



# STI Voice

*Newsletter - 2017*



**Science**



**Technology**

**STI**

**Innovation**



**Pakistan Council for Science & Technology**

Shahrah-e-Jamhuriat, G-5/2, Islamabad. [www.pcst.org.pk](http://www.pcst.org.pk)

# STI Voice

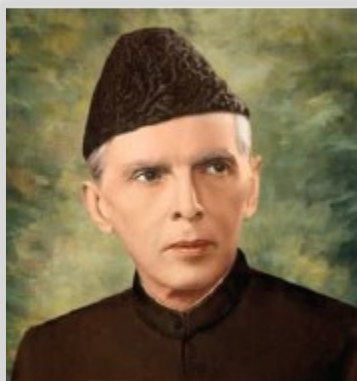
## Newsletter - 2017

### Editor-in-Chief

Prof. Anwar-ul-Hassan Gilani (SI)  
Chairman

### Editor

Prof. Dr. Farzana Latif Ansari (TI)



### Quaid's Voice

*"The great majority of us are Muslims. We follow the teachings of the Prophet Mohammed (PBUH). We are members of the brotherhood of Islam in which all are equal in rights, dignity and self-respect. Consequently, we have a special and a very deep sense of unity. But make no mistake: Pakistan is not a theocracy or anything like it".*

*Muhammad Ali Jinnah*

### Chairman's Voice



STI Voice 2017 is in your hands. Being the last volume during my 3 year tenure, it also lists some milestones of the Council achieved during this period in addition to touching routine columns such as Quran and Science, Muslim Scholars of the past, Nobel Laureate, young scientist etc.

The year 2017 has been very productive for PCST, in achieving some historical milestones, which includes Promulgation of Act of the Council (PCST is now autonomous body), finalizing of NCST Agenda, automation of recording scientific data of over 4000 productive scientists and securing funding for two development projects.

Following a meeting of the 6<sup>th</sup> ECNCST held on March 09, 2016 after a gap period of 14 years, it took us an year to finalize National Strategy and Action Plan with clear roadmap, as the main agenda item of the forthcoming 4<sup>th</sup>

NCST meeting to be chaired by PM; it is satisfying for the Council (secretariat of NCST) that the complete agenda prepared in consultation with all stakeholders has already been submitted to the PM Office after a gap period of 16 years. The efforts of PCST team are appreciated in this regard, who worked day and night to make this happen.

Science & technology and research & development can play an important role to realize almost all the goals and targets of the Vision 2025 of the Government, while some of the goals require direct interventions of science and technology. A National Research Agenda (NRA) has been developed by PCST 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 Vision 2025. The NRA was prepared based on the foresight studies conducted at PCST over the period of time, four of which namely, Automobile, Housing, Robotics and Mineral

resources were recently added in the list.

Health is of primary concern of everyone. In view of its importance and my expertise in Functional foods and Health, a series of five national level workshops on “Organic Food and Health – Avenues of Innovation and Entrepreneurship” was organized by PCST in all provinces and in Islamabad, which was highly appreciated by public and academia.

At the end, I would like to express my sincere appreciation to Prof. Farzana Latif Ansari, Editor, STI Voice for her creativity and dedicated efforts along with the efforts of other team members in making this newsletter an effective platform of communication for the community of science and technology as well as for public.

**Prof.Dr. Anwar-ul-Hassan Gilani (SI)  
Chairman**

**"The Hour (Last Day) will not be established until (religious) knowledge will be taken away (by the death of religious learned men), earthquakes will be very frequent, time will pass quickly, afflictions will appear, murders will increase and money will overflow amongst you."**

Narrated Abu Huraira, Sahi AlBukhari 1:85

## Editor's Voice



The STI Voice 2017 is with you.

As per previous practice, the contents include the activities of PCST, the Chairman and that of the staff are highlighted in different columns. Major breakthrough activity includes promulgation of the act of PCST which is now an autonomous body besides, NCST Agenda was finalized.

Apart from the institutional reports, the columns like Quran and science voice, past eminent Muslim scientist's voice, brief account of the achievements of Nobel laureates, Young scientists' of the year and Women's voice are important components of the newsletter.

A huge 'thank you' to all the persons who contributed writing the wonderful and inspiring articles, without which there wouldn't have been this newsletter issue.

Last but not least, I would like to thank the Chairman, PCST who initiated the idea of this newsletter and enabled the publication of this document throughout his stay at PCST for 3 years. I wish him every success in his future endeavors for the academia specifically and scientific community in general.

Prof. Dr. Farzana Latif Ansari (TI)  
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## Quran's Voice

In the previous issues of STI voice, we have discussed the technological advancements inspired by the design of few insects e.g. fly, mosquito, honey bee and an ant. These bio-inspired designs include the designing of super camera and drone by mimicking the eye of a fly, heralding painless micro-needles inspired by the anatomy of the snout of a mosquito and natural, organic and futuristic buildings by mimicking the hexagon of the honey bee are just a few examples of thousands of nature inspired solutions to the challenges that we face daily. Let us see what technological inspiration lies in spider –an insect of the size of a few millimeters, the significance of which is evident from the fact that a whole surah has been named after it in the Holy Quran. In the Holy Quran three surahs have been named after the names of three insects, namely AlNahl, The Bees, surah 16, AlNaml, The Ants and surah 27 AlAnkabut (Spider) surah 29.



مَثَلُ الَّذِينَ اتَّخَذُوا مِنْ دُونِ اللَّهِ أَوْلِيَاءَ كَمَثَلِ  
 الْعَنْكَبُوتِ اتَّخَذَتْ بَيْتًا وَإِنَّ أَوْهَنَ الْبُيُوتِ لَبَيْتُ  
 الْعَنْكَبُوتِ لَوْ كَانُوا يَعْلَمُونَ ﴿٤١﴾

*The example of those (disbelievers) who have taken others (i.e., idols) as guardians instead of Allah is like the story of a spider who builds (for herself) a house (of cobweb). And no doubt the weakest of all houses is the spider's house. Would that they knew it!*

*Al Ankaboot 29:41*

Regarding the first two surahs i.e. Al Nahl (The Bees) and Al Naml (The Ants), the names are plural since these insects live in groups while naming the surah 29 with the singular form Al Ankaboot "The Spider" indicates the solitary life of this animal, except at times of mating and egg hatching.

In Surah Al Ankaboot 29, verse 41, Allah, the Almighty gives an example of the idolaters who revere gods besides Allah. The idolaters hope that those gods will assist them, provide for them, and they turn to them in

times of hardship. In this regard, they are like the spider's house, in its weakness and frailty, because by clinging to these gods they are like a person who holds on to a spider's web and does not gain any benefit from that. Had they known this, they would not have taken protectors other than Allah. This is unlike the Muslim believer, whose heart is devoted to Allah and, in addition, does well in following Allah's decrees. The Muslim has grasped the most trustworthy handle, the one that never breaks because of its strength and stability.

The spider is an animal of phylum Arthropoda and scientists today know more than thirty thousand types of spiders which vary in sizes, shapes and colors.

It is important to note that in verse 41, the two words "ankebut" العنكبوت and "ittekhazet" اتخذت both are feminine words since the suffixes for female and male verbs are different in Arabic. Spider is an animal which weaves in the air a flimsy thin web which is the flimsiest house, whether physically or spiritually. This has been proven by the late studies in zoology. In this noble Quranic verse, there is a clear indication that the building the spider's house is a mission shouldered by the female spiders since it is the female which has in its body the glands for secretion of the silk material from which the spider's house is woven.

In the Almighty's saying: "(the flimsiest of houses is the spider's house)". Despite the miraculous building of the spider's web, it is weak physically as well as spiritually. Physically, it is the weakest house of all, because it is made of a number of very delicate interwoven silk threads leaving large separating spaces at most times. Therefore, they do not protect it from sun heat, cold, rain, storming winds, or the dangers of attackers.



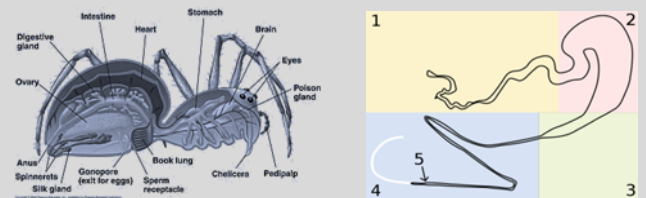
Regarding spiritually weakness, it is the flimsiest of all houses, because it is deprived of all love and kindness, which are the pillars of any happy home. The female, being more violent kills the male and eats its body shortly after mating. When the eggs hatch, the

spiderlings come out to find themselves in a very crowded place inside the eggs bag. The siblings then start to fight for food and space and start killing one another. This makes the spider's house the most violent and ruthless house, lacking all forms of kinship. Hence, Allah the Almighty sets it as a parable in its weakness and frailty because it lacks the simplest form of kindness between the members of a family.

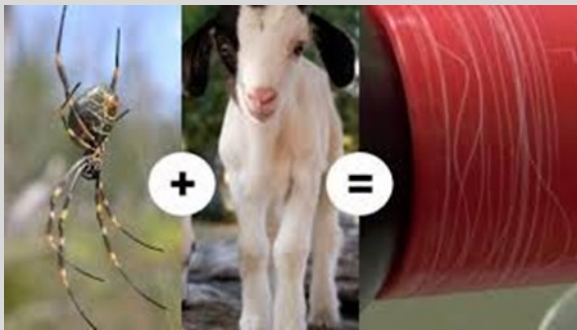
Furthermore, the weakness is in the spider's house and not the threads; for the Almighty says "(the flimsiest of houses)". This is a clear indication that the weakness and frailty are within the spider's house and not the spider's threads. The threads of the spider's house are made of very delicate silk. Despite its delicacy, it is the strongest biological substance known to mankind so far. The silk threads which make up the spider's web are considered stronger than steel, and their strength is surpassed only by the melted quartz. The thin thread stretches to five times its length before it is cut. Therefore, the scientists call it "biological steel" or "bio-steel". It is more than five times stronger than the metal steel of the same thickness.

The house of the spider is not merely its dwelling place. Being the sticky net, it constitutes a trap for flying insects which are a prey on which the spider feeds. Similarly, those idolaters who revere gods besides Allah, and call people to those revered gods, are in fact calling them to an artful trap which leads them to their death and destruction in this life and the hereafter. These facts were unknown to any human at the time of revelation and were realized in the last decades of the 20<sup>th</sup> century only.

The wonder web of the spider is made of a type of silk protein that is secreted inside the silk glands of this design master. Spider silk is a protein formed inside living cells by a process that happens at body temperature, unlike the manufacturing of steel, which happens in a furnace. Spider silk has long been admired by material scientists for its unique combination of high-performance properties including toughness, strength, lightness and biodegradability. "Mimicking its properties has been the holy grail of material science for a long time.



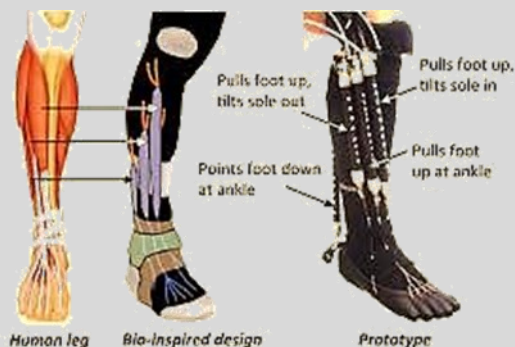
Nexia Biotechnologies Inc. has finally made the world's first spider silk fibers from man-made materials with properties similar to natural spider silk. The company has developed a recombinant spider silk, trade named BioSteel®. The company has developed a herd of transgenic goats that have the ability to produce spider web proteins in their milk. For this purpose, a gene from the common golden orb spider is added to the DNA of the goats. This gene only affects the mammary glands and milk production in the female goats. The milk looks and tastes normal, but when salt is added, the proteins curdle and fall to the bottom of the tank. These proteins are removed and water is added. The result is a golden syrup that is identical to the web fluid in a spider's body.



This bio-inspired material known as biosteel has got many applications in the medical, military and fiber markets.

Spider silk is being used as scaffold for regenerating damaged ligaments, artificial tendons and exceptionally fine sutures for stitching up surgeries or wounds to nerves or eyes, to help them heal without scarring.

Many commercial glues are made of petroleum that makes them less eco-friendly. Scientists today, being inspired by the stickiness of the spider's web, are thinking of 'green' glue substitutes that may be regarded as the most powerful biological adhesive.



The scientists have identified two proteins, responsible for stickiness of a spider's web, may be cloned into bacterial or insect cell lines. These cells may then be used as biological factories to produce large quantities of the proteins for application in the natural glue.



Another application of the spider silk is its use in the army's body armor and the bulletproof vest of the future that will not be made from super-strong plastics but from spider silk which is stronger than Kevlar.

Mentioned above are just a few examples of the technological ideas extracted from the life of a spider. Allah has been repeatedly asking human beings in the Holy Quran to look around and ponder over His creations.

وَسَخَّرَ لَكُم مَّا فِي السَّمَوَاتِ وَمَا فِي الْأَرْضِ جَمِيعًا مِّنْهُ إِنَّ فِي ذَلِكَ لَآيَاتٍ لِّقَوْمٍ يَتَفَكَّرُونَ ﴿١٣﴾

أَفَلَا تَتَفَكَّرُونَ

“Will you not take thought?”

Al Anam 6:50

## Activities of Chairman PCST



International conference on “**Current Research in Chemicals and Pharmaceutical Science**, Jan 18-21, 2017 FC College University, Lahore. Participated as Guest of Honor and Keynote Speaker title: *Efficacy and Safety of Natural Products is Influenced by the Presence of Synergistic and/or Side-effects Neutralizing Combination*.



International Workshop on “**Science Communication: Enhancing Public Understanding**” organized by COMSTECH and Technology Times at COMSTECH Secretariat Building, Jan 10, 2017, Islamabad, Chaired a Session.

**United Nations Commission on Science and Technology for Development Inter-sessional Panel 2016-2017**, 23-25 January 2017 Geneva, Switzerland, participated as the country representative and delivered a lecture titled: *The Role of Science, Technology and Innovation in Ensuring Food Security - Interventions in Pakistan*.



**Investor Connect for Cleantech Innovators in Pakistan**” organized by the UNIDO and Ministry of Climate Change, Jan 12, 2017 Marriott Hotel, Islamabad, Participated as the Guest of Honor.



**6<sup>th</sup> International Fisheries Symposium and Expo 2017**, University of Veterinary and Animal Sciences, Lahore, Feb 8-9, 2017 Guest of Honor and Keynote Speaker: *Functional Foods for Health and Wellness – Avenues of Entrepreneurship*.



International Symposium & Workshop on “**Bio-Waste Derived Carbons for Waste-to-Energy Conversion and Water Purification**” as Guest of Honor and Keynote Speaker and delivered lecture titled “**Nurturing a Scientific Culture in the Era of Knowledge Based Economy**”. Also acted as the **Chief Guest at the Research Productivity Award Ceremony**, held at University of Sindh

**Workshop on Health and Sustainable Development Goals** jointly by WHO, Aga Khan University and Ministry of Health and delivered a keynote lecture titled: “**The Role of Research and Capacity Development in Pakistan to address SDG’s: What can be done**” held on **March 6-7, 2017** at Pakistan Academy of Sciences, Islamabad



International Conference on “**Food & Nutritional Security: Impact of Climate change (FNCS-2017) & “Food and Nutrition Expo”** March 7-8, 2017, at Government College University, Faisalabad; Guest of Honor and keynote Speaker at closing session titled “**Functional Food for Health and Wellness: Avenues of Entrepreneurship**”.



**1<sup>st</sup> National Graduate Conference**” March 15-16, 2017, Organized by Allama Iqbal Open University, Islamabad; Participated as **Guest of Honor** and delivered a motivational lecture to students in the Inaugural Session.



International Islamic University, Islamabad, April 06, 2017, Research Productivity Award Ceremony, participated as the Chief Guest and Key Note Speaker titled: **How Ramadan Fasting Can Improve Health and Cure Chronic Diseases**



**University of Central Punjab, Award Ceremony of Life Sciences Achievements, April 17**; participated as the Chief Guest and Key Note Speaker title: *Prophetic Medicine – Way forward to Healthy Society*





**“One Health Fellowship Program”** March 30, 2017, jointly organized by National Academy of Sciences US and Pakistan Academy of Sciences, Islamabad. Participated as a plenary speaker and delivered a lecture titled: **“ONE HEALTH-ENSURING HEALTHY SOCIETY”**



**One day meeting of the Smoke- Free Certification Board, Global Wellness Council,** June 9, 2017, Kuala Lumpur.



**2<sup>nd</sup> National Summit on Invention to Innovation,** April 25-26, 2017, University of Balochistan, Quetta. Participated as Guest of Honor and Keynote speaker title: *Emerging Health Challenges and Treating with Prophetic Medicine*



**Institute of Rural Development, Islamabad,** July 26, 2017 delivered lecture titled: *Harnessing Potential of Triple Helix Linkages for Rural Development.*



**Public lecture at the Higher Education Commission of Pakistan, June 6, 2017** titled *“ How Ramadan Fasting can improve health and treat chronic diseases”*



**Workshop on Research Evaluation and Recognition in Pakistan-** Jointly organized with International Center for Chemical and Biological Sciences, University of Karachi, July 28. Plenary lecture title: Role of Pakistan Council for Science & Technology in promoting Research Output in Pakistan.



International Conference on Science, technology and Medicine, