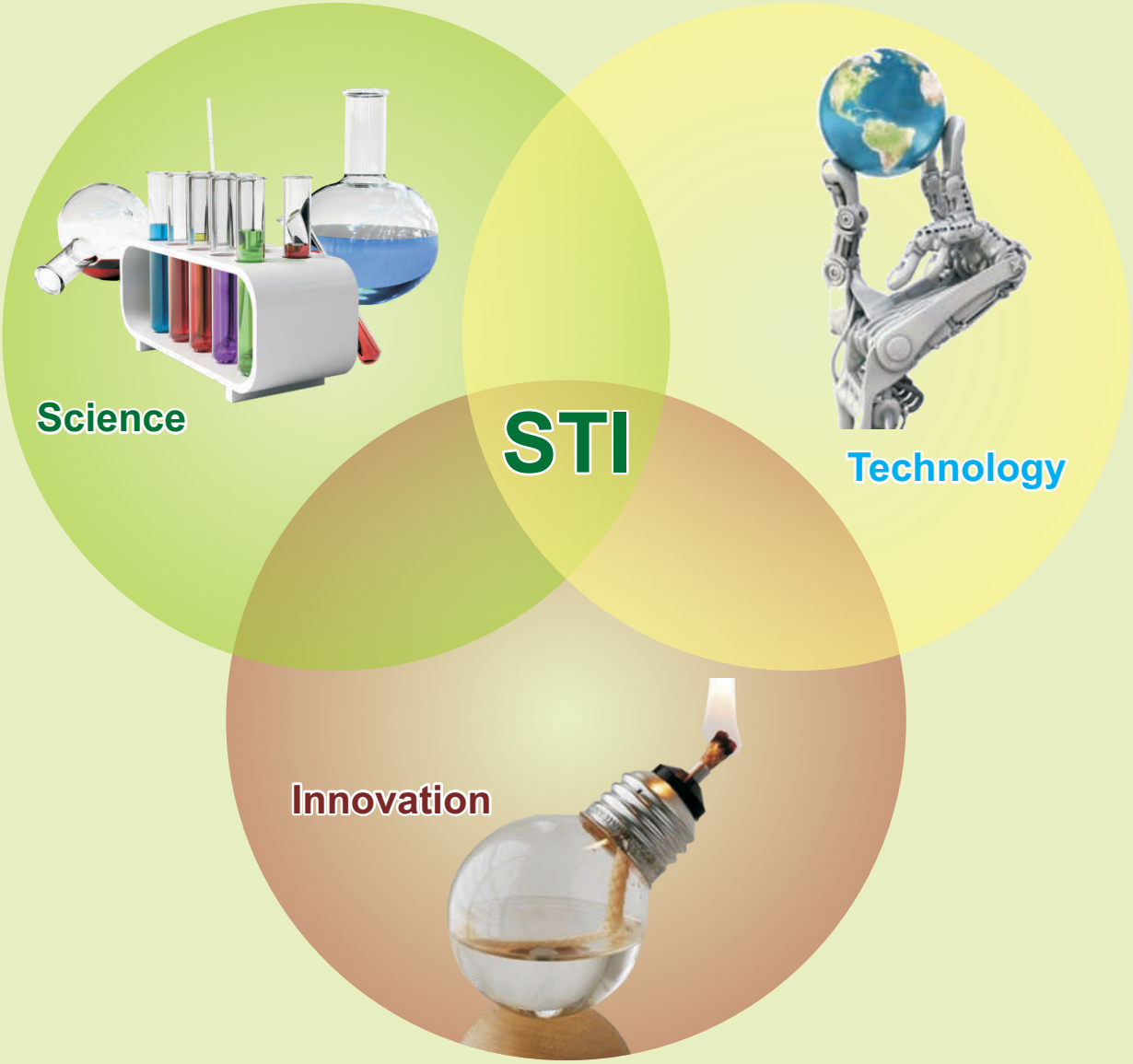
PCST

STI Voice

Quarterly Newsletter

Volume 2
No. 3, Jul-Sep, 2016
No. 4, Oct-Dec, 2016



Pakistan Council for Science & Technology
Shahrah-e-Jamhuriat, G-5/2, Islamabad. www.pcst.org.pk

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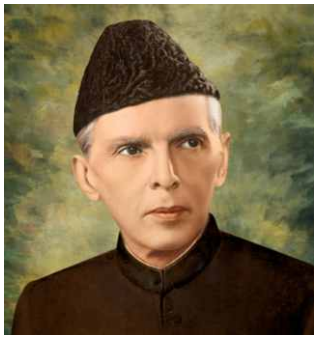
Editor in-Chief
Prof. Dr. Anwar-ul-Hassan Gilani (SI)
Chairman
Pakistan Council for Science and Technology (PCST)

Editor
Prof. Dr. Farzana Latif Ansari (TI)



Quaid's Voice

"My guiding principle will be justice and complete impartiality, and I am sure that with your support and co-operation, I can look forward to Pakistan becoming one of the greatest Nations of the world".

(Address to the Constituent Assembly of Pakistan Aug 11, 1947)

Chairman's Voice

The importance of Science, Technology and Innovation (STI) for economic growth is well recognized and is evident from the fact that the countries which have achieved significant progress have given due consideration to STI. In the era of knowledge-based economy, innovation plays a key role as a driver of economic growth and prosperity and is gaining prominence in whole sphere of economic and social development activities. The countries which are higher in the innovation ladder prosper more than those which are at the lower end. Switzerland, which is the top ranked country in the Global Innovation Index 2015, has per capita income of 85,616 US$. To embrace similar economic progress, we are bound to give due diligence to growth in scientific and technological infrastructure of the country, particularly when Pakistan finds itself at the 131st position in the list of 141 counties which are included in the Global Innovation Index 2015.

Last few months have been very productive for PCST, in achieving some historical milestones, which include organizing the 6th Meeting of the Executive Committee of the National Commission for Science and Technology (ECNCST), held on Mar 9, 2016 after a gap period of 14 years. It was a productive meeting as the forum was able to recommend concrete proposals for the next meeting of the National Commission for Science and Technology (NCST) to be chaired by the Prime Minister shortly. The efforts of PCST team that worked day and night to make this happen are appreciable in this regard.

In 2012, National Science, Technology and Innovation Policy 2012 had been approved by the government and was widely circulated among all stakeholders for implementation. Recognizing the important role of STI in realization of the Vision 2025, it was felt necessary, to align efforts of S&T to the Vision 2025. Pursuant to economic revival vision of the government, PCST formulated a National STI Strategy 2014-18 to implement National STI Policy 2012. However, to make it more meaningful, focused and precise, it was decided to review it carefully. As a result thereof, a number of consultative meetings with implementing agencies and stakeholders, PCST finalized activity-based National Science, Technology and Innovation Strategy and Action Plan 2017 with clear time bound targets. The main features of the revised STI Strategy and Action Plan include clearly defined timelines, estimation of costs, identification of implementing agencies, major stakeholders, milestones, deliverables and key outcomes for each proposed action.

PCST is also working on the National Research Agenda under the supervision of MoST, with the aim to align the national R&D and innovation activities with the Vision 2025 and to provide a direction to the national R&D efforts so that they adequately support achievement of the goals under the seven pillars set in the said document.

Regular columns on Quran & Science, Muslim Scholars of the past, Young Scientists column along with Nobel Laureates, 2016 and news about innovation in science and technology will continue.

Lastly, I would like to express my sincere appreciation to Prof. Farzana Latif Ansari (TI), Editor, STI Voice for her creativity and dedication together with the efforts of other team members in making STI Voice an effective platform of communication for the scientific community as well as for public.

Prof. Dr. Anwar-ul-Hassan Gilani (SI)
Chairman, PCST
Editor-in-Chief

"What has **reached** you was never meant to **miss** you and what has **missed** you was never meant to **reach** you".

Hadith Sahih Sunan Abu Dawud 4699

Editor's Voice

The rapid dissemination of the latest knowledge of science and technology essentially requires its faster sharing with the scientific community. STI Voice is one such platform serving this purpose for its vast readership. Although quarterly in its frequency, the combining of its two issues i.e. 3 and 4 was circumstantial.

In line with the previous format of STIV, the current issue also offers you a taste of diversity of news, encompassing biographies of one of the many eminent Muslim scholars of the past as well as the young scientist of today, all related to science and technology. The innovative ideas of technological development extracted from the miraculous life and living of the ant are abbreviated in the column Quran's and Science Voice. A brief account of the contributions of the Nobel Laureates in the fields of chemistry, medicine and physics has been included for the interest of its community. An important piece of information for the scientists is the inclusion of a list of national and international funding agencies with their weblinks as compiled by COMSATS courtesy (COMSATS). Different activities of PCST and those of the Chairman have also been highlighted as a regular feature. The names of four new elements that finally complete the 7th row of the Periodic Table, have been included as a news item while the newly completed Periodic Table appears as the inside back cover of STI voice.

PCST endorses its deep condolence on the sad demise of Prof. Dr. Ahmad Zewail, Nobel Laureate (Physics) and considers it an irreparable loss, not only for Muslim Ummah, but of the entire scientific community.

A huge "Thank you" to the Chairman, PCST and all the contributors without which the current issue of STIV would have been impossible. Looking forward to your feedback for the improvement of your own newsletter.

Prof. Dr. Farzana Latif Ansari (TI)
Editor

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Department of Chemistry
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Inside this issue

The Quran's and Science Voice

In previous issues of STIV, three examples of very insignificant creatures namely, a house fly, a mosquito and a honey bee, all mentioned in the Holy Quran, had been discussed with emphasis on their miraculously designed creation and the lessons learnt from them in the technological advancement by the human beings.

This learning from the nature has been described by the scientists today as Biomimcry. The term biomimicry originated from the word roots bios (life), and mimesis (to imitate) and refers to the imitation of systems and processes in nature that inspire solutions to human problems. For example, the use of bacteria to clean waste-water in water-treatment technologies as well as the design of solutions and new technologies as inspired by nature, known as bio-inspired design.

The designing of unmanned aircrafts i.e. a drone and super cameras, mimicing the eye of a house fly, heralding painless microneedles inspired by the anatomy of the snout of a mosquito, the designing of natural, organic and futuristic buildings mimicking the hexagon of a honey bee's hive are a few examples of biomimicry discussed in earlier issues of STIV. The most important point to be focused here is the clear indications of the anatomical design of these small creatures and the technological advice that lies underneath the relevant verses of the Holy Quran in its different chapters. The example of the ant in this article is a continuation of the same theme.

The Holy Quran quotes about ants in Surah AlNaml in the following verse.

حَتَّىٰ إِذَا أَتَوْا عَلَىٰ وَادِ النَّمْلِ قَالَتْ نَمْلَةٌ يَا أَيُّهَا النَّمْلُ ادْخُلُوا
مَسَاكِنَكُمْ لَا يَحْطِمَنَّكُمْ سُلَيْمَانُ وَجُنُودُهُ وَهُمْ لَا يَشْعُرُونَ

"Until, when they came upon the valley of the ants, an ant said, "O ants, enter your homes so that you do not be crushed by Solomon and his soldiers while they do not feel it."

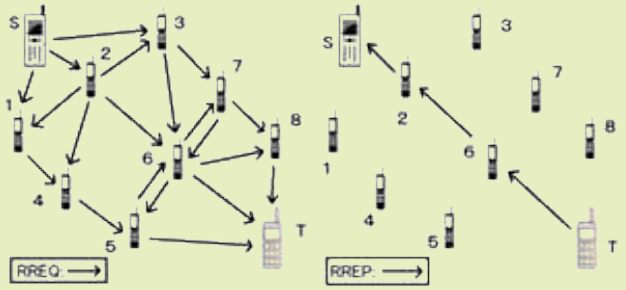
(AlNaml 27.18)

For centuries philosophers thought that only humans were rational while animals only followed instinct. Actually this false belief was so entrenched in Arabs that they included it in their grammar, referring to humans as rational (عـاقـل) and all other animals, plants and inanimate objects as irrational (عاقل غيـــر). However today scientists have confirmed that animals do not act by instinct alone, as Arabs thought, but rather animals have their own logic and communication systems, that is, they make rational decisions like humans but at a much lower scale. However the Quran did not make the mistakes of the Arabs, instead it says that ants have their own logic and do communicate with their own species. Today we are certain that animals live in communities and have their own languages but 1400 years ago this was undoubtedly beyond imagination.

The ant is a species which is found worldwide but is especially common in hot climates. Apart from its fine anatomical design, one remarkable point is that all male ants have wings while the female ants are wingless recently been discovered that. If the ant mentioned in the Quran had wings it would have flown off, however, it didn't have this option, instead it's only option was to hide underground. Here the Quran correctly addressed this ant in the female mode by using the word Qalat instead of Qala.

The significant existence of the ants on the planet is evidenced by the very fact that the Holy Quran dedicated a whole surah AlNamal (surah 27) to the ant just as it did to the honey bee in surah AlNahl, numbered 19.

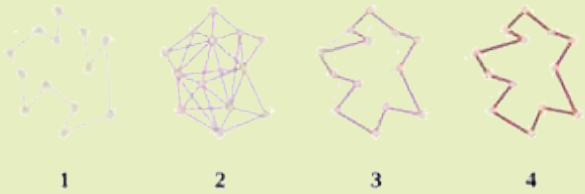
An ant's nest is a vertical tunnel with horizontal chambers used for specific purposes like storing food, nursing places and resting rooms for the worker ants. To keep these rooms intact, the ants have to struggle a lot. Deriving inspiration from ants' communication system, scientists have devised a mobile ad hoc network (MANET) comprising of mobile hosts for communication using wireless links. Modeled on ants, this novel routing algorithm called GPSAL (GPS/AntLike Routing Algorithm) is based on Global Positioning System (GPS).



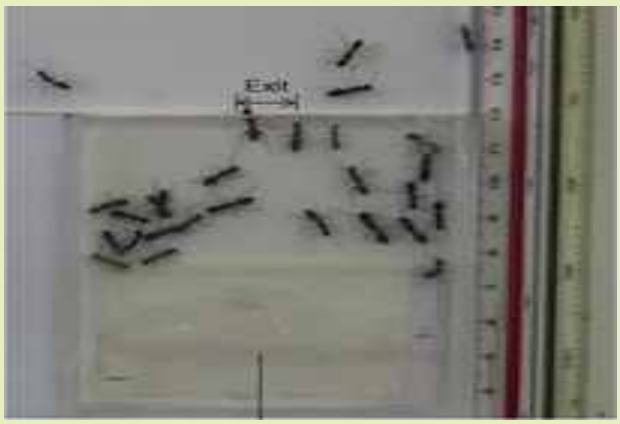
Scientists have discovered that the ants find the shortest route to a food source, not by looking at their watches to check the time, but by using chemical signaling compounds called pheromones which they lay down as they travel so that other ants can follow their trail. The first ants to choose the shortest path to a food source, return to the nest before their fellow food-seekers. These ants leave strong chemical signals along their chosen pat, allowing their companions back at the nest to preferentially follow the shortest route to the food source themselves. Inspiration by the ability of ants to choose the shortest path between their nests to a food source, has led to improved vehicle routing. The ants' "Follow Me" signal is being used today by UPS and gasoline truck companies for delivering mail more quickly and efficiently by improving their routes from stop to stop.

Ant colony optimization is a technique for solving hard computational problems, which are simplified such that their solutions involve simply finding the best path through a problem 'map', just as ants find

dishwasher, and up onto your counter. This technique has many applications in the real world, for example, its use in communications networks, where ant colony behavior has inspired better distribution of media through networks and to mobile users. Ant colony optimization is just one example out of many instances where nature inspires better solutions to our everyday problems.



The saving of lives of people during an emergency by rapid evacuation of an affected building has always been a great challenge. Perhaps ants can come to the rescue of the architects while designing the exits in the buildings. Scientists in Melbourne, Australia set up a miniature building model with moveable walls and exits, and then populated it with ants. Next, citronella ant repellant was applied at various locations and the ant behavior was observed. It was noticed that exits in corners resulted in more rapid ant escape than similar exits located along walls. "The location of the exit at the corner is found to be more effective in reducing the evacuation time than when the exit was positioned in the middle of the wall. Moreover, obstacles like poles or columns can improve the flow of panicking ants. They concluded, by analogy, that corner exits are also a natural emergency destination for people and are the most efficient escape routes for saving lives in office buildings, sports arenas, railway stations etc.



Ants escaping through emergency exit

In a previous issue of STIV, under the same column i.e. Quran's voice, the lessons from the life of the honey bee and the technological inspirations thereof, were discussed briefly. Looking at the ants, it appears that things are no different for them either. Allah has inspired in them a social order also and they abide by it absolutely. This is the reason why each group of ants performs the duty assigned to it perfectly with absolute self-surrender and does not strive for more. Furthermore all the social order in their colonies and the work they perform is made possible by an inspiration Allah has given them.

The Quran very clearly states that that the animals communicate with each other and that they are nations just like humans are nations.

"There is no animal on land, nor a bird, that flies with wings who are not nations like you. We didn't miss a thing in the Book then to their Lord they will be gathered".

(Al-Anam 6.38)

Activities of Chairman, PCST

Chairman PCST, Prof. Dr. Anwar-ul-Hassan Gilani represented PCST at the following different national and international platforms.

1. As Guest of Honor delivered a keynote address titled *"Science as a Career"* on **Launching Ceremony/student orientation session of Science Talent Farming Scheme** at a National Workshop organized by Pakistan Science Foundation at Hill View Hotel, Islamabad (Jul 20, 2016).

2. As Chief Guest delivered a keynote lecture on *"Nutrition/Functional foods & One Health"* in the **One Health" Symposium at The University of Agriculture, Faisalabad** (Aug 8, 2016).

3. Attended **Annual Asian Council for Science Editors (ACSE) meeting** in Dubai and chaired a session. In addition, he participated in two workshops as a part of this event (Aug 10-11, 2016).

4. As Guest of Honor delivered a keynote lecture on *"Efficacy and Safety of natural products is influenced by the Presence of Synergistic and/or side-effects neutralizing combinations of chemicals"* at the **13th Biennial Conference** conducted by CIIT Abbottabad Campus (Aug 25, 2016).

5. Chief organizer of **National Workshop on "Organic Food and Health: Avenues of Innovation and Entrepreneurship** held at UMT, Lahore. Chairman, PCST also delivered a keynote lecture on "Functional Foods for Health and wellness-opportunities of entrepreneurship"(Aug 29, 2016).

6. As Guest of Honor and delivered Keynote lecture titled *Contribution of STI to the Three Dimensions of Sustainable Development* during **National seminar on South-South Cooperation in the Framework of Sustainable Development Goals** by PAS & COMSATS at PAS, Islamabad (Sep 22, 2016).

7. As Guest of Honor delivered a keynote lecture titled *"Holistic Approach to Address Microbial Resistance to Antibiotics and other Health Issues"* at **National Conference on Recent Innovations in Pharmaceutical Sciences** organized by Riphah International University at Margalla Hotel, Islamabad (Oct 26, 2016).

8. Chief Guest of the Concluding Ceremony of 3rd National Conference on **Frontiers of Nanoscience and Nanotechnology** organized by PINSTECH at Islamabad (Oct 27, 2016).

9. As Guest of Honor delivered a lecture titled *"Overcoming challenge of R&D and innovation financing in developing countries: a proposed way forward for Pakistan"* at the **1st International conference on Science Technology and Innovation Policy and Management** under the aegis of MUET, PCST, HEC and ECO Science Foundation at Karachi (Nov 16, 2016).

10. As Chief Guest delivered a keynote lecture on *"Food Security through Sustainable Agriculture"* at the **National Conference on Feeding the 9-billion through sustainable agriculture** held at University of Haripur, KPK (Dec 12, 2016).

11. Chief Guest in the **International Workshop on Research Methods in Nutrition** and distributed RPA certificates among the winners at The University of Agriculture, Faisalabad (Dec 13, 2016).

12. Guest of Honor, in **AGAHI Awards 2016** at National Library of Pakistan, Islamabad (Dec 16, 2016).

13. Participated in the **International Workshop and Twelfth Session of the Governing Council of The Asia and Pacific Centre for Transfer of Technology (APCTT)** and delivered invited lecture titled *"Gender Mainstreaming in STI in Pakistan: Current Status & Future Prospects"* at Ramada Hotel Islamabad (Dec 19-21-2016).

14. Chief Guest in **DICE AUTOMATIVE-2016** and distributed RPA certificates among the winners at NED University of Engineering and Technology, Karachi (Dec 28, 2016).

Past Eminent Muslim Scholar's Voice

Muhammad ibn Musa al- Khwarizmi (Father of modern Algebra)

Islam gave birth to a new civilization that spread from China in the east, India in the south east, Russia in the north, and Anatolia in the west of Asia, to East and North Africa up to the Mediterranean regions of Southern Europe. This civilization was marked by a deep interest in science. In the heart of the Islamic scientific tradition lays the queen of sciences, mathematics, where the scholars of bilad al-Islam (lands of Islam) excelled in all its branches practiced in pre-modern times.

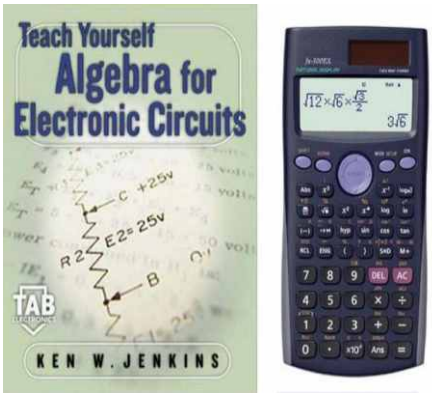
One of the greatest minds of the early mathematical production in Arabic was Abu Abdullah Muhammad ibn Musa al-Khwarizmi (b. before 800, d. after 847 in Baghdad) Muhammad ibn Musa al- Khwarizmi was a Persian mathematician, astronomer, astrologer geographer and a scholar in the House of Wisdom in Baghdad. He was born in Persia of that time around 780. Al-Khwarizmi was one of the learned men who worked in the House of Wisdom where he flourished while working as a member of the House of Wisdom in Baghdad under the leadership of Kalif al-Mamun, the son of the Khalif Harun al-Rashid. The House of Wisdom was a scientific research and teaching center that had a large and rich library *(Khizânat Kutub al-Hikma)* and distinguished scholars of various faiths were assembled to produce scientific masterpieces as well as to translate faithfully nearly all the great and important ancient works of Greek, Sanskrit, Pahlavi and of other languages into Arabic. He devoted himself entirely to Khizânat al-Hikma and was appointed court astronomer of Caliph Al-Ma'mun who also commissioned him to prepare abstracts from one of the Indian books entitled *Surya Siddhanta* which was called *al-Sindhind* in Arabic.

Muhammad ibn Musa Al-Khwarizmi is one of the greatest scientific minds of the medieval period and the most important Muslim mathematician, justly called the 'father of algebra'. He wrote the *Kitâb al-Jem wa'l Tafrîq bi Hisâb al-Hind* also called *Kitâb Hisâb al-adad al-Hindî* on arithmetic. In this book he used Indian numerals including zero in place of depicting numbers by the letters of the alphabet and the decimal notations or numeration by position for the first time. It deals with the four basic operations of addition, subtraction, multiplication and division as well as with both common and sexagesimal fractions and the extraction of the square root. The book is devoted to finding solutions to practical problems which Muslims encountered in daily life concerning matters of inheritance, legacies, partition, lawsuits and commerce, with over eight hundred examples. This book is preserved only in a Latin translation, *Algoritmi de numero Indorum* ("Al-Khw rizm Concerning the Hindu Art of Reckoning") It is indeed from the name of the author that rendered in Latin as Algoritmi, originated the term *algorithm. It is for this reason of developing the concept of algorithm, that he is called the grandfather of computer science by some people.*

His book *Hisâb al-Jabr wa'l-Muqâbalah,* is considered the foundational text of modern algebra. The meaning of the Arabic word *Al-Jabr* is restoration by transposing negative quantities to the other side of the equation to make them positive; and the term *Al-Muqâbalah* refers to the process of eliminating identical quantities from the two sides of the equation. But the best translation for *Hisâb al-Jabr wa'l-Muqâbala*, is 'the science of equations'.

Title page of an Arabic manuscript copy of al-Khwarizmi's Kitab al-jabr wa-'l-muqabala (The original Arabic text of the book is lost and only its Latin translation is available).

This book provides an exhaustive account of solving polynomial equations up to the second degree, and introduced for the first time the fundamental algebraic methods of "reduction", "completion" and "balancing". The book is actually on applied mathematics. Its first part discusses the equations of the first and second degrees. All his proposed problems can be reduced to one of the six standard forms. He gives rules for the solution of each of the six forms and explains with examples how to reduce any given problem to one of these standard forms. The second part of the book deals with practical mensuration by giving rules for finding the area of various plane figures including the circle, and for finding the volume of a number of solids including cones and pyramids. The third part concerns legacies as well as inheritance consisting entirely of solutions to problems which arise out of legacies. His work of Algebra is regarded as the foundation and cornerstone of all the sciences.



Two instances of the modern application of algebra.

Al-Khwarizmi had also contributed to the science of geography. His book on geography entitled *Kitâb Sûrat al-Ard* (Book of the image of the earth) consists almost entirely of lists of longitudes as well as latitudes of localities and gives in a tabulated form the coordinates of the places such as cities, mountains, seas, rivers and islands. It is said that this was also accompanied by regional maps of each of the climes and by a single world map called "*al-Sûrat al-Ma'muniyya*" but these have been lost. It is also said that his map of the world was the first map of the heavens and the earth drawn by Muslims. The map of the world has now been fully reconstructed by an Indian scholar, on the basis of description and data given in his *Kitâb Sûrat al-Ard*.

Al-Khwarizmi is also the author of several books on astronomy and history. He also compiled a set of astronomical tables *(Z j)*, based on a variety of Hindu and Greek sources. This work included a table of sines, evidently for a circle of radius 150 units. Like his treatises on algebra and Hindu-Arabic numerals, this astronomical work (or an Andalusian revision thereof) was translated into Latin.

Muhammad ibn Musa al- Khwarizmi died in c. 850 and is remembered as one of the most seminal scientific minds of early Islamic culture. May Allah rest his soul in eternal peace, ameen.

A stamp issued in honor of al-Khwarizmi by the former USSR post in 1983. The text in Cyrilic reads: 1200 Years, Muhammad al-Korezmi.

In the memory of the achievements of Muhammad Ibn Musa al-Khwarizmi, the Iranian Ministry of Science, Research and Technology had instituted the Khwarizmi International Award (KIA) in 1987.This award is organized annually to recognize outstanding scientific achievements made by Researchers, Inventors and Innovators from all over the world and to appreciate their invaluable achievements and contributions to various fields of science and technology. Detailed information on this award is available at the website http://www.khwarizmi.ir

Activities of PCST

PCST Secured Funding for two Studies

1.First National Industrial Innovation Survey

In this era of knowledge-based economy, innovation is crucial for developed countries to maintain their competitive advantage while for developing nations, it is important to leapfrog to higher stages of development. Industrially advanced and newly emerged economies took the benefit of knowledge through its application to industry, hence their industries turned innovative and competitive.

Entrepreneurship and innovation are important interventions of the Government's Vision 2025 which will likely boost private sector investment in the country. The project is in line with the core objectives defined in the Vision 2025 i.e. building a competitive knowledge-based economy through value addition, enhancing competitiveness and innovation. It would be a landmark study which will generate valuable information for more informed decisions, by the policy makers regarding industrial and STI policies as well as promoting innovation culture in industrial sector.

2.Need Assessment of S&T Human Resources for Driving Innovation and Achieving Vision 2025

Quality human resource development can play a pivotal role in transforming the country into a knowledge-based economy. The existing schemes for producing highly qualified manpower is a critical but a resource intensive endeavors which demands judicious utilization of scarce financial resources. There is a gap between the relevance of the highly qualified manpower produced and the socio-economic development priorities of the country. No detailed studies, in a systematic manner, have been conducted at the national level to assess and plan for the country's future demand for the human resources development.

The prime objective of the project is to review current status of human resources working, both in public and private sector universities, S&T/R&D organizations, Ministries/Divisions and in the industry. Further, the project also aims to tracking PhDs produced in different disciplines during the last five years to gauge their gainful employment / unemployment status in order to establish a co-relation between the demand and supply side of human resource in the country as well as to carry out future need assessment of human resources to pace with the Vision 2025. The results of this study is expected to have a huge impact in terms of its usefulness for universities/HEIs, helping to plan for human resource development in the areas of high demand as well as for students in their career planning.

Directory of Productive Scientists of Pakistan (PSP)

Pakistan Council for Science and Technology (PCST) is the only organization that maintains a national database of productive scientists of Pakistan. These data organized by PCST, along with the numerical scoring of scientists, are widely employed by R&D organizations and Universities/ Institutions for keen assessment of potential candidates with respect to appointments and promotions. Moreover, these data are also made available for medals, awards and nomination of prestigious scientific bodies on request of MoST and other concerned agencies.

From this comprehensive data, in the course of last two decades, PCST has published seven (07) directories on the subject of scientific research evaluation. The 8th study (PSP – 2016) has been completed recently, which includes the life-time research profile of 3268 scientists, including engineers and health professionals employed in public / private sector universities, colleges and R&D organizations categorized in different subjects while updating of data for PSP-2017 is under process. This document provides complete information on the productive scientists of Pakistan and is based on a credible and transparent process, using a wide range of bibliometric parameters with ownership both in the scientific community and the Government (details of individual parameters of profile of each scientist shared openly at the PCST website and accessible to public before final publication; http://www.pcst.org.pk/psp2017.php).

The PSP–2016 is based on the revised criteria covering a wide range of parameters, which include authorship of books, PhD research supervision, cumulative impact factor and citations for the papers published in impact factor journals, patents granted, awards and competitive grants won. Additional parameters under innovation/ applied research output i.e. Crop Varieties / Engineering Processes / Medical Devices etc. are also taken into account for scientists and engineers involved in the applied research. The criteria for this

evaluation are devised and reviewed by a national level committee comprising eminent scientists with representation both from academia and R&D organizations as well as from the Ministry of Science & Technology (MoST).

Journal of Science, Technology and Development (STD)

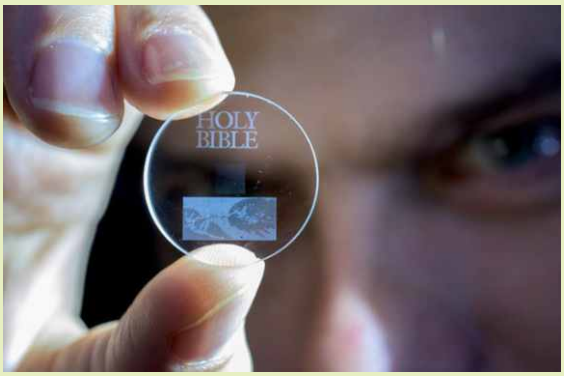
PCST has been regularly publishing its quarterly journal titled "Science, Technology & Development" since 1982. All 1-4 issues of STD, volume 35 of the current year are available on PCST website while issues 1-2 have already been printed and sent to different organizations on its mailing list. New members from, around the globe and from different scientific fields of S&T, have been added to its Editorial Board to increase diversity of its members. The Journal has already been recognized by HEC and efforts are being made for its up-gradation and registration at different data bases especially with ISI-Web of knowledge.

Technology Foresight Exercise (TFE)

PCST has regularly been conducting Technology Foresight Exercises in front line research areas of the country on priority. During Oct-Nov, 2016, PCST initiated Technology Foresight studies on Mineral Sector and Automotive Sector separately. The Expert Panel on Mineral resources was constituted having representation of top level experts from public sector, academia, private sector and industry from different provinces. Initially, comments / inputs for the promotion of Mineral sector Industry in Pakistan were invited from the experts. The 1st meeting of the expert panel has been planned in January, 2017 at PCST, Islamabad. Technology Foresight studies on Automotive sector are also underway, the Expert Panel on Automotive sector has already been constituted and the first expert panel meeting has been scheduled early 2017. The comments of the experts of both panel meetings will be included in the National Research Agenda of the National Commission for Science and Technology meeting to be held shortly.

Nearly eternal data storage method discovered

Everything degrades eventually, and there is no way to store data on one device for truly extended periods of time. But that may no longer be true due to a discovery made by the University of Southampton. Scientists have successfully used nano-structured glass to create a process for recording and retrieving data. The storage device is a small glass disk about the size of an American quarter that can hold 360TB of data and remain intact up to 1,000°C. This means that its average shelf life when held at room temperature would be approximately 13.8 billion years (Roughly the same amount of time the universe has existed).



Data is written on the device using an ultrafast laser via short and intense light pulses. Each file is written in three layers of nanostructured dots that are only 5 micrometers apart. When read, the data is realized in five dimensions: the three dimensional position of the nanostructured dots as well as their size and orientation.

Obituary

Ahmed Zewail, the Linus Pauling Professor of Chemistry, Professor of Physics, and Director of the Physical Biology Center for Ultrafast Science and Technology at California Institute of Technology (Caltech), passed away, at the age of 70, on Tuesday, August 2, 2016.

Born in 1946 in Damanhur, Egypt, Zewail received his early education in Egypt and earned his BS and MS degrees from Alexandria University in 1967 and 1969. He received a PhD from the University of Pennsylvania in 1974 and completed an IBM postdoctoral fellowship at UC Berkeley before joining the faculty at Caltech in 1976 as an Assistant Professor. He became an Associate Professor in 1978 and a Professor in 1982. He was Linus Pauling Professor of Chemical Physics from 1990–97. Zewail was the author of some 600 articles and 14 books, and was known for his effective public lectures and writings not only on science but also in global affairs. For his leadership role in these world affairs, he received, among others, the "Top American Leaders Award" from The Washington Post and Harvard University.

Zewail was the sole recipient of the 1999 Nobel Prize in Chemistry for his pioneering developments in femtoscience, making possible observations of atoms in motion on the femtosecond (one femtosecond is a millionth of a billionth of a second) time scale. These developments led to the establishment of the discipline of femtochemistry. More recently, he and his group developed "4D" electron microscopy for the direct visualization in the four dimensions of space and time of materials and biological behaviors.

For his contributions to science and for his public service, Zewail received honors from around the globe. Fifty honorary degrees in the sciences, arts, philosophy, law, medicine, and humane letters were conferred on him, including those from Oxford University, Cambridge University, Peking University, École Normale Supérieure, Yale University, University of Pennsylvania, and Alexandria University.

Zewail was decorated with the Order of the Grand Collar of the Nile, Egypt's highest state honor, and was named to the Order of Légion d'Honneur by the President of France. Among the more than 100 international prizes and awards, he was the recipient of the Albert Einstein World Award, the Benjamin Franklin Medal, the Leonardo da Vinci Award, the Robert A. Welch Award, the Wolf Prize, the King Faisal Prize, the Othmer Gold Medal, and the Priestley Gold Medal. In his name, international prizes have been established in Amsterdam, Cairo, Detroit, Trieste, and Washington, D.C.; in Cairo, the AZ Foundation provides support for the dissemination of knowledge and for merit awards in arts and sciences.

He was an elected member of academies and learned societies including the National Academy of Sciences, the Royal Society of London, the American Philosophical Society, the French Academy, the Russian Academy, the Chinese Academy, and the Swedish Academy.

Following the 2011 Egyptian revolution, the government established Zewail City of Science and Technology as the national project for scientific renaissance, and Zewail became its first chair of the Board of Trustees.

In 2009, President Barack Obama appointed Zewail to the Council of Advisors on Science and Technology, and in the same year he was named the first U.S. Science Envoy to the Middle East. Subsequently, in 2013, Secretary General of the United Nations Ban Ki-moon invited Zewail to join the U.N. Scientific Advisory Board. In Egypt, he served in the Council of Advisors to the President.

"Ahmed was the quintessential scholar and global citizen. He spent a lifetime developing instruments that interrogate nature in fundamentally new ways, and defining new directions that cut across the physical and biological sciences. Ahmed's fervor for discovery never abated and he serves as an inspiration to colleagues and generations of students. The Caltech community deeply mourns his loss".

Thomas F. Rosenbaum
Caltech President

Nobel Laureates' Voice

Nobel Prize in Physiology or Medicine

How cells destroy and recycle cellular components-autophagy

The 2016 Nobel Prize in Physiology or Medicine has been awarded to Prof.Dr. Yoshinori Ohsumi for his discoveries of mechanisms for autophagy. Professor Ohsumi, a cell biologist, is working at Tokyo Institute of Technology's Institute of Innovative Research.

Yoshinori Ohsumi

This year's Nobel Laureate discovered and elucidated mechanisms underlying autophagy, a fundamental process for degrading and recycling cellular components. The word autophagy originates from the Greek words auto-, meaning "self", and phagein, meaning "to eat". Thus, autophagy denotes "self eating". This concept emerged during the 1960's, when researchers first observed that the cell could destroy its own contents by enclosing it in membranes, forming sack like vesicles that were transported to a recycling compartment, called the lysosome, for degradation. Difficulties in studying the phenomenon meant that little was known until, in a series of brilliant experiments in the early 1990's,

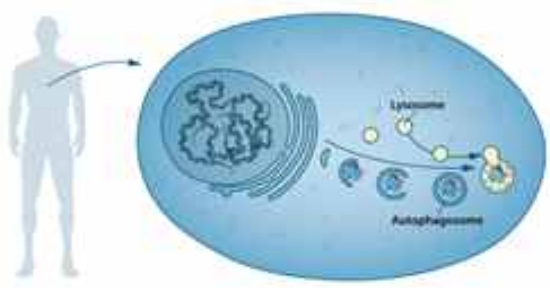


Figure 1. Lysosome is a special compartment in the cell that contains enzymes for the digestion of cellular contents while Autophagosome is a new type of vesicle that engulfs cellular contents such damaged proteins and organelles. Finally it fuses with lysosome where the contents are degraded into smaller constituents. This process provides the cell with nutrients and building blocks for renewal.

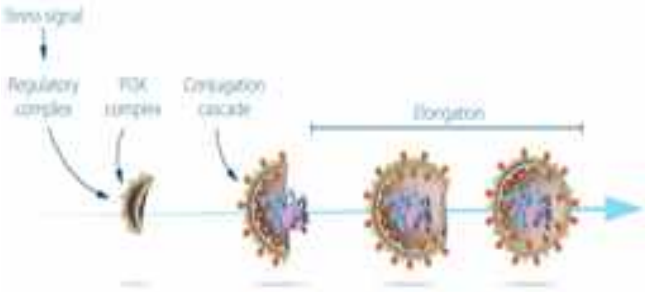


Figure 2: Ohsumi studied the function of the proteins encoded by key autophagy genes. He delineated how stress signals initiate autophagy and the mechanism by which proteins and protein complexes promote distinct stages of autophagosome formation.

Yoshinori Ohsumi used baker's yeast to identify genes essential for autophagy. He then went on to elucidate the underlying mechanisms for autophagy in yeast and showed that similar sophisticated machinery is used in our cells. Ohsumi's discoveries led to a new paradigm in our understanding of how the cell recycles its content. His discoveries opened the path to understanding the fundamental importance of autophagy in many physiological processes, such as in the adaptation to starvation or response to infection. Mutations in autophagy genes can cause disease, and the autophagic process is involved in several conditions including cancer and neurological disease. It is interesting to note that the phenomenon of autophagy essentially requires deprivation of the body of nutrition which is nothing but Muslim fasting in the month of Ramadan. (Ps Filler 3 for detail)

Nobel Prize in Physics

Strange phenomena in matter's flatlands

David J. Thouless

F. Duncan M. Haldane

J. Michael Kosterlitz

This year's Laureates opened the door on an unknown world where matter exists in strange states. The Nobel Prize in Physics 2016 is awarded with one half to David J. Thouless, University of Washington, Seattle, and the

other half to F. Duncan M. Haldane, Princeton University, and J. Michael Kosterlitz, Brown University, Providence. Their discoveries have brought about breakthroughs in the theoretical understanding of matter's mysteries and created new perspectives on the development of innovative materials. The most common phases of matter are solid, liquid and gase, however more exotic phases of matter also exist . By using advanced mathematical methods they explained strange phenomena in unusual phases of matter, such as superconductors, superfluids or thin magnetic films.

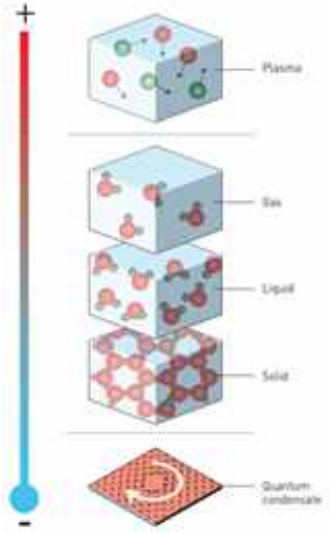


Figure 1. Common and exotic phases of matter.

Kosterlitz and Thouless have studied phenomena that arise in a flat world – on surfaces or inside extremely thin layers that can be considered two-dimensional, compared to the three dimensions (length, width and height) with which reality is usually described. Phase transition occurs when phase of matter transition between each other such as when ice melts and becomes water. Using topology, Kosterlitz and Thouless decribed a topological phase transition in a thin layer of very cold matter. In cold vortex pairs are formed which separate at the temperature of phase transition. This was one of the most important 20th century discoveries in the physics of condensed matter.

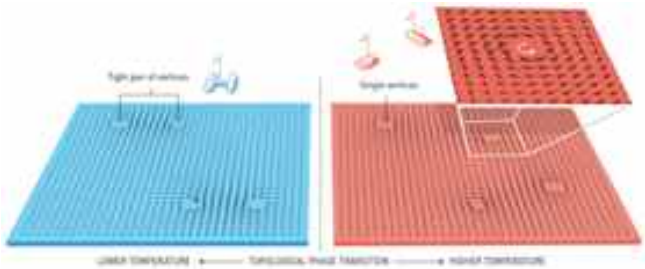


Figure 2. Phase transition.

Topology is the branch of mathematics that studies the properties that change step-wise like the number of holes in the above objects. Topology was the key to the Nobel Laureates 'discoveries that explains why electrical conductivity inside thin layers changes in integer steps. Haldane studied matter that forms threads so thin they can be considered one-dimensional.

Figure 3. Stepwise change of properties.

Topological insulators, topological superconductors and topological metals are now being talked about. These are examples of areas which, over the last decade, have defined frontline research in condensed matter physics, not least because of the hope that topological materials will be useful for new generations of electronics and superconductors, or in future quantum computers. Current research is now revealing the secrets of matter in the exotic flatlands discovered by this year's Nobel Laureates.

Nobel Prize in Chemistry

How molecules became machines

Jean-Pierre Sauvage Sir J. Fraser Stoddart Bernard L. Feringa

This year's Nobel Prize in Chemistry goes to three men who helped develop the world's tiniest machines, not out of miniature pistons or gears, but out of mere molecules

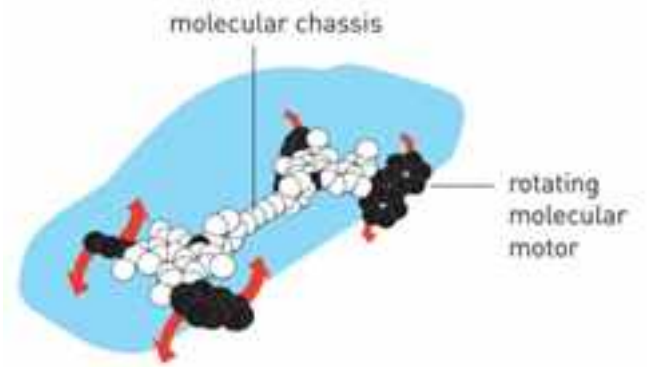


Figure 1. Ben Feringa's four-wheel driven nanocar.

The Nobel Prize in Chemistry 2016 is awarded to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa for their development of molecular machines by linking molecules together to design everything from a tiny lift to motors and minuscule muscles. Molecules typically join together through covalent

bonds, with their atoms sharing electron pairs. But Sauvage's team figured out how to link two molecules in a mechanical chain, using a copper ion. Importantly, these molecules are not just fixed rigidly together. They're still able to move about. Once you take that step, you can start thinking about tiny machines.

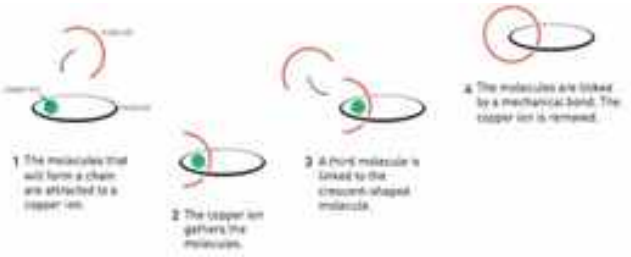


Figure 2. Jean Pierre Sauvage used a copper ion to interlock molecules using a mechanical bond.

In 1991, Stoddart's research team built a molecular ring that fit around an electron-rich "axle." When he applied heat, the ring moved back and forth on the axle, like a shuttle. This is called a rotaxane, and Stoddart later demonstrated that extremely small computer chips can be built with this structure.

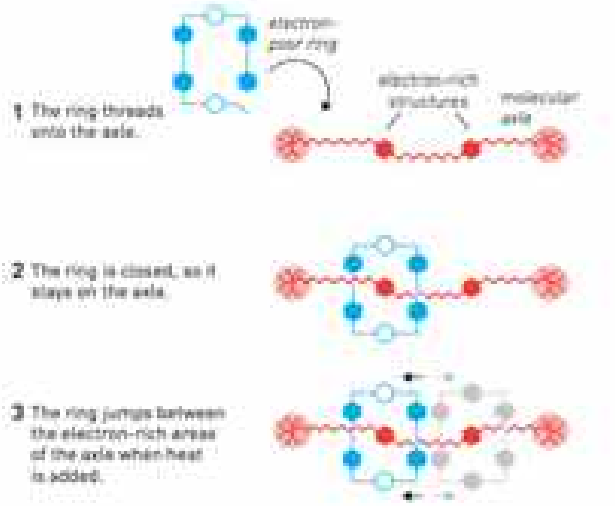


Figure 3. Fraser Stoddart created a molecular shuttle that could move along an axle in a controlled manner.

In 1999, Ben Feringa, showed how to make mechanical motors out of molecules. Normally, molecules spin back and forth erratically. But Feringa created chemical structures that, when exposed to pulses of UV light, spun continuously in one direction:

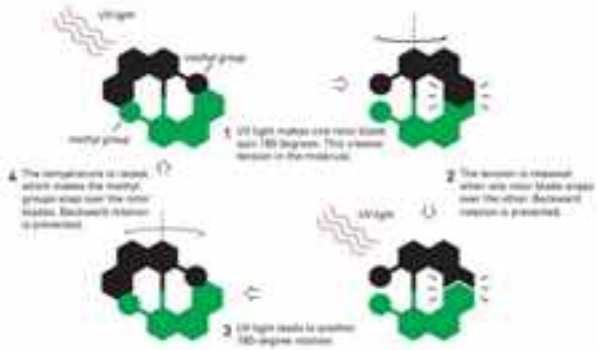


Figure 4. Ferringa created the first molecular motor constructed mechanically to spin in a particular direction at 12 million revs per second.

The principle behind Feringa's motor to develop light-activated switches can be applied to deliver drugs in the body exactly where and when they are needed, vastly increasing their effectiveness. A spinning motor allows chemist to build even more complex machines like nanometer-scale cars, which Feringa first built in 2011. Researchers today are linking these motors together into long polymers that can heal themselves when scratched, which could lead to scratch-resistant films. Other materials could wind up or shrink when exposed to light, thereby, raising the possibility of developing new types of batteries, or adjustable sensors that react to light. Powerful nanomotors might one day help clean up pollution or repair small circuits. It's still early days, but chemists are convinced that molecular machines will eventually prove invaluable by doing things no other machines can do. The Nobel committee seems to agree: "Time has clearly shown the revolutionary effect of miniaturizing computer technology, whereas we have only seen the initial stages of what could result from the miniaturization of machines."

"Be aware of your own worth, use all of your power to achieve it. Create an ocean from a dewdrop. Do not beg for light from the moon, obtain it from the spark within you".

Allama Mohammad Iqbal (1877-1938)

Experiencing Science Forum South Africa-2016

In December 2016, I had the opportunity to the "Science Forum South Africa: Igniting conversations about science" which was held in Pretoria, South Africa. Inspired by events such as the EuroScience Open Forum (ESOF) in Europe, AAAS annual meetings in the United States and Science Agora in Japan, and eager to continue to ignite conversations about science and to build on the success of the first Science Forum South Africa (held in December 2015), the South African Department of Science and Technology hosted the second Science Forum South Africa (SFSA-2016) on 8th-9th December 2016 at the CSIR (Council of Scientific and Industrial Research) International Conference Centre in Pretoria, South Africa. The Forum was intended to serve as a large, open, public platform for debating the science and society interface. The key objectives of the Forum were:

- To create a platform for a vibrant debate on the role of science, technology and innovation in society;
- To promote international science, technology and innovation partnerships; and
- To create a platform for interaction of key science, technology and innovation actors, including senior government leaders, academics, scientists, industry, civil society and students.

Format of the SFSA-2016

The Forum was designed as a "public science event" open to all interested stakeholders, which provided a platform for discussion and debate on the role of science in South African society in particular and African society as well as globally in general.

The SFSA-2016 consisted on four plenary sessions, including opening and closing sessions. There were also four (4) rounds of eight (8) parallel sessions (total number of 32 sessions), each consisting on a Chair of the session and 5-7 panellists. In between, there were around 30 presentations made by the individual presenters.

The SFSA-2016 also included exhibition and public outreach activities. Around 70 organizations / agencies exhibited stalls showcasing their scientific & technological achievements or consisting on introductory material regarding their activities.

Science and Technology in South Africa

As per information provided during the Forum, South Africa, and Africa as a whole, lags behind many other countries in science and technology. There are too few scientists, inadequate publication & innovation achievements and poorly resourced science institutions. But at the same time progress has been made on this front as more African researchers are broadening their horizons and engaging in much-needed projects in food security, energy, transport, and health (malaria and HIV). The number of papers from African researchers has doubled in just over a decade, improving in quantity, quality, and international citation according to data from Scopus.

South Africa's R&D expenditure as % of GDP is 0.73 (2012) which is showing decreasing trend since 2006 when it was 0.90% of GDP. However, the funding for social sciences and humanities has been consistently increasing in South Africa during the last few years. Between 2003-04 and 2013-14, the percentage of the country's total R&D funding allocated to the social sciences and humanities increased significantly from 12.4% in 2004-05 to 19.8% in 2013-14.

South Africa intends to increase its R&D expenditure upto 1% of GDP. In this regard, efforts are being made to increase the share of the private sector in the total national R&D expenditure. For this purpose, incentives have been announced for the private sector enterprises that invest in the creation, design and improvement of new products and processes. Industry is being encouraged to conduct investigative activities with the intention of making a discovery that can either lead to the development of new products and processes or to the improvement of existing products. Some of the incentives available to the industry are:

- Grants for small R&D projects
- Grants for large R&D projects
- R&D tax incentive

- Grants for feasibility studies
- Technology and Human Resources in Industry Programme (THRIP)
- SEDA Technology Programme
- Technology Venture Capital Fund
- R&D in the automotive industry

Focus of the SFSA-2016

The focus of the SFSA-2016, as expressed by the South African Minister for Science and Technology, Ms. Pandor, was that scientists and researchers need to contextualize their work in the socio-economic reality. She was of the view that inspiration drawn from the life and combat of the late President Mandela, and the values enshrined in South Africa's constitution, should provide the context for the work, also within the area of science, technology and innovation. In view of Cheryl de la Rey, head of the National Advisory Council on Innovation and Vice-Chancellor of the University of Pretoria, while focusing on science, technology and innovation, the importance of studying human society and social relationships should not be ignored.

There was also an overwhelming view at the Forum that in the 'age of social media', the science, including social science, has become more important than ever for every country. As social media becomes ever more pervasive, and emotional untruths on the internet trump facts, we need science to counter this. We need evidence-based policymaking, and evidence & facts must remain the yardsticks for progress.

Personal Contribution

The undersigned prepared a presentation titled "Role of Universities in Building Regional Knowledge-based Economy and Society in Developing Countries" for presenting in the Forum. However, as the decision of NAM S&T Centre to send its nominees to the Forum was bit late, presentations from the nominees of the NAM S&T Centre could not be included in the programme of the Forum.

An interview of the undersigned was recorded during the Science Forum South Africa 2016. Glimpses of the same were posted on the social website of the South African Department of Science and Technology (https://www.facebook.com/dstgovza/) with the caption "Mr. Tariq Bashir from Pakistan, exclaims how science and technology is ultimately shaping and transforming society in diverse ways".

Take-Home Messages from the Forum

- Open science forums, such as SFSA-2016, with their peculiar mix of science, topical issues and less jargon than traditional science conferences, can be an important tool for promoting and enhancing understanding of the importance of science, technology and innovation, and providing evidence for that.

- Existence of a legislated regulatory body for "science professionals", inter alia, can help in addressing concerns of science and technology professionals and streamlining their voice into STI policies, ensuring evidence-based policy formulation, and providing evidence of impact of STI activities on socio-economic development to the policy makers.

- Scientists and researchers need to contextualize their work in the local / national socio-economic realities.

- Regional cooperation in science and technology is crucial for development of science and technology as well as utilizing science and technology for social and economic benefits. In this regard the concept of "uniting for development" should be promoted.

Dr. Tariq Bashir
Principal Research Officer, PCST

Young Scientist's Voice

This column is dedicated to the innovative research contribution of a young scientist or a team of scientists that made notable contribution in science and technology. Current selection of the young scientist has been made on the basis of the ranking of Productive Scientists of Pakistan 2015 by PCST wherein Dr.Jamil is the top ranking scientist in Category A in the field of Mathematics.

Dr. Mubasher Jamil, NUST, Mathematics

Dr. Mubasher Jamil received B. Sc. degree in 2001 from University of Punjab, Lahore and M. Sc. Degree (Mathematics) in 2004 from Quaid-i-Azam University, Islamabad. He completed PhD from National University of Sciences and Technology (NUST), Islamabad, Pakistan in 2010 under the supervision of Prof. Asghar Qadir. He joined NUST-School of Natural Sciences (SNS) as Assistant Professor soon after finishing his PhD in 2010. During 2010-11, he visited twice Abdus Salam International Center for Theoretical Physics in Italy as a High Energy Junior Guest Scientist. From Feb. 2012 till Feb. 2013, he worked as a Foreign Visiting Professor at the Department of Physics, L.N. Gumilyov Eurasian National University, Astana, Kazakhstan. He has published 126 research papers in ISI listed journals, an Invited Review, one Invited Chapter and 2 books in the field of General Relativity and Cosmology, published by a German publisher. His total citations are more than 2400 and total impact factor ca 300 according to Web of Science. He has also successfully supervised 7 MS thesis (3 in Physics and 4 in Mathematics) at NUST. He has established collaborations with 68 local and foreign scientists from USA, Japan, Finland, Greece, Turkey, South Africa, Iran, India and Italy. He has presented his research work at numerous national and international conferences held in Pakistan, France, South Korea, Italy and Kazakhstan both as invited and plenary speaker. He is an active referee for many ISI listed scientific journals and has been in the organizing committees of two international conferences in physics as well.

In his young age he is a well decorated scientist. In 2011, he was awarded the prestigious Dr. Raziuddin Siddiqi Prize in Mathematics from Pakistan Academy of Sciences. In the years 2011 and 2012, he was ranked as Category-A scientist by Pakistan Council for Science and Technology (PCST), Islamabad and consequently received Research Productivity Award in 2011 and 2012. He won the Best Research Paper Award 2013 of Higher Education Commission. From NUST he won the Best Researcher Award and the Best Teacher Award in 2014 and 2016 respectively. He is also the recipient of the prestigious Abdus Salam Prize in Mathematics from Pakistan Academy of Sciences in 2016.

He was selected as the Young Affiliate Fellow of "The World Academy of Sciences" (TWAS), Italy in 2012 for a period of five years. Recently he has been nominated by TWAS to participate in the 66th Lindau Nobel Laureate Meeting. Dr. Jamil is a member of Global Young Academy (GYA) Germany, life-time member of Pakistan Physical Society and National Academy of Young Scientists (NAYS), Pakistan. In 2017, he joined the TWAS Young Affiliate Network (TYAN).

His current research interests include aspects of Black Hole Physics including super-radiance, geodesic dynamics, fluid dynamics and Theories of Modified Gravity etc.

PCST congratulates this young scientist and wishes him continued success in his academic endeavors.

Staff's voice

- **Prof. Dr.Farzana Latif Ansari**, Adviser, PCST, delivered a Plenary lecture titled *"Rationale for exploiting computational chemistry in medicinal chemistry"* during 2nd International conference on Frontiers of Chemistry, Allama Iqbal Open University, Islamabad (Nov 24-25, 2016).

- As Chief Guest, she delivered a lecture titled *"The Holy Quran and Biomimicry"* at International Islamic University, Islamabad (Nov 17, 2016).

Dr. Saima Nasir, Senior Research Officer was selected by UNESCO (ISTIC) to attend the Training Workshop on Developing Leadership Talents of Women in Science, Technology and Innovation in Kuala Lumpur, Malaysia (July 18-22 2016). This workshop was organized by International Science, Technology and Innovation Centre for South-South Cooperation under the Auspices of (ISTIC) with the support of the Islamic Development Bank (IDB) and the Ministry of Science, Technology and Innovation (MOSTI). It was designed to train participants on the elements of leadership, communication, and entrepreneurship. 25 participants from 15 countries comprising S&T professionals from middle to high level management of research centers and universities participated. The training workshop enabled participants to enhance their own leadership talents, knowledge, skills and attitudes as well as their confidence besides providing an opportunity for networking among participants.

First solar-powered airplane to travel around the world

Not since Amelia Earhart's ill-fated round-the-world trip in 1937 has an aviation attempt so captured the world's attention. Bertrand Piccard and Andre Borschberg took turns piloting the Solar Impulse–a 100% solar-powered aircraft–on a "17-stage journey that covered some 42,000km, taking in four continents, three seas and two oceans." The project was a decade in the making, resulting in an aircraft that's about the weight of a car but with the wingspan of a Boeing 747; that span houses 17,000 solar cells. The journey itself took 16.5 months and saw the piloting duo breaking 19 aviation records, including the absolute world record for longest (time duration) uninterrupted solo flight at nearly 118 hours. While this achievement is certainly significant, its inspirational cachet is arguably more so. Upon landing in Abu Dhabi to end the around-the-world flight that began with the intent to raise awareness of the capabilities of renewable energy, Piccard said, "The future is clean. The future is you. The future is now. Let's take it further."

Funding Opportunities/Announcements

Winning a research grant today is a vital requirement of researchers in order to conduct quality research and to establish state-of-art facilities at their home institution. COMSATS has recently published the following comprehensive guide of both national and international funding agencies to facilitate the researchers in winning a research grant.

(A Guide to Research Grant Programs of National and International Funding Agencies 2015-16, ORIC, COMSATS)

With the courtesy of COMSATS, PCST is including a list of these funding agencies along with their websites for facilitating its readership in winning a research grant.

No	Name of funding agency	Web address
1	Access to Scientific Instrumentation (HEC)	http://hec.gov.pk
2	Australia Pakistan Agriculture Sector Linkages Program 2010-15	http://aciar.gov.au/aslp
3	Academic Linkages and Education U. S. Embassy Islamabad	https://pk.usembassy.gov/
4	Agricultural Development Policy Research Program Strategy ACIAR	http://aciar.gov.au/programarea/Agricu ltural%20Development%20Policy
5	Andrew Sabin Family Foundation Korean-Turtle Grants	https://www.turtleconservancy.org
6	Asia Pacific Leadership Program (APLP) Fellowship	https://www.eastwestcenter.org/education/aplp
7	Breast Cancer Research Program Breakthrough Award	www.ebrap.org
8	Biosafety Research in Pakistan Grants Program (BRPGP)	http://ilsi.org/
9	Cultural Grant Assistance Program (Japan)	http://www.pk.emb-japan.go.jp/Culture/CulturalGrants/WhatisCulturalGrant_P1.html
10	COMSTECH-IFS Research Grants Program	http://www.comstech.org/comstech-ifs-joint.aspx
11	CIIT Research Grants Program (CRGP)	http://ww3.comsats.edu.pk/ORIC/CRGP.aspx
12	Dr. S. J. Zuberi Research Grant (Pakistan Medical Research Council)	http://phrc.org.pk/research-grant.html
13	DEBRA International	http://www.debra-international.org/homepage.html
14	DAAD Research Grants for Youth Faculty of Pakistani Universities	http://ic.daad.de/islamabad/en/19411/index.html
15	European Research Council Starting Grants	https://erc.europa.eu/funding/starting-grants
16	European Research Council Consolidator Grants	https://erc.europa.eu/funding/consolidator-grants
17	European Research Council Advanced Grants	https://erc.europa.eu/funding/advanced-grants
18	European Research Council Synergy Grants	https://erc.europa.eu/funding/synergy-grants
19	European Research Council Proof of Concept Grants	https://erc.europa.eu/funding/proof-concept
20	Fund for Innovative Training (GIZ)	https://www.giz.de
21	Grand Challenges Canada	http://www.grandchallenges.ca/
22	Grant for Organizing Seminars / Conferences/ Workshops (HEC)	http://hec.gov.pk/english/services/universities/GrantsforSeminarConferenceTraining/Pages/Introduction.aspx
23	Grant for Spare Parts / Maintenance/ of Equipment (HEC)	http://hec.gov.pk/english/services/universities/gspme/Pages/default.aspx
24	Grand Challenges Explorations (Bill & Melinda Gates Foundation)	https://gcgh.grandchallenges.org/challenges?f%5B0%5D=field_initiative%3A37073
25	Georg Forster Research Fellowship (HERMES)	https://www.humboldt-foundation.de/web/georg-forster-hermes-fellowship.html
26	Horticultural Research Programs Strategy	http://aciar.gov.au/programarea/Horticulture
27	HORIZON 2020	https://ec.europa.eu/programmes/horizon2020/
28	IGC-Pakistan Programme	https://www.theigc.org/country/pakistan/
29	International Climate Protection Fellowships Germany	https://www.humboldt-foundation.de/web/iks.html
30	INSPIRE Strategic Partnership Fund (British Council)	https://www.britishcouncil.pk/international-strategic-partnerships-research-education

31	Institutional Strengthening / Up-Gradation of Laboratories (HEC)	http://hec.gov.pk/english/services/universities/InstitutionalStrengtheningGrantUpgradingLaboratoriesLibraries/Pages/ISULL.aspx
32	Interim Placement of Fresh PHDs Program (HEC)	http://www.hec.gov.pk/english/scholarshipsgrants/IPFP/Pages/default.aspx
33	International Foundation for Sciences (ISF)	http://www.ifs.se/
34	International Research Support Initiative Program (HEC)	http://www.hec.gov.pk/english/scholarshipsgrants/IRSIP/Pages/default.aspx
35	ISESCO-COMSTECH Research Grants	http://www.comstech.org/COMSTECH-ISESCO.aspx
36	IASP Developed-Developing Countries Collaborative Research Grants	https://www.iasp-pain.org/Education/GrantDetail.aspx?ItemNumber=762
37	IASP Developed-Developing Countries Collaborative Cancer Pain Research Grants	https://www.iasp-pain.org/Education/Content.aspx?ItemNumber=4668
38	IASP Early Career Research Grants Program	https://www.iasp-pain.org/Education/GrantDetail.aspx?ItemNumber=712
39	Japan World Exposition 1970 Commemorative Fund Grant	https://www.osaka21.or.jp/jecfund/en/index.html
40	Knowledge Economy Partnerships Pakistan – UK Livestock Production Systems	https://www.britishcouncil.org/education/ihe/oportunities/knowledge-economy-partnerships-pakistan-uk
41	Live Stock Productions Systems	www.aciar.gov.au
42	Land and Water Resources Research Program by ACIAR	http://aciar.gov.au/programarea/Land%20and%20Water%20Resources
43	New Investigator Awards by Welcome Trust	https://wellcome.ac.uk/funding/investigator-awards-science
44	National ICT R & D Fund	https://www.ictrdf.org.pk/
45	National Research Grant for Universities (HEC)	http://www.hec.gov.pk/english/services/universities/nrpu/Pages/Introduction.aspx
46	Organization for the Prohibition of Chemical Weapons	https://www.opcw.org/
47	Pak-Norway Institutional Cooperation Framework	https://www.norad.no/en/toolspublications/publications/2013/review-of-pakistan---norway-institutional-cooperation-framework/
48	Pakistan Agriculture Research Council (PARC)	http://www.parc.gov.pk/index.php/ en/
49	Pakistan Program for Collaborative Research (HEC)	http://hec.gov.pk/english/services/faculty/Pakistan%20Program%20for%20Collaborative%20Research/Pages/Introduction.aspx
50	Pakistan Science Foundation (Research Grant)	http://www.psf.gov.pk/researchSupport.aspx
51	Pakistan Science Foundation (Travel Grant)	http://www.psf.gov.pk/travelGrant.aspx
52	Pak-US S & T Cooperation Program (HEC)	http://hec.gov.pk/english/services/universities/Pak-Us-stcp/Pages/default.aspx
53	Partial Support for PhD Studies Abroad (HEC)	http://hec.gov.pk/english/scholarshipsgrants/Pages/International%20Scholarships/Partial%20Support%20Program%20-%20PSP/IntroductionObjectives.aspx
54	Post Doctoral Research (HEC)	http://hec.gov.pk/english/Pages/Home.aspx
55	Partnerships for Enhanced Engagement in Research (PEER) Science	http://sites.nationalacademies.org/pga/peer/index.htm
56	PHRC Research Grant for Projects in High Priority Areas of Health	http://phrc.org.pk/research-grant.html
57	Pakistan Strategy Support Program (PSSP)	http://pssp.ifpri.info/
58	PHRC Routine Research Grant (Pakistan Medical Research Council)	http://phrc.org.pk/
59	Research and Advocacy Fund (RAF)	http://mariestopespk.org/research-and-advocacy-fund-raf/
60	Regional Programme ICT-Asia-France	https://pk.ambafrance.org/8th-call-for-Proposals-ICT-ASIA
61	South Asia Network of Economic Research Institutes (SANEI)	http://www.saneinetwork.net/
62	Science and Technology Research Partnership for Sustainable Development (SATREPS)	https://www.jst.go.jp/global/english/

63	Split PhD and Post Doctoral Fellowship Programme in France (HEC)	http://hec.gov.pk/english/scholarshipsgrants/SPPDFPF/Pages/default.aspx
64	Senior Investigator Awards by Welcome Trust	https://wellcome.ac.uk/funding/investigator-awards-science
65	Student Research Grant Programme WWF Pakistan	http://www.wwfpak.org/sgp/StudentReserchGrantProgramme.php
66	Textbook & Monograph Writing Scheme	http://www.hec.gov.pk/english/services/faculty/MTBW/Pages/default.aspx
67	The Leadership Development for Higher Education Reform (LEADHER)	http://www.iau-aiu.net/content/leadher-0
68	The Academy of Finland's (AF)	http://www.aka.fi/en
69	Thematic Research Grant Programme (HEC)	http://hec.gov.pk/english/services/faculty/trgp/Pages/default.aspx
70	Travel Grant to University Teachers (HEC)	http://hec.gov.pk/english/services/faculty/HEC%20Research%20Travel%20Grant/Pages/HEC-Research-Travel-Grant.aspx
71	TWAS-COMSTECH Joint Research Grants	https://twas.org/opportunity/twas-comstech-joint-research-grants
72	The International Development Research Centre (IDRC)	https://twas.org/opportunity/twas-comstech-joint-research-grants
73	UNESCO MAB Young Scientists Awards	http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/man-and-biosphere-programme/awards-and-prizes/mab-young-scientists-awards/
74	University Industry Technology Support Program (UITSP)	http://hec.gov.pk/english/services/faculty/University%20Industry%20Technological%20Support%20Program/Pages/Introduction.aspx
75	U.S. Ambassador's Fund Program	https://sgafp.org.pk/fund-amb-2/
76	USAID's Small Grants Program	https://sgafp.org.pk/small-grants/
77	World Wildlife Fund (WWF) Small Grants Programme	http://www.wwfpak.org/sgp/index.php

Forthcoming event

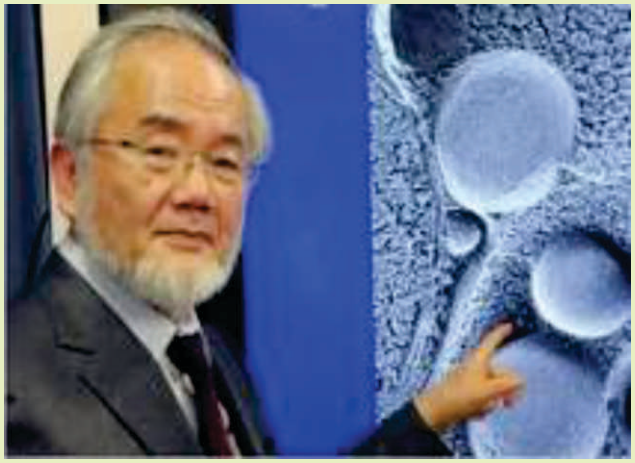
In line with the PCST' s initiative for the development of country's mineral resource industry, PCST, in collaboration with Sheikh Zayed Islamic Research Center, Karachi, Pakistan, is organizing a two-day International Conference on Mining and Fuel Industries (CMFI-2017) in Karachi during October 19-21, 2017. This conference will be followed by Post Conference field visits in Pakistan. The conference will mainly focus on the development and growth of mining, mineral and fuel (coal, oil & gas) industries in Pakistan and other countries of the region. Department of Geology, Federal Urdu University of Arts, Science and Technology, Karachi Society of Economic Geologists and Mineral Technologists (SEGMITE) Inspectorate of Mines, Department of Mines and Mineral Development, Sindh, Pakistan Department of Mining Engineering, Dumlupinar University, Kutahya, Turkey and PCST. This international event will provide a platform for academicians, geoscientists, engineers, policy makers, regulators and those engaged in mineral and petroleum industries to share their research or technologies. Engr. Farid Bakhtiar, PRO(Tech) from PCST, is the member of the organizing committee.

"Tear down the mosque, the temple, everything in sight. But don't break a human heart. For that is where God resides".

Bulleh Shah (1680-1757)

Nobel Prize winning study (Autophagy) and fasting

The 2016 Nobel Prize in Physiology or Medicine has been awarded to Prof.Dr. Yoshinori Ohsumi for his discoveries of mechanism of autophagy. Professor Ohsumi, a cell biologist, is working at Tokyo Institute of Technology's Institute of Innovative Research.



He delineated how stress signals initiate autophagy and the mechanism by which proteins and protein complexes promote distinct stages of autophagosome formation.

Autophagy literally means "to eat oneself". This is the body's mechanism of getting rid of all the broken down, old cell machinery (organelles, proteins and cell membranes) when there's no longer enough energy to sustain it. It is a regulated, orderly process to degrade and recycle cellular components.

Quite a similar, better known process is "apoptosis" also known as programmed cell death. Cells, after a certain number of divisions, are programmed to die. While this may sound kind of macabre at first, in fact, this process is essential in maintaining good health. It is analogous to getting rid of an old car that costs you a lot of money every year for is maintenance.

The same thing happens in the body. Cells become old and junky. It is better that they be programmed to die when their useful life is done.

The same process also happens at a sub-cellular level. You don't necessarily need to replace the entire car. Sometimes, you just need to replace the battery, throw out the old one and get a new one. This also happens in the cells. Instead of killing off the entire cell (apoptosis), you only want to replace some cell parts. That is the process of autophagy, where sub-cellular organelles are destroyed and new ones are rebuilt to replace it. Old cell membranes, organelles and other cellular debris can be removed.

This is done by sending it to the lysosome which is a specialized organelle containing enzymes to degrade proteins.

Autophagy was first described in 1962 when researchers noted an increase in the number of lysosomes (the part of the cell that destroys stuff) in rat liver cells after infusing glucagon. The Nobel prize-winning scientist Christian de Duve coined the term autophagy. Damaged sub cellular parts and unused proteins become marked for destruction and then sent to the lysosomes to finish the job. This is in essence a form of cellular cleansing. The body identifies old and substandard cellular equipment and marks it for destruction.

The consequences of accumulating old junky proteins all over the place can be seen in two main conditions: Alzheimer's Disease (AD) and cancer. AD involves the accumulation of abnormal protein, either amyloid beta or Tau protein which gums up the brain system. It would make sense that a process like autophagy that has the ability to clear out old protein could prevent the development of AD. It stops cancerous growths and metabolic dysfunction like obesity and diabetes besides controlling inflammation and immunity.

The key activator of autophagy is to deprive the body of nutrition which is nothing but "Fasting". When the body is deprived of nutrition, insulin goes down, while glucagon goes up. These two hormones i.e. insulin and glucagon work opposite: if insulin goes up, glucagon goes down and vice versa. As we eat insulin goes up and glucagon goes down. When we don't eat (fast) glucagon goes up. This increase in glucagon, in fact, stimulates the process of autophagy. It may, therefore, be inferred that fasting provides the greatest known boost to autophagy.

During autophagy, old junky cell components are broken down into the component amino acids. In the early stages of starvation, amino acid levels start increasing which serves three main purposes. Firstly, these amino acids are delivered to the liver for gluconeogenesis. Secondly, they are broken down into glucose through the tricarboxylic acid (TCA) cycle. The third potential fate of amino acids is their incorporation into new proteins.

The process of autophagy is turned off by eating e.g. glucose, insulin and proteins. Even a small amount of amino acid could stop autophagy. So this process of autophagy is unique to fasting, something not found in simple caloric restriction or dieting. Fasting is actually far more beneficial than just stimulating autophagy. Besides stimulating autophagy, fasting stimulates growth hormone that completely renovates the body. So the process of destruction (removal) is just as important as the process of creation.

Scientists strongly believe that fasting may actually reverse the entire aging process by getting rid of old cellular junk and replacing it with new parts. For example, Alzheimer's Disease that involves the accumulation of abnormal proteins, either amyloid beta or Tau protein which gums up the brain system. It would make sense that a process like autophagy that has the ability to clear out old protein could prevent the development of AD.

There is a balance here, of course. You get sick from too much autophagy as well as too little which gets us back to the natural cycle of life - feast and fast. Not constant dieting. This allows for cell growth during eating, and cellular cleansing in a fasting-balance. Life is all about balance.

How blessed we, Muslims are to observe one-month intensive fasting program that revitalize the body as well as the soul of the entire Muslim Ummah each year.

Michael Mosley, a British television journalist, producer and presenter at BBC has been credited for popularizing the "5:2 diet" plan, in a documentary "Eat, Fast & Live Longer" on BBC. He is a strong advocate of "intermittent fasting" i.e. fasting and eating alternately. This plan is no different from the practice of two days fasting a week by our Prophet Mohammad (PBUH) as evidenced by the following two ahadith.

- It was narrated that 'Aa'ishah (may Allah be pleased with her) said: "The Prophet (PBUH)) was keen to fast on Mondays and Thursdays" (Al-Tirmidhi, 745).

- It was narrated from Abu Hurayrah (may Allah be pleased with him) that the Prophet (PBUH) said: "Deeds are shown (to Allaah) on Mondays and Thursdays, and I like my deeds to be shown when I am fasting." (Al-Tirmidhi, 747).

"And what is it to work with love? It is to weave the cloth with threads drawn from your heart, even as if your beloved were to wear that cloth".

Khalil Gibran (1883-1931)

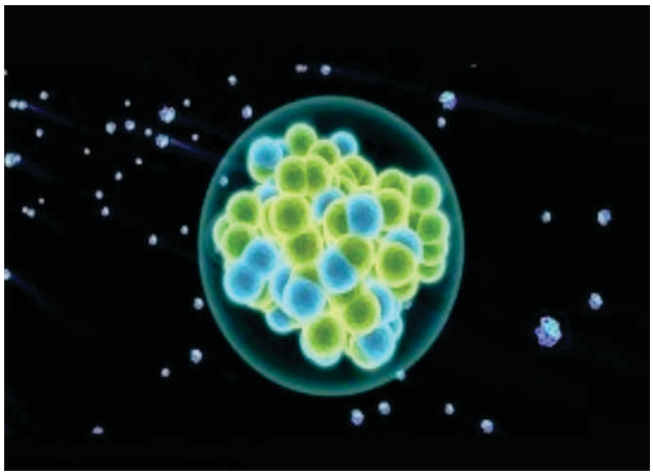
Names of Four new elements included in Periodic Table

Welcome Nihonium, Moscovium, Tennessine and Oganesson

The periodic table has already four new names added to its lower right-hand corner.

Element 113 is set to be named nihonium (Nh); element 115, moscovium (Mc); element 117, tennessine (Ts); and element 118, oganesson (Og), according to the proposals by chemistry's governing body, the International Union of Pure and Applied Chemistry (IUPAC). "Although these choices may perhaps be viewed by some as slightly self-indulgent, the names are completely in accordance with IUPAC rules," said Jan Reedijk, president of IUPAC's inorganic-chemistry division, in a media statement.

Element 113, Nihonium (Nh), is the first artificial element to be discovered in East Asia. "Nihon" is one of two ways to say "Japan" in Japanese, and means "Land of Rising Sun." The element was discovered by a team at RIKEN Nishina Center for Accelerator-Based Science.



Element 115, Moscovium (Mc) , named after the Moscow region honours the ancient Russian land that is the home of the Joint Institute for Nuclear Research. Element 117, Tennessine (Ts) is in recognition of the contribution of the Tennessee region, including Oak Ridge National Laboratory, Vanderbilt University, and the University of Tennessee at Knoxville, to superheavy element research.

Perhaps the most striking choice is for element 118, Oganesson (Og) which is named after an 83-year-old researcher Professor Yuri Oganessian ((born 1933) at Russia's Joint Institute for Nuclear Research (JINR) in Dubna who helped to discover many super heavy elements and now an element is named after him.

All four elements are not found in nature, and were synthetically created in laboratories. Until now, these elements had temporary names and symbols on the periodic table as their existence was hard to prove. Because they decay extremely quickly, scientists found it difficult to reproduce them.

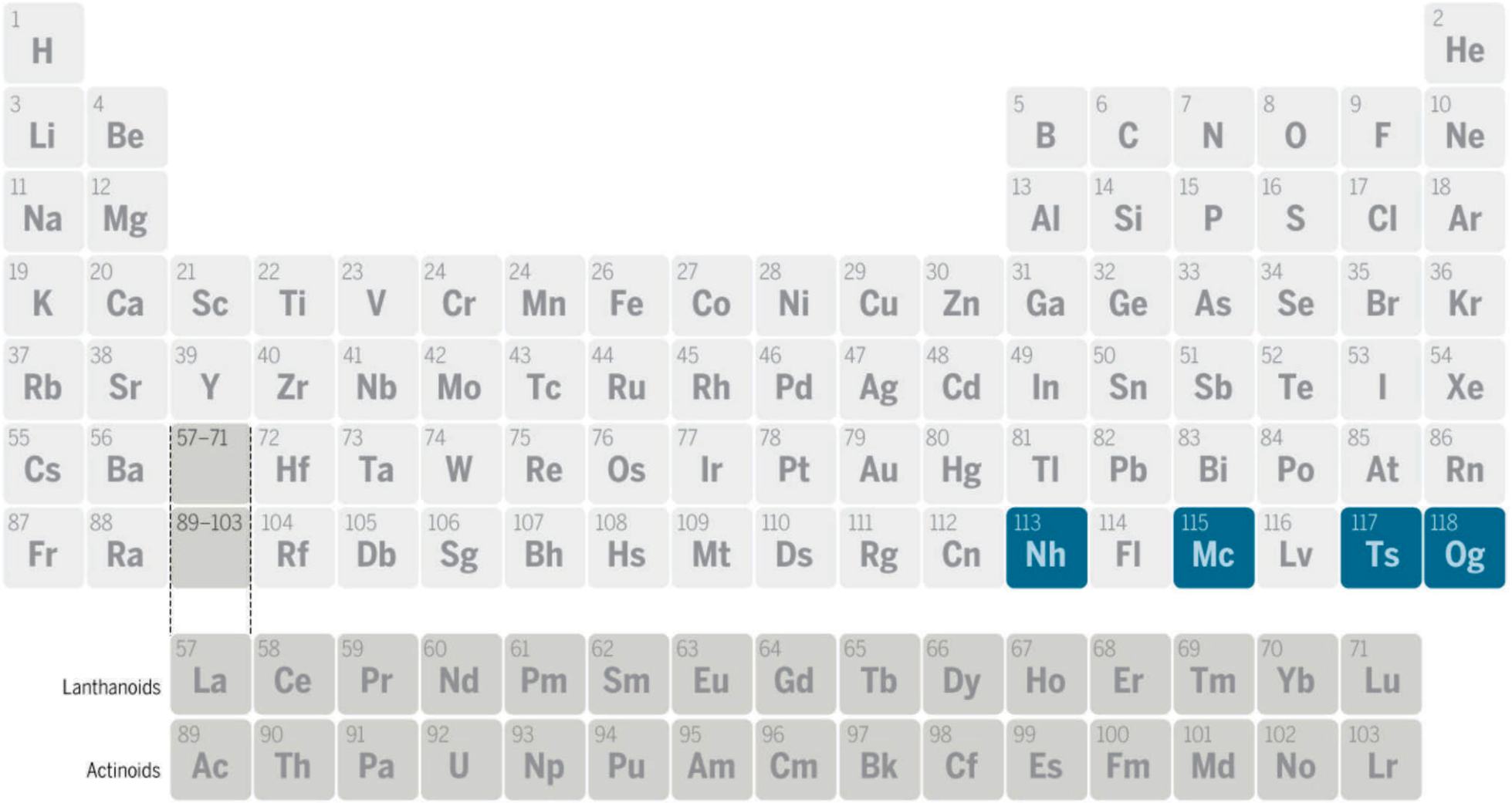
"It is a long process from initial discovery to the final naming, and IUPAC is thankful for the cooperation of everyone involved. For now, we can all cherish our periodic table completed down to the seventh row."

Prof. Jan Reedijk, President of the Inorganic Chemistry Division

"Say not I have found **The Truth**, but rather I have found **A Truth**".

Khalil Gibran (1883-1931)

Periodic Table with Four New Elements

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