistan, which led to his name being placed on the Exit Control List in 1996 at the request of Dr. A.Q. Khan. From 1991 to 2004, he hosted and authored three 13-part documentary series on science and education for Pakistan Television (PTV), the only science documentaries ever produced by PTV. In 2003, he received UNESCO's Kalinga Prize for popularizing science.

Nergis Mavalvala (1968 – onwards)

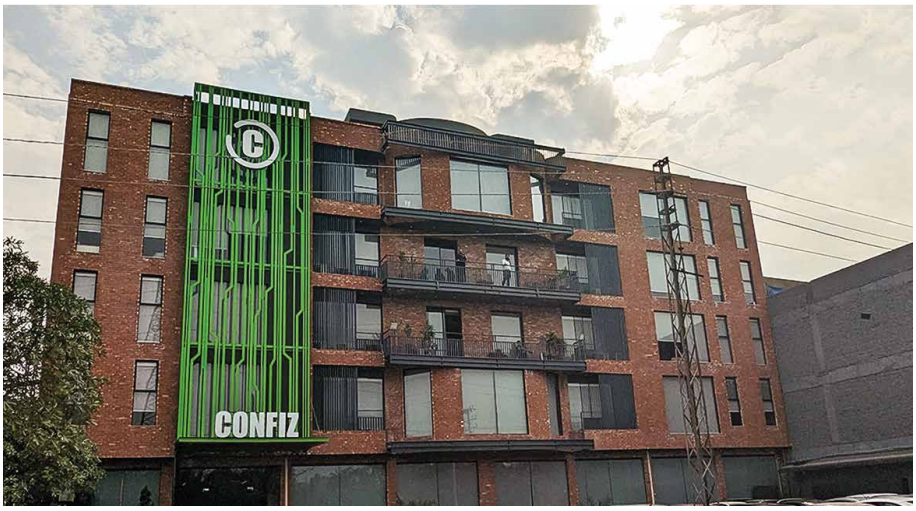
Nergis Mavalvala is an astrophysicist renowned for her pivotal role in the first direct detection of gravitational waves in 2015, as part of the Laser Interferometer Gravitational-Wave Observatory (LIGO) project. She contributed significantly to the development of advanced quantum measurement techniques that made this groundbreaking discovery possible. Mavalvala's expertise extends to experimental physics, particularly in quantum optics and interferometry. She is the first Pakistani-born woman to receive the prestigious MacArthur Fellowship, also known as the "Genius Grant," in recognition of her pioneering work. In 2020, she was appointed Dean of the School of Science at the MIT, where she continues her research and leadership in astrophysics.

Sarah Qureshi

Sarah Qureshi is the CEO of Aero Engine Craft, where she is developing the world’s first contrail-free jet engine aimed at reducing aviation's environmental impact. She is a pioneer in sustainable aviation technology, working to minimize the effects of climate change through innovative propulsion systems. Qureshi holds multiple patents for eco-friendly aircraft technologies and completed her Ph.D. in Aerospace Propulsion from Cranfield University. Her contributions to aviation and environmental sustainability have earned her significant recognition in the field.

TECH PARTNER

CONFIZ



Founded in 2005 with a mission to deliver innovative digital solutions, Confiz has grown into a global technology consulting firm specializing in Microsoft Business Applications, Data & AI, Cloud services, Software Development, and Staff Augmentation. From SMEs to Fortune 100 companies, Confiz serves clients across industries, including retail, CPG, manufacturing, and finance, providing impactful services and solutions that drive digital transformation in today's AI-driven world.

A Collaborative Work Culture

At Confiz, the culture is shaped by six core values: empathy, lean, bias for action, continuous learning, ownership, and collaboration. These values create an engaging environment where students and professionals alike can begin and grow their careers. The work culture encourages innovation, creativity, and teamwork, empowering employees to develop modern solutions that address real-world challenges.

As emphasized by the company's CEO, Kashif Manzoor, every team member plays a vital role in the company's success. Confiz is committed to maintaining an open and inclusive environment where all ideas are valued, and individuals are encouraged to take the initiative. With flexible work arrangements and a strong focus on work-life balance, Confiz nurtures a positive, stress-free setting where technology professionals are empowered to excel and reach their full potential.

Opportunities for Aspiring Students

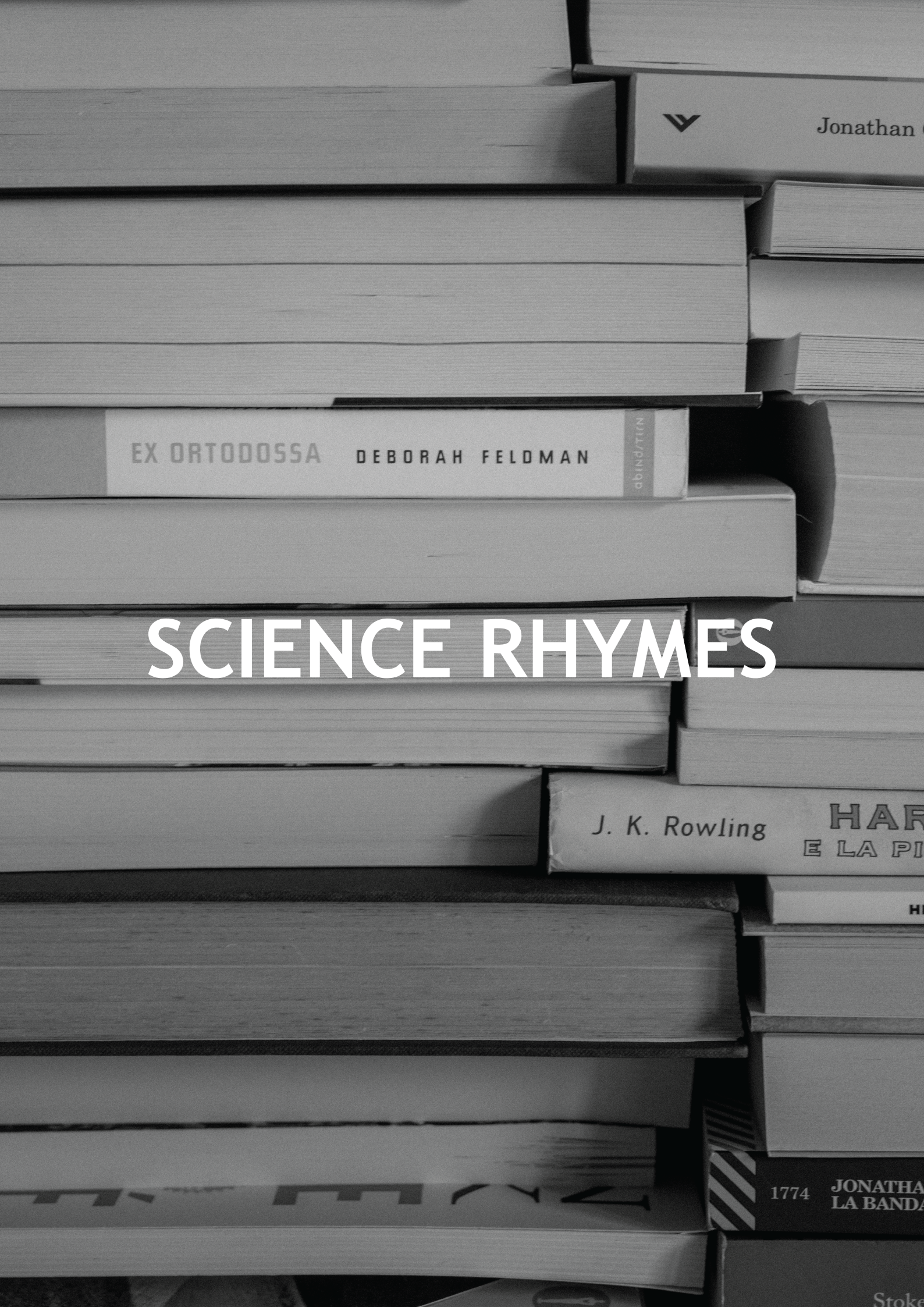
Confiz offers a range of opportunities for students eager to start their careers in IT. From internship programs and Management Trainee (MTO) programs to recruitment drives and mentorship, Confiz is dedicated to nurturing young talent. A standout initiative is ConfizConnects, designed to bridge the gap between academia and industry by fostering a dynamic exchange of knowledge, ideas, and resources. Through ConfizConnects, university students gain valuable insights into the corporate world with mentoring sessions on interview preparation, Q&A interactions with industry experts, and facility tours.

Interns and fresh graduates at Confiz aren't confined to routine tasks; they're given the opportunity to work on real-world projects, collaborate with seasoned professionals, and develop in-demand, cutting edge skills. This hands-on experience exposes students to innovative technologies and practical problem-solving, preparing them to make meaningful contributions to the IT industry.

Confiz also emphasizes personal development through its Learning and Development Framework (LDF). The program offers three specialized tracks: Engineering, Test Engineering, and Management. Each track provides targeted training to help individuals enhance both their technical and soft skills and become leaders in their fields. Through leadership and capability-building opportunities like these, Confiz provides an ideal launchpad for a successful IT career.

Confiz's Role in Defining the Future of IT in Pakistan

Confiz is at the heart of Pakistan's evolving IT landscape, driving growth through innovation, industry leading solutions, and a nurturing environment for talent. By bridging the gap between academia and industry, fostering a culture of creativity, and offering hands-on opportunities, Confiz empowers students and young professionals to shape the future of technology. For those looking to launch a meaningful career in IT, Confiz offers not just a job, but a journey of growth, impact, and continuous learning.



SCIENCE RHYMES

SCIENCE

Everything works,
because of science.
Even your old
kitchen appliance.
What about your
mom's car?
Without science,
it wouldn't go far.
With science we could make,
a computer or phone,
If you want a twin,
just ask for a clone.
Science will explain,
nature and trees,
It's also used ,
to find cures for diseases.
Science is cool,

By Martin Dejnicki

THE SCIENCES SING A LULLABY

Physics says: *Go to sleep. Of course*
You are tired. Every atom in you
has been dancing the shimmy in silver shoes
nonstop from mitosis to now.
Quit tapping your feet. They will dance
inside themselves without you. Go to sleep.

Geology says: *it will be all right. Slow inch*
by inch, America is giving itself
to the ocean. Go to sleep. Let darkness
lap at your sides. Give darkness an inch.
You are not alone. All of the continents used to be
one body. You are not alone. Go to sleep.

Astronomy says: *the sun will rise tomorrow,*
Zoology says: *on rainbow-fish and lithe gazelle,*
Psychology says: *but first, it has to be night, so*
Biology says: *the body clocks are stopped all over town and*
History says: *here are the blankets, layer on layer, down and down.*

By Albert Goldbarth

MY PROTEINS

They have discovered, they say,
The protein of itch—
Natriuretic polypeptide b—
And that it travels its own distinct pathway
Inside my spine.
As do pain, pleasure, and heat.

A body it seems is a highway,
A cloverleaf crossing
Well built, well traversed.
Some of me going north, some going south.

Ninety percent of my cells, they have discovered,
Are not my own person,
They are other beings inside me.

As ninety-six percent of my life is not my life.

Yet I, they say, am they—
My bacteria and yeasts,
My father and mother,
Grandparents, lovers,
My drivers talking on cell phones,
My subways and bridges,
My thieves, my police
Who chase my self-night and day.

My proteins, apparently also me,
Fold the shirts.

I find in this crowded metropolis
A quiet corner,
Where I build of not-me Lego blocks
A bench,
Pigeons, a sandwich
Of rye bread, mustard, and cheese.

By Jane Hirshfield

A JOURNEY IN SPACE

I have a dream to go to space
because space is an amazing place.
In space, stars shine like little lights.
I'd love to touch their mighty heights.

Ten, nine, eight, seven, six, five, four ...
We're going to leave this Earthly floor.
Three-two-one, we're blasting off.
We're going to space! It could be tough.

Flying through Earth's thin atmosphere
we're finally in space – we're finally here!
Looking back, what do I see?
Mercury, Venus and Sun face me.

Moving on to miraculous Mars,
zoom and see a heap of stars.
Flying into the Asteroid Belt ...
mind those little rocks don't pelt.

Flying through the asteroids
each one's a challenge to avoid.
I see the king of the Milky Way
where Jupiter's colours swirl and sway.

Saturn's beautiful rings of ice
can freeze us all in just a trice.
Next we fly past Uranus
then Neptune, blue and serious.

By Frances

SINGULARITY

Do you sometimes want to wake up to the singularity
We once were?
So compact nobody
Needed a bed, or food or money—
Nobody hiding in the school bathroom
Or home alone
Pulling open the drawer
Where the pills are kept.
For every atom belonging to me as good
Belongs to you. Remember?
There was no Nature. No
Them. No tests
To determine if the elephant
Grieves her calf or if
The coral reef feels pain. Trashed
Oceans do not speak English or Farsi or French;
Would that we could wake up to what we were
—when we were ocean and before that
To when sky was earth, and animal was energy, and rock was
Liquid and stars were space and space was not
At all—nothing
Before we came to believe, humans were so important
Before this awful loneliness.
Can molecules recall it?
What once was? before anything happened?
No I, no we, no one. No was
No verb no noun
Only a tiny tiny dot brimming with
is is is is is
All everything home

By Marie Howe

ARTIFICIAL INTELLIGENCE

Have we invented the technology to replace us?
Have we thrown humanity under a bus?
If technology can talk, what does it have to say?
If technology can walk, how will it play?
We have AI and robots today ...
What do robots and AI do with their day?
They are just machines, and machines cannot create;
They are just machines, and machines cannot relate.
When we see the development of this new world,
We wonder how it will all unfold.
Will it take our jobs and so we feel we've been beat?
Will it replace us with machines, so humanity's obsolete?
It seems unlikely as we get on and do,
And focus on things machines cannot do.
We change, destroy, progress and create.
We, as humans, will always have a role to play because we relate.
We, as humans, can rage against the machine
And focus on where machines have not been.
We have thoughts and emotions that change everything;
We have blood, veins and nerves ... that is something.

By Chris Skinner

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MANUFACTURING PROCESSES

Football Manufacturing Process

Pakistan is one of the world's largest producers of hand-stitched footballs, supplying about 70% of the global market and the city of Sialkot, known as the "Football Capital of the World," is renowned for its skilled artisans who have been crafting high-quality footballs for over a century. Now let's explore the industrial process of football manufacturing.

Raw Material Sourcing:

The football's outer cover is made from durable synthetic leather (polyurethane or PVC) produced in specialized factories. The bladder, crafted from rubber or latex, is either harvested from rubber trees or synthesized chemically. High-strength polyester or nylon threads for stitching are sourced from textile factories, while the lining fabric, typically a polyester or nylon mesh, is obtained from textile mills to provide structural support. These carefully selected materials ensure the football's quality, durability, and performance.

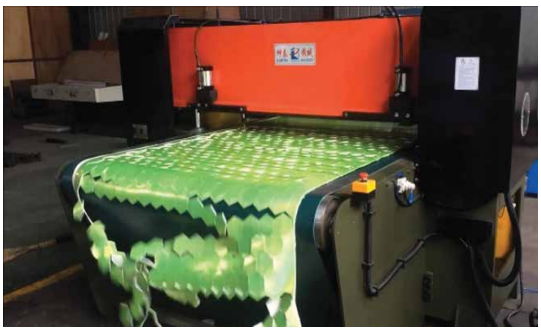
Manufacturing Process:

1- Preparing the Panels:

Design: Football panels typically consist of hexagons and pentagons, printed using digital or screen-printing techniques.

Cutting: Panels are precision-cut from synthetic leather rolls using die-cutting or laser cutting machines.

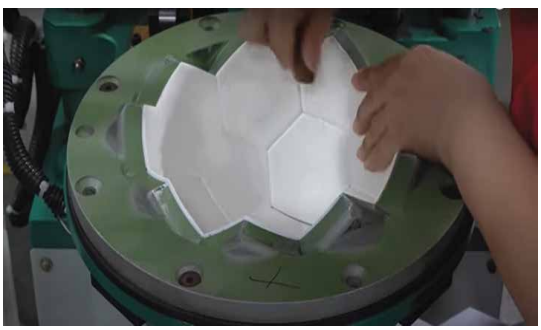
Treatment: Panels are pre-treated with primer or adhesive on the edges for bonding or stitching.



2- Assembly of Panels:

Stitching: Panels are stitched together using industrial sewing machines, either manually or automatically, with high-tensile threads for durability.

Thermal Bonding: Some footballs use thermal bonding where heat and pressure fuse the panels together, using specialized machines.



3- Bladder Insertion:

Preparation: The bladder, which is the inflatable core of the football is made from rubber or latex, is molded and cured to achieve the desired shape and elasticity. It is then slightly inflated to check for uniformity and air retention, ensuring it meets quality standards before being inserted into the football's outer cover.

Insertion: The bladder, after being slightly inflated, is carefully inserted into the stitched or thermally bonded outer cover of the football. This ensures that the bladder fits snugly inside the cover, maintaining the football's shape. Once positioned correctly, the bladder is fully inflated to achieve the desired pressure and final shape.

4- Final Shaping:

Inflation: The bladder is fully inflated to shape the football, using machines that ensure the correct shape and pressure.

5- Quality Check:

Footballs are inspected for shape, stitching quality, and air retention, either manually or with automated systems.

Performance Testing: Footballs undergo bounce tests, weight checks, and durability tests to ensure they meet industry standards.

Pressure Testing: Footballs are checked for pressure retention and overall durability.

Fabric Production Process Overview

Pakistan is the 8th largest exporter of textile products in Asia and it accounts around 60% of the country's total exports. Let's delve into the industrial process of making raw fibers to piece of cloth.

1- Raw Material Sourcing:

Natural Fibers: Cotton is harvested, cleaned, and baled. Wool is sheared from sheep, cleaned, and carded. Silk is produced by silkworms, and linen comes from the flax plant's stalks.
Synthetic Fibers: Polyester and nylon are created through chemical reactions, often derived from petroleum byproducts, forming polymers that are spun into fibers.

2- Fiber Preparation:

Ginning: Cotton fibers are mechanically separated from seeds using a cotton gin. The cleaned fibers are then compressed into bales for easy transport to spinning mills.
Scouring & Combing: In scouring, fibers are washed to remove natural oils and impurities. Combing then aligns the fibers parallel, removing short fibers to ensure smooth, high-quality yarn production.

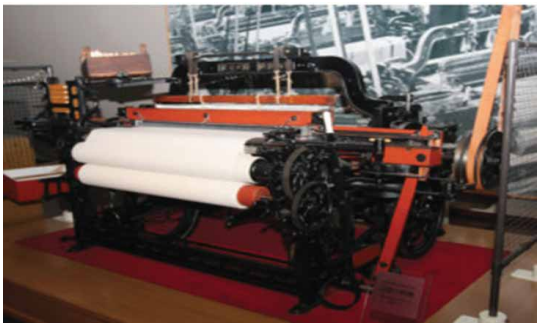
3- Spinning:

Spinning is the process of twisting fibers together to create yarn. This can be done using various methods.
Ring Spinning: Fibers pass through rollers, stretched, and twisted to create yarn, which is wound onto bobbins.
Open-End Spinning: Fibers are fed into a rotor, twisted without a spindle, producing a faster but coarser yarn.
Air-Jet Spinning: High-speed air currents twist fibers into yarn quickly, though the resulting yarn is usually less strong.
Quality Control: Yarn is regularly inspected for thickness, strength, and uniformity, using tools like evenness testers and tensile strength meters.

4- Weaving or Knitting:

Weaving:

Yarn threads (warp and weft) are interlaced at right angles on a loom. Automated looms can rapidly produce fabric with consistent patterns and quality, while manual looms offer more control for intricate designs.



Knitting:

Yarns are inter-looped to form fabric.

Weft Knitting: The yarn runs horizontally across the fabric.

Warp Knitting: Multiple yarns run vertically, often used for stretchy fabrics like tricot.

5- Dyeing & Printing:

Dyeing:

Dyeing is the process of adding color to the fabric. This can be done at various stages of production—either at the fiber, yarn, or fabric stage.

Batch Dyeing: Fabric is immersed in a dye bath, agitated to ensure even color distribution.

Continuous Dyeing: Fabric runs through a dye bath and rollers that remove excess dye, followed by dry.

Printing:

Printing is the application of patterns or designs to fabric. The most common printing methods include:

Screen Printing: A stencil is used to apply dye to specific areas.

Digital Printing: An inkjet-like process sprays dye onto the fabric, ideal for intricate designs.

Block Printing: Carved blocks are dipped in dye and pressed onto the fabric for unique patterns.



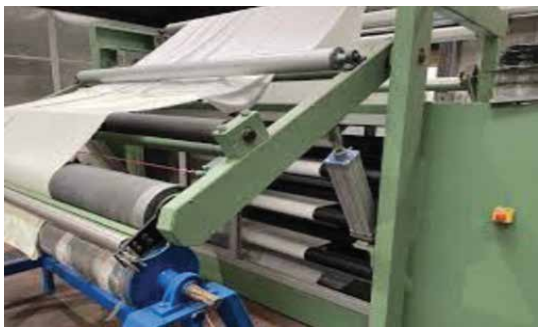
6- Finishing:

Mechanical Finishing:

Mechanical finishing processes enhance the fabric's texture, appearance, and performance.

Calendaring: Fabric passes through heated rollers, smoothing and polishing the surface.

Brushing: Raised surface fibers create a softer texture, commonly seen in flannel.

Chemical Finishing:

Chemical treatments are applied to fabrics to impart specific properties:

Waterproofing: Fabrics are treated with a water-repellent finish to make them resistant to moisture.

Flame Retardancy: Fabrics are treated with chemicals to reduce their flammability, commonly used in protective clothing and upholstery.

Anti-Microbial Finish: This treatment prevents the growth of bacteria and fungi, making the fabric more hygienic.

Quality Control: Final inspections test for colorfastness, durability, and the effectiveness of finishes.

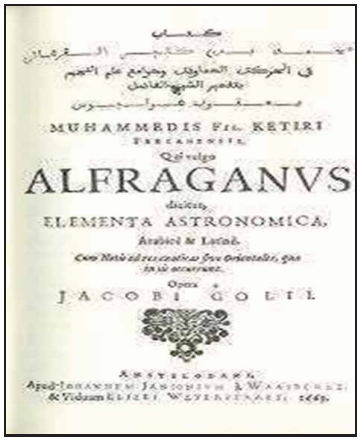
ISLAMIC GOLDEN AGE OF SCIENCE

Al-Farghani (805-870 CE)

Notable Works:

- Al-Farghani's most famous work, "The Elements of Astronomy," systematically compiled and expanded upon Ptolemy's Almagest. This seminal text was later translated into Latin and became a crucial reference for European astronomers during the Renaissance.

- Al-Farghani precisely measured the diameter of the Earth and the length of a degree of meridian, showcasing his exceptional skills in mathematical geography.

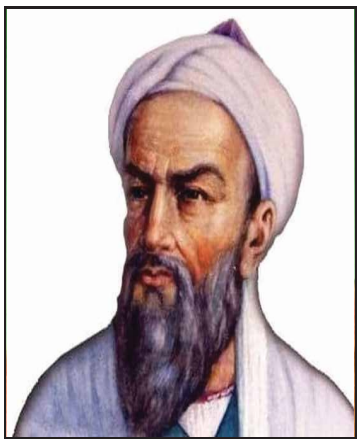


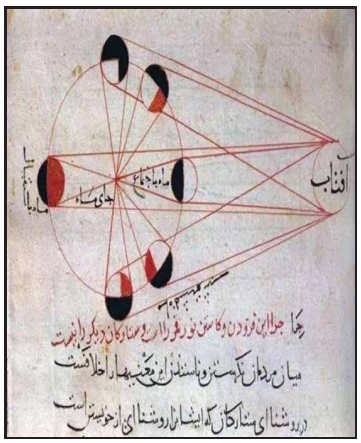
Al-Biruni (973-1048 CE)

Notable Works:

- Al-Biruni's "Kitab al-Hind" is a monumental work that explains Indian culture, religion, and science. His meticulous observations and objective analysis showcase his profound respect for diverse civilizations.

- Al-Biruni achieved the remarkable feat of accurately calculating the Earth's circumference, demonstrating his exceptional and deep understanding of geodesy. This accomplishment highlighted his ability to blend theoretical knowledge with practical observation.



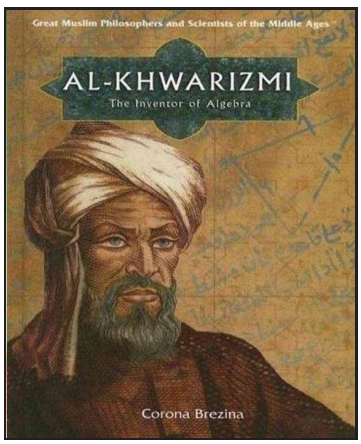


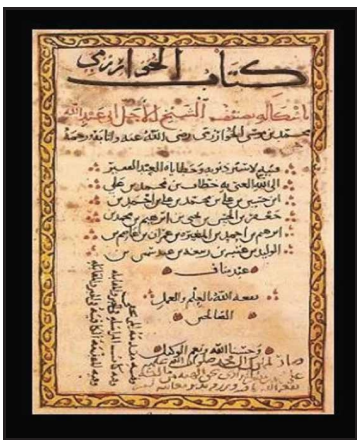
Al-Khwarizmi (780-850AD)

Notable Works:

- Developed the concept of algebra and introduced Arabic numerals to Europe.

- Wrote the influential book "Al-Kitab al-mukhtasar fi hisab al- jabr wa'l-muqabala" (The Compendious Book on Calculation by Completion and Balancing).



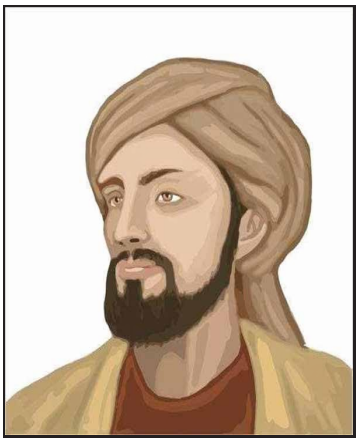


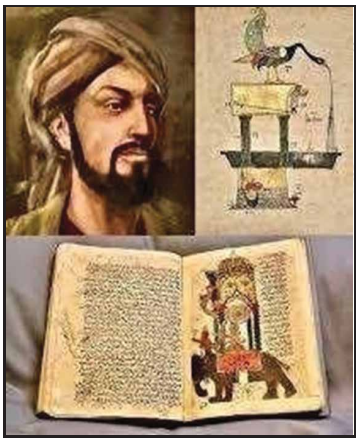
Al-Jazari (1136-1206 CE)

Notable Works:

- Al-Jazari authored "The Book of Knowledge of Ingenious Mechanical Devices," detailing numerous innovative machines and devices, some of which are considered the precursors to modern engineering marvels.

- Al-Jazari also known as "Father Of Robotics" for creating early programmable humanoid robots and sophisticated clocks, showcasing his exceptional understanding of mechanical engineering and automation.



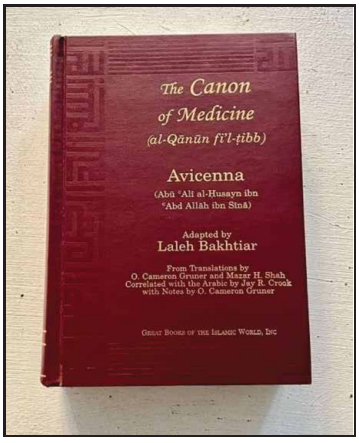


Ibn Sina (980-1037 CE)

Notable Works:

- Ibn Sina is best known for his work in the field of medicine. His most famous book " The Canon of Medicine" (Al-Qanun fi al- Tib), was a comprehensive medical encyclopedia that systematically compiled and expanded upon the medical knowledge of the time.

- Ibn Sina was also a prolific scientist who made advancements in various fields including astronomy, chemistry, geology and physics. In astronomy, he criticized the Ptolemaic system and proposed a more heliocentric model of the universe.

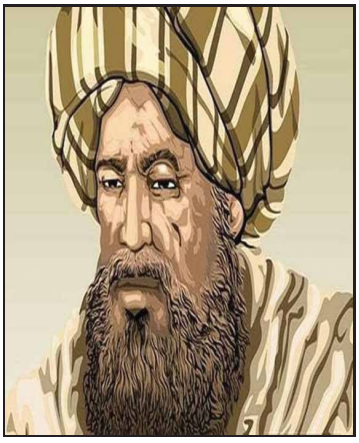


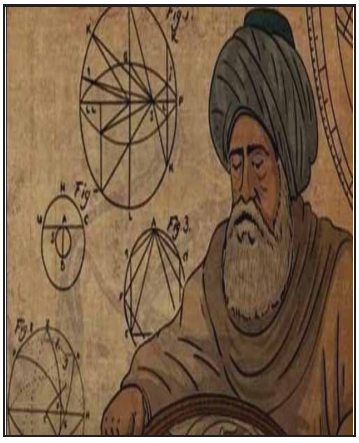
Al-Battani (850-929 AD)

Notable Works:

- Made precise astronomical measurements and calculations, improving knowledge of planetary orbits.

- Wrote the important astronomical treatise "Kitab al-Zij" (The Book of Astronomy).



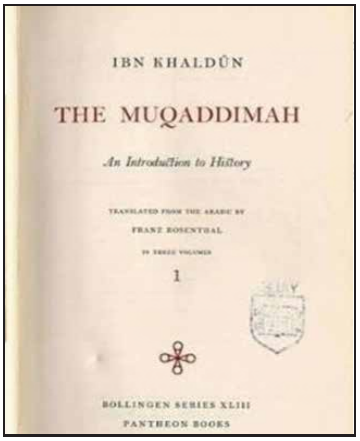


Ibn Khaldun (1332-1406 AD)

Notable Works:

- Ibn Khaldun was noted for developing one of the earliest nonreligious philosophies of history. He is generally considered the greatest Arab historian as well as the father of sociology and science of history.

- The Muqaddimah, also known as the Muqaddimah of Ibn Khaldun or Ibn Khaldun's Prolegomena, is a book written by the historian Ibn Khaldun in 1377 which presents a view of universal history.

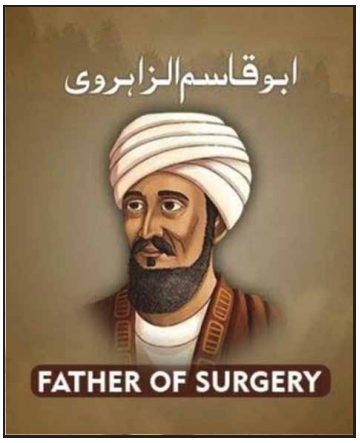


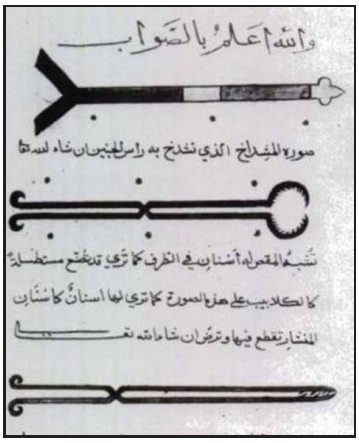
Abu al-Qasim Al-Zahrawi

Notable Works:

- More than 200 surgical tools were invented by Al-Zahrawi. Al-Zahrawi specialized in curing disease by cauterization.

- The Kitab al-Tasrif took al-Zahrawi over 50 years to complete. It contains information about a wide variety of illnesses, injuries, medical conditions, treatments, and surgical procedures. It describes over 200 different surgical instruments.



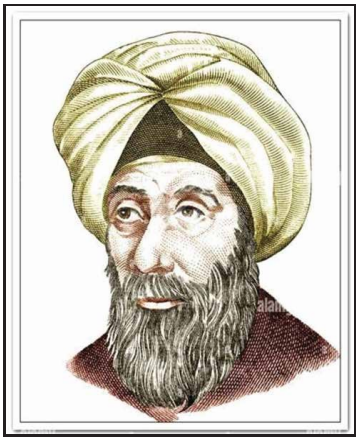


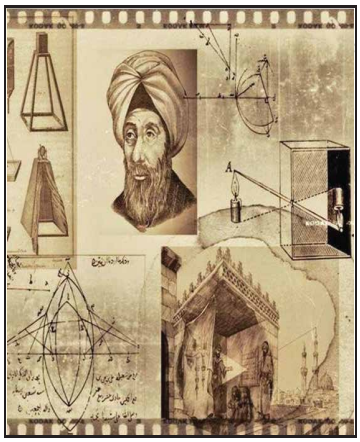
Ibn-al-Haytham (965-1040AD)

Notable Works:

- Made significant contributions to the field of optics and the study of light.

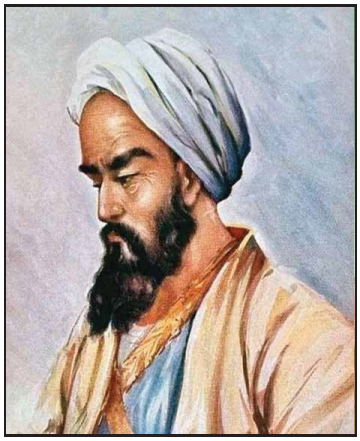
- Wrote the seminal work "Kitab al-Manazir" (The Book of Optics).

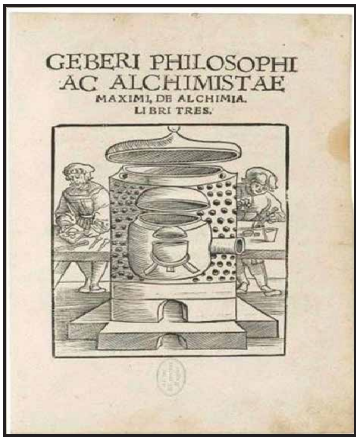




Jabir Ibn Hayan (721-815 AD)

Notable Works:



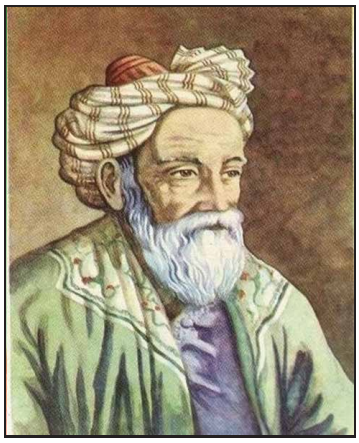


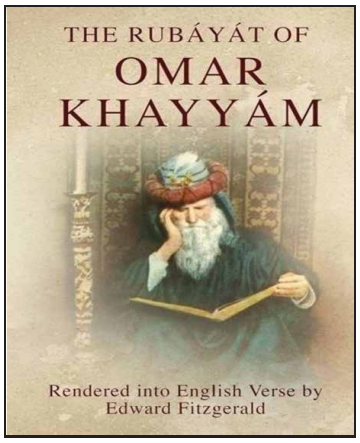
- One of his notable works is the "Book of the Composition of Alchemy" (Kitab al- Kimya). This book is among the many attributed to him and considered foundational in the field of alchemy and early chemistry.

- Jabir 's notable work, the "Book of Stones" (Kitab al-Ahjar), delves into the classification and properties of minerals and gemstones. In this book, he explored alchemical theories regarding the transformation of substances and the creation of the philosopher's stone.

Omer Khayyam (1048-1131 AD)

Notable Works:



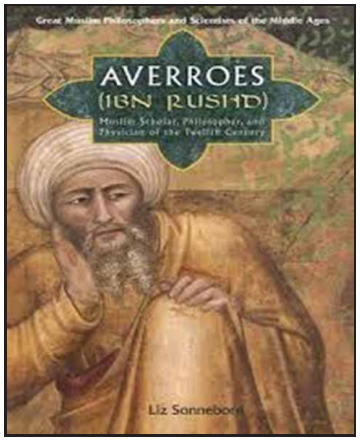


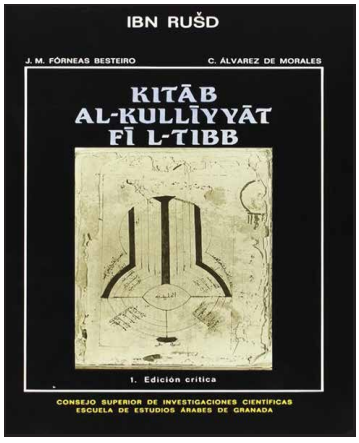
- Khayyam's contributes to mathematics were groundbreaking. In his treatise "Treatise on Demonstration of Problems of Algebra" he presented a geometric method for solving cubic equations by intersecting conic sections.

- Khayyam made significant contributes to science and philosophy, he is perhaps best known in the West for his literarywork, particularly the "Rubaiyat of Omer Khayaam " which are quatrains that explore themes of life, love and fate.

Ibn-e-Rushd (1126-1198 AD)

Notable Works:





- Wrote over 20,000 pages covering a variety of different subjects, including early Islamic philosophy, logic in Islamic philosophy, Arabic medicine, Arabic mathematics, Arabic astronomy, Arabic grammar, Islamic theology, Sharia (Islamic law), and Fiqh (Islamic jurisprudence).

- Most important works dealt with Islamic philosophy, medicine, and Fiqh.

ARTICLES AND REVIEWS

CANNIBALISTIC CLOUDS: THE STRANGE FEAST IN MILKY WAY

Muhammad Rayan, UET Science Society

The universe is a vast and mysterious place, teeming with phenomena that often defy our understanding. Among these cosmic curiosities is the recently discovered "cannibalistic cloud" known as SDC 138. This entity, nestled within the Milky Way, is not merely drifting through space but is engaged in a peculiar act of self-consumption. Let's dive into the intriguing world of SDC 138 and uncover the secrets of this bizarre cosmic feast.

Researchers at the Harvard-Smithsonian Center for Astrophysics (CfA) discovered SDC 138 using data from the Stratospheric Observatory for Infrared Astronomy (SOFIA). SOFIA, a flying observatory mounted on a Boeing 747SP jetliner, provided crucial data revealing an unusual radio wave signature from the cloud. Typically, such signatures are associated with star formation, but SDC 138 had a surprise in store.

SDC 138 is not a nursery for new stars. Instead, it's being ravaged by a powerful stellar wind from a nearby massive star. Stellar winds, streams of charged particles released by stars, typically nudge surrounding gas gently. However, the wind impacting SDC 138 is slamming into the cloud at supersonic speeds, creating a shockwave that heats and compresses the gas within.

This intense interaction caused the heated gas to emit the radio waves that initially caught the researchers' attention. The discovery that the stellar wind penetrates deep into the cloud, rather than just affecting its edges, challenges existing theories about how such winds interact with interstellar clouds.

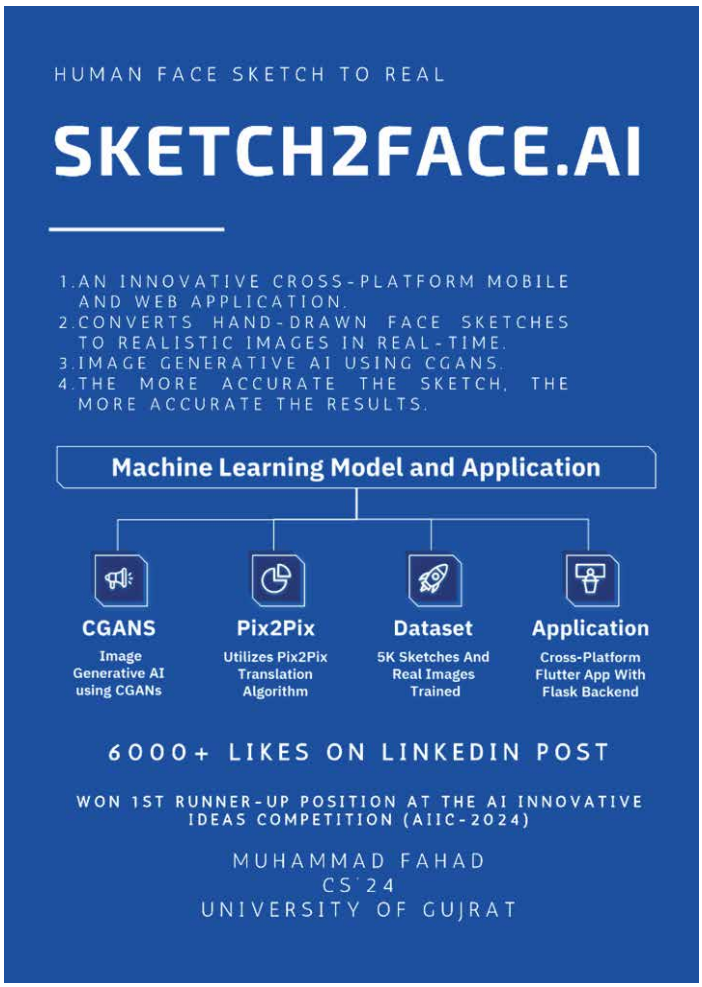
The revelation of SDC 138's cannibalistic nature has significant implications for our understanding of star formation. Traditionally, scientists believed that stellar winds primarily influenced the outer regions of gas clouds, facilitating the birth of new stars. However, the case of SDC 138 suggests that these winds can create internal turbulence, potentially disrupting star formation processes altogether.

Dr. Bally elaborates, "The strong stellar wind could potentially disrupt the cloud's ability to form new stars." This hypothesis, if proven, could revolutionize our comprehension of the intricate dance between stars and their surrounding environments.

SDC 138 is a testament to the dynamic and sometimes violent nature of our galaxy. It showcases that interstellar clouds are not merely passive observers but active participants in the cosmic drama of star formation. As we continue to explore the universe, discoveries like SDC 138 remind us of the boundless mysteries that await. The tale of this cannibalistic cloud is a captivating chapter in the ever-evolving story of our cosmos, filled with surprises, challenges, and the thrill of uncovering the unknown. The next time you gaze up at the night sky, remember that even the most serene-looking clouds might be engaged in a dramatic and unseen cosmic feast.

SKETCH2FACE.AI - HUMAN FACE SKETCH TO REAL

Muhammad Fahad, University of Gujrat



Automation is essential in this fast-paced world with technological breakthroughs. It is necessary to train machines to work alongside men for everyday increasing human effort, leading to improved productivity, fast work, and expanded options. A key area of study in computer vision, image processing, and machine learning has always been the automatic production, synthesis, and identification of face sketch photos. Image processing techniques like Sketch-to-image translation have various applications, including using image generators and discriminators with a generative opponent network to map edges to photos, creating realistic-looking images.

Sketch2Face.AI mobile and web applications provide the facility to convert roughly hand-drawn human face sketches into realistic face images using image Generative AI in real time. Users can draw human face sketches on the application-provided interface, perform editing operations while drawing, and then have the sketch processed by an advanced deep-learning model to generate the real image of that sketch. The proposed modules comprise a user-friendly drawing sketching interface, an advanced deep learning model, and real-time face generation related to the sketch. The development process involves training a deep learning model on a dataset of real images of human faces and their corresponding sketches, utilizing Generative Adversarial Networks (GANs). The pix2pix algorithm, based on GAN architecture, is used for the sketch-to-image translation task.

Here we created a dataset of human face images around 5000+ samples as a research student, made the corresponding sketches, and merged the sketch and real face image in a vertical direction using the OpenCV library. The application's cutting-edge technologies include Conditional Generative Adversarial Neural Networks (Image-To-Image Translation) deep learning-based algorithm for model development and the Flutter framework for application development.

In summary, our vision is to create a user-centric, technologically advanced solution that bridges the gap between artistic imagination and reality, empowering artists, aiding law enforcement, and enriching lives worldwide. The Human Face Generator Using Sketch (Sketch2Face) project has successfully developed Android and Web applications for converting human face sketches into real face images using image-generative AI. Robust testing of the Deep Learning model for sketch image interpretation has validated the app's efficacy. Future work includes additional features like managing sketch images, real-time cropping, filters for enhancement, color selection, and exploring additional platforms or devices for broader reach.

TIME CRYSTAL TRANSFORMING INDUSTRIES

Sharjeel Abbas, UET Science Society

With ongoing advancements in quantum physics, researchers have made significant progress in developing time crystals. These unique structures can maintain perpetual motion without requiring external energy, making them incredibly efficient. Time crystals promise to revolutionize various fields, including quantum computing, energy storage, telecommunications, and medical diagnostics.

Time crystals could transform quantum computing by stabilizing qubits, making quantum computers faster and more reliable. This improvement enables the solving of complex problems that current computers cannot address, boosting performance in fields like cryptography. Secure transmission in cryptography relies on complex mathematical problems, which require precise control and substantial energy to keep qubits stable.

Time crystals, which oscillate without using extra energy, save large amounts of energy in quantum systems. Energy efficiency is crucial for enabling quantum technology to handle more complex applications in daily life. This also leads to reduced energy consumption and overall sustainability of quantum computing technologies, which are expected to be widely adopted.

In the telecommunications industry, time crystals have led to the development of ultra-stable clocks and timing devices, improving accuracy in GPS and communication networks. In signal processing, a time crystal oscillator creates uniform time signals, reducing errors and significantly improving information transmission accuracy. Additionally, the stability of time crystals could decrease phase noise among oscillators in signal processing, enhancing signal quality with lower noise levels. This is especially valuable for communication and radar systems.

Time crystals could also revolutionize energy storage. Their perpetual oscillation allows for the creation of super-efficient batteries that store energy for extended periods without significant loss. This advancement could be a game changer for renewable energy sources like solar and wind power, making energy storage more reliable and sustainable. The impact of time crystals on various industries could be profound and long-lasting. In future, time crystals are expected to play a fundamental role in emerging technologies. Their ability to maintain coherence over extended periods in quantum computing could lead to the development of highly efficient, powerful quantum processors. This opens up new horizons in fields such as artificial intelligence, and complex simulations.

Quantum cryptography, which uses quantum mechanics to enhance communication security, could also benefit from time crystals. The most well-known application, Quantum Key Distribution (QKD), allows for generating a shared, secret key for encrypting and decrypting messages. Time crystals could make encryption algorithms more advanced and harder to break, offering enhanced protection against computational attacks.

Innovations in Biomass Power: Lessons for Pakistan

Abdul Wahab, UET Lahore

As fossil fuels continue to deplete at an alarming rate, the global energy landscape is undergoing continuous transformation. According to the latest BP Statistical Review of World Energy, total global reserves of coal, natural gas, and crude oil are estimated to be 1,139 billion tons, 187 trillion cubic meters, and 1,707 billion barrels, respectively. With the current rate of consumption, these reserves will start to deplete in the next four to five decades. To address this, the world is rapidly transitioning toward renewable energy, expected to become the primary source by 2050. In Pakistan, energy shortages and reliance on imported fossil fuels pose a serious threat to the economy. The electricity shortfall has widened to 7,000 MW, with demand rising to 28,200 MW while supply stands at 21,200 MW. Biomass could be a potential solution to this energy crisis. Pakistan produces 20,494 million tons of agricultural wastes, 25,271 million tons of agro-industrial wastes, and 1,121 million tons of wood-based residues. Major cities produce 7,121,626 tons of municipal solid waste (MSW), with a total energy potential of 63,900 GWh.

Despite this potential, Pakistan primarily relies on traditional biomass conversion methods, such as direct combustion. In rural areas, biomass is used for household cooking and heating, while industries use it to produce steam for electricity generation. However, these methods are inefficient and contribute to environmental degradation. To fully harness biomass potential, Pakistan must adopt modern technologies offering cleaner, more efficient energy conversion.

One advanced method is Fluidized Bed Combustion (FBC), used by Danish companies like Babcock & Wilcox Vølund (B&W Vølund). In FBC, solid particles are suspended in an upward stream of air, creating a fluid-like state. Biomass is introduced into this bed, exposed to high temperatures and adequate oxygen, leading to combustion. The heat generated is then used for power generation.

Gasification technology in Finland, used by companies like ANDRITZ Oy and Valmet Oyj, involves pretreating biomass before introducing it into a gasifier. Here, it is exposed to high temperatures with limited oxygen, producing syngas for power generation.

Anaerobic digestion involves collecting organic wastes in a digester where microbial activity breaks them down, producing biogas for power generation, heating, and fuel.

Hybrid solar-biomass systems are also effective. These systems combine solar energy with biomass to optimize energy output, reducing biomass use when solar irradiance is available. Spain's TERMOSOLAR BORGES, for example, produces 98 GWh annually.

To transition from conventional to biomass energy, Pakistan needs a new renewable energy policy, incentives for investment, education for farmers and technicians, and a robust supply chain. Establishing research centers to develop and improve biomass technologies will further support this transition.

AI-ASSISTED JOINT SURGERY IN CHINA

Hasnain A. Zaidi, UET Science Society

Artificial intelligence (AI) is revolutionizing joint surgery in China, supported by local and central governments. At the International Conference on Robotics and Automation in Xi'an, experts highlighted the significant advancements AI is bringing to orthopedics. Sponsored by the Institute of Electrical and Electronics Engineers (IEEE), the conference underscored AI's role in enhancing precision medicine, computer navigation, and 3D printing in surgical applications.

The IEEE, a leading global association for electronic and electrical engineers, plays a pivotal role in advancing AI and robotics across various fields. With over 1,300 industry standards, it is a major force in telecommunications, biomedicine, and consumer electronics. This year's conference, themed "AI and Robotics Applications in Intelligent Orthopedics," attracted over 150 professionals, including surgeons, mechanical engineers, and software developers, all collaborating to address joint surgery's complexities through interdisciplinary innovation.

Einstein once noted that significant scientific breakthroughs often challenge conventional wisdom, and AI in orthopedics exemplifies this idea. Professor Kunzheng Wang from Xi'an Jiaotong University emphasized AI's transformative potential, often termed the "fourth industrial revolution." AI technologies are reshaping joint surgery by improving precision and minimizing intraoperative damage. For example, deep learning algorithms are enhancing diagnostic models for conditions like osteonecrosis of the femoral head and femoral neck fractures, providing precise positioning and computer-aided navigation to locate necrotic areas accurately. These innovations minimize invasive procedures and improve surgical outcomes, making them essential for modern medical practice.

Professor Peifu Tang introduced the "Digital Twin" concept, which involves creating virtual models of human body systems to aid in precise medical interventions. This approach uses AI and machine learning to classify femoral fractures, offering new insights into orthopedic diagnostics and treatment planning. By integrating digital twins, surgeons can simulate procedures, improve implant designs, and tailor treatments to individual patients, enhancing the precision and safety of joint surgeries.

Professor Fangwen Zhai from Tsinghua University highlighted the current limitations of orthopedic surgical robots, which often lack the ability to perform complex procedures independently. He advocated for a unified platform integrating preoperative planning with real-time execution, enhancing functionality and interoperability.

AI-assisted joint surgery in China is poised to transform orthopedic care by enhancing precision, efficiency, and patient outcomes. Continued government support and innovation are setting AI on a path to become an integral part of modern medical practice, reshaping the future of joint surgery and offering unprecedented possibilities for patient care and medical progress.

SELF-NAVIGATING PALLET HANDLING ROBOT FOR WAREHOUSES

Haider Sajjad, Air University Islamabad

The self-navigating pallet handling robot is an Autonomous Mobile Robot (AMR) designed to automate pallet placement in warehouses. Online sales have grown significantly, with the COVID-19 pandemic accelerating this trend and changing the way goods are distributed. This shift has increased the need for warehouse automation to meet evolving customer expectations.

This project supports SDG 8 by increasing economic growth through enhanced warehouse efficiency, leading to greater product delivery. By automating warehouses, it also promotes sustainable industrialization, minimizing the use of fossil fuels by replacing traditional forklifts that rely on non-renewable energy sources. Despite the clear benefits, automation remains largely underutilized, with 76% of companies having never implemented an Automated Guided Vehicle and 70% having never deployed an AMR. However, larger facilities are adopting automation, with 50% of those over one million square feet introducing AMRs. E-commerce leads the adoption race with a 39% rate, closely followed by the automotive industry at 38%.

The robot's development involves both hardware and software components. The hardware includes designing and interfacing wheels, sensors, and cameras, ensuring seamless integration. The software includes the algorithm that enables the robot to navigate through the warehouse and the code that interfaces with the sensors, facilitating effective communication between the hardware and the control systems.

LIDAR sensors are used for accurate mapping and localization within the warehouse environment. These sensors provide precise environmental mapping, enabling the robot to navigate effectively and avoid obstacles. Proximity sensors help in identifying and locating pallets accurately. The Kalman Filter algorithm is employed to predict the robot's future position, which aids in proactive task placement and path planning. ROS, a modular framework, and Gazebo, a powerful simulation tool, are utilized for developing and testing the robotic system efficiently.
At the start, LIDAR maps the warehouse environment, and this map is uploaded to the microcontroller. Algorithms are then used to reduce noise in the data—a one-time process handled by the developers, categorized as admin mode. Once set up, the robot continuously maps the environment in real time, comparing it to the initial map to ensure accurate navigation. It then moves to the pallet, lifts it, and navigates to the destination while avoiding any obstacles in its path. Upon reaching the destination, it drops the pallet and checks for further commands from the control room. If no commands are given, the robot returns to the charging point to recharge and prepare for the next task.

This project aims to reduce time, human error, and expenses in industries. Automated robots, with their higher efficiency and accuracy, outperform humans who are prone to mistakes and have limited speed and endurance. Robots also lower operational costs, as fewer robots are needed to automate a warehouse compared to the number of human workers required. Implementing automation in warehousing supports e-commerce businesses in meeting high logistics demands without incurring high maintenance costs.

VERTICAL FARMING OF HORTICULTURE CROPS

Wajeeb Ur Rehman, UET Science Society

Vertical farming is gaining recognition as a complementary approach to traditional farming, enabling more sustainable food production for the world's growing population. Recent studies have focused on the resilience and circularity of vertical farming addressing environmental and food issues.

Vertical farming utilizes available vertical surfaces instead of traditional farming practices. Cultivation occurs in vertically stacked layers, allowing farmers to maximize space and produce more food within the same area of land. These layers are often integrated into buildings, warehouses, or other spaces unsuitable for traditional farming.

This innovative farming method has gained popularity worldwide, including in India, due to its high net returns. The world's growing population poses a challenge to feed people with limited land resources, and vertical farming is seen as a viable solution.

There are several methods used in vertical farming. Hydroponics is the most common, where plants are grown in a water-based solution containing all the essential nutrients they need to thrive. Aeroponics, similar to hydroponics, grows plants without soil, but instead of a water solution, the roots are misted with a nutrient-rich solution several times a day. Aquaponics combines fish farming with hydroponics, where the waste from the fish provides nutrients to the plants, and the plants help filter water for the fish, creating a closed-loop system that minimizes water use. Vertical farming can increase yield by more than ten times by utilizing vertical space. It minimizes the impact of environmental conditions that can damage traditional outdoor crops, allows year-round production of small crops, and reduces the environmental impact of agriculture while promoting sustainability. Automation in vertical farming reduces labor costs, although the initial investment is high. It produces high-quality, nutritious crops annually and uses up to 95% less water than traditional farming.

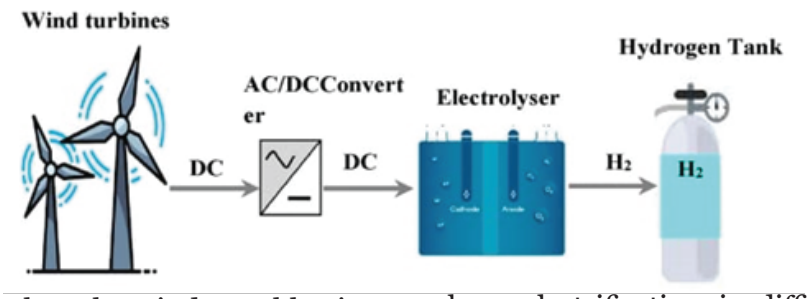
Researchers are developing automated systems to monitor nutrient solutions and optimize water and electricity usage in vertical farming. Factors like light intensity, photoperiod, and fertilizer dosage are being studied to improve crop yields and efficiency. Automated systems closely monitor and control the growing environment, ensuring optimal plant health. The amount of nutrients added, along with other parameters, is supervised by AI-powered machines. Advanced technologies such as LED lighting help optimize energy consumption in vertical farms.

Vertical farming is being introduced across major Pakistani cities like Islamabad, Lahore, Thar, and Faisalabad. This innovative approach allows crops to grow in soil-free, pesticide-free conditions on multi-story buildings, offering a sustainable solution to the challenges of modern agriculture.

CURTAILMENT IN WIND ENERGY FOR GREEN HYDROGEN

Muhammad Urwa Tul Wuska, UET Lahore

Due to the growing trends in the quest for clean energy in the world, the use of renewable energy in power generation, such as wind energy, has been enhanced. One of the drawbacks of wind energy, however, is curtailment—situations where the energy generated is too much to be used, and hence has to be limited or even shut off. What is generally considered a waste from time to time can be turned into a valuable resource, as this curtailment demonstrates. By utilizing curtailed wind energy to drive electrolysis plants to produce green hydrogen, there arises potential to change the paradigm of energy storage, control grid stability, and enable the origination of clean fuel.



Wind energy is not produced continuously according to consumer requirements but only when the winds are blowing, which may not coincide with the times when energy is most needed. At times of low demand or during 'grid congestion,' wind turbines are curtailed, meaning they must be slowed down or shut off. This leads to the loss of an opportunity to harness energy that could have been of significant use. Curtailment has become a bigger problem with the rise of wind farms and higher penetration of wind energy in various parts of the world.

While curtailment is necessary to prevent grid collapse, it is seen as highly wasteful in renewable energy systems. Rather than continuing to waste this energy, there has been a growing trend to find other uses for it. This is where green hydrogen, generated using renewable electricity to split water molecules, steps in. Electrolysis is a process where an electric current decomposes a compound—in this case, water (H_2O) into hydrogen (H_2) and oxygen (O_2). When the electricity used is from renewable energy sources like wind, the hydrogen produced is known as green hydrogen. Curtailing wind energy to drive electrolysis plants allows the excess electricity to be converted into a storable form, green hydrogen. This hydrogen can then be used as fuel in sectors like transportation, manufacturing, and electricity generation, or stored for later use. A key issue with renewable energy is its unpredictable nature. Green hydrogen serves as an intermediate form of energy storage and can help balance available energy during high wind power generation and periods of low wind. This reduces curtailment while also enhancing the grid's operability and reliability by evening out fluctuations in supply.

Green hydrogen is carbon-free and can be used in industries where electrification is difficult, such as aviation, shipping, and heavy manufacturing. When combined with wind power, the two technologies create a clean fuel that can power these sectors and reduce reliance on fossil fuels, thereby decreasing greenhouse gas emissions. The creation of green hydrogen from curtailed wind energy also presents new economic possibilities, particularly in regions with significant wind energy potential. Establishing a green hydrogen industry could generate employment, attract investment, and position these regions as development hubs for the hydrogen economy.

Pilot projects around the world, such as Germany's "Wind Gas" initiative and Australia's "Hydrogen Energy Supply Chain," have already shown the potential of utilizing curtailed wind power to create green hydrogen. Moving forward, integrating wind energy with electrolysis at scale will address the problem of curtailment while meeting the growing demand for green hydrogen, which will play a crucial role in the energy transition.

ARTIFICIAL INTELLIGENCE & BRAIN ACTIVITY ALIGNMENT

Noor Fatima, UET Science Society

The study of brain activity and its alignment with AI systems has gained significant attention in recent years. Researchers are working to bridge the gap between neural processes and machine learning models, leading to exciting advancements in both fields. This synergy promises to revolutionize our understanding of the brain and the capabilities of artificial intelligence.

The human brain, an extraordinarily complex organ, is composed of approximately 86 billion neurons interconnected through trillions of synapses. Brain activity arises from electrical impulses and chemical signals, which process information, control bodily functions, and generate thoughts and emotions.

AI's progress is heavily influenced by neuroscience, the study of the nervous system, including the brain. Conversely, AI provides powerful tools and models that help neuroscientists understand brain function more deeply. This relationship aims to create AI systems that not only perform specific tasks but also mimic the brain's adaptive learning and problem-solving abilities.

A direct application of aligning AI with brain activity is the development of brain-computer interfaces (BCIs). BCIs enable direct communication between the brain and external devices, allowing control of computers, prosthetics, and other tools through thought alone. Advanced AI algorithms process brain signals to interpret the user's intentions accurately. This technology holds immense potential for enhancing the quality of life for individuals with disabilities.

The alignment of AI with brain activity involves both encoding and decoding models. Encoding models use functional magnetic resonance imaging (fMRI) to generate brain representations based on external stimuli. These models provide insights into how the brain processes information. Conversely, decoding models solve the inverse problem by reconstructing stimuli from fMRI data, essential for BCIs and understanding cognitive processes.

Inspired by deep learning's success in fields like natural language processing, computer vision, and speech recognition, researchers have proposed neural encoding and decoding architectures. Encoding models aid in diagnosing neurological conditions and designing targeted therapies. Decoding models enable communication between the brain and external devices, potentially revolutionizing assistive technologies for individuals with severe impairments.

Researchers have curated large cognitive neuroscience datasets related to passive reading, listening, and viewing of concept words, narratives, pictures, and movies. These datasets are valuable for training and evaluating brain alignment models, leading to more accurate and effective applications.

ROLE OF 5G NETWORKS IN ENABLING SMART CITIES

Asmara Irfan, UET Science Society

Picture a city where smart systems predict your commute, emergency drones save lives, and energy flows efficiently—all enabled by 5G. While the world anticipates 6G, 5G is quietly transforming our cities today, and making science fiction dreams into reality. This article explores how, contrary to being a simple progression, 5G is a revolution that empowers today's smart cities and paves the way for tomorrow.

Smart cities use intelligent networks of devices along with sensors that control various aspects of the city such as traffic congestion and energy use. The vast amount of data from these devices must be processed in real-time. 4G, for example, cannot handle the amount and rate of devices that exist and need to interact. This is where 5G networks come into play.

5G can support up to one million devices per square kilometer, compared to 100,000 for 4G. This is crucial for smart cities, where connected devices are densely concentrated. For example, smart streetlights fitted with sensors can adjust light intensity based on pedestrian traffic and weather conditions. These adjustments happen instantly with 5G, thus increasing energy efficiency and public safety.

Real-time traffic control is another area where 5G shines. Cities can implement intelligent traffic systems using data from cameras, sensors, and vehicles. Autonomous vehicles can safely navigate complex urban environments thanks to 5G's ability to support V2X (Vehicle-to-Everything) communication. In smart cities like Singapore, lights adjust based on vehicle flow to minimize congestion. Connected vehicles share information with TMS (Traffic Management Systems) to prevent accidents and improve traffic flow. This level of real-time communication is only possible with 5G's speed and low latency.

Just as 5G revolutionizes traffic management, it also optimizes energy use in smart cities, enhancing sustainability. Smart grids can manage supply and demand better by sharing data with other smart devices like smart meters and smart appliances. In cities like Copenhagen, 5G connects renewable energy sources like solar panels and wind turbines, stabilizing their supply output. By improving energy management and reducing waste. 5G networks are central to making smart cities a reality, offering the connectivity and real-time data processing needed for various applications. From mobility to energy efficiency, 5G is expanding applications in urban environments. As cities grow, 5G's role will only deepen, enabling intelligent, safe, and eco-friendly cities. But here we can emphasize that as the cities develop, the role of 5G will expand, ensuring the development of intelligent, safe, and eco-friendly cities.

ENVIRONMENTAL IMPACT OF ELECTRIC VEHICLES

Zia Ur Rehman, UET Science Society

The transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs) is often seen as vital for reducing greenhouse gas emissions and addressing climate change. However, the environmental impact of EVs extends beyond their zero tailpipe emissions. This research examines the entire life cycle of EVs—from production to operation and disposal—to offer a comprehensive view of their environmental footprint, including battery production, electricity sources, and recycling, in comparison to ICE vehicles.

EVs have gained widespread support as a cleaner alternative to traditional ICE vehicles. Governments globally are promoting EV adoption to reduce air pollution and greenhouse gas emissions. While EVs promise zero tailpipe emissions, a broader evaluation of their overall environmental impact is necessary.

The production of EVs, particularly their batteries, is resource-intensive. Lithium-ion batteries, the most common in EVs, require significant amounts of raw materials like lithium, cobalt, nickel, and manganese. Extracting and processing these materials can cause environmental degradation and pollution. For instance, lithium extraction in South America's "lithium triangle" leads to water scarcity, while cobalt mining in the Democratic Republic of Congo raises environmental and ethical concerns. Additionally, EV manufacturing is energy-intensive, often relying on fossil fuels, contributing to greenhouse gas emissions. However, ongoing advancements in battery technology are improving the efficiency and sustainability of EV production.

A key advantage of EVs is their potential for zero tailpipe emissions, reducing urban air pollution and improving public health. Yet, the environmental benefit of EVs largely depends on the source of electricity used for charging. In regions where renewable energy dominates, EVs have significantly lower operational emissions than ICE vehicles. However, in areas dependent on fossil fuels for electricity, the environmental advantage of EVs diminishes, underscoring the need for a transition to renewable energy to maximize EV benefits.

The disposal and recycling of EV batteries pose challenges and opportunities. Improper disposal can cause environmental contamination, but efficient recycling processes can recover valuable materials, reducing the demand for new raw materials and mitigating environmental impacts. The "second-life" application for EV batteries—repurposing them for energy storage in renewable energy systems—is gaining traction.

Comparing EVs with ICE vehicles across their life cycles reveals that while ICE vehicles have lower production emissions, their operational phase results in higher greenhouse gas emissions. EVs, with higher production emissions, offer the potential for significantly lower operational emissions, especially when charged with renewable energy.

ENERGY EFFICIENCY & SEISMIC RESILIENCE IN HIGH-RISE BUILDINGS

Civil Society, UCP

In the last few years, the global energy crisis emerged leading to a huge increase in the prices of gas, electricity and fuel worldwide. Pakistan's urban landscape has seen a rapid surge in high-rise buildings posing significant challenges in terms of energy consumption and seismic vulnerability. As energy demands escalate and the threat of seismic activities persists, integrating sustainable solutions is essential.

The energy crisis in Pakistan is based on a combination of factors including insufficient energy infrastructure, reliance on non-renewable energy sources, inefficient energy policies, population growth, and urbanization. These factors collectively contribute to a persistent shortage of electricity and fuel in the country. It is important to note that buildings consume 30-40% of the world's total energy. The higher usage of electricity or energy in high-rise buildings emits a large amount of CO_2 in the atmosphere which pollutes the environment and causes Smog or ozone depletion. The Polluted environment badly affects the air quality which is very harmful to human health. Pakistan contributes 0.5% to the world's carbon emissions and has faced significant climate changes, with hot weather prevalent in most regions.

To make the buildings eco-friendly it is necessary to make them energy efficient. Developing seismic-resilient high-rise buildings in Pakistan is crucial to mitigate potential risks and ensure the safety of occupants and assets during seismic events. Many cities like Singapore, lights adjust based on vehicle important buildings were constructed before modern seismic codes and even those following the codes in Pakistan may now need fortifications due to increased seismic activity. It means if a building was built according to the old code, it might not be strong enough for current seismic demands. Fortifying buildings improve their ability to withstand earthquakes making them safer.

In future, to make our high-rise buildings eco-friendly and lifelong, they should be energy efficient and seismic resilient. Structural insulated panels (SIPs) offer a promising solution for improving energy efficiency and seismic resilience in pre-designed high-rise buildings. Similarly, combining Textile Reinforced Mortar (TRM) with Polyurethane (PUR) foam enhances these aspects in post-designed high-rise buildings.

However, there is a significant gap in understanding how these measures affect structural and energy performance in Pakistan's high-rise buildings. Additionally, the lack of a unified approach for integrating SIPs and TRM with PUR in building design has limited their widespread use. This research aims to address this gap by creating a comprehensive framework that uses BIM modeling, energy analysis, and seismic assessment to evaluate these measures for high-rise buildings in Pakistan.

"The important thing is not to stop questioning. Curiosity has its own reason for existing."

— Albert Einstein

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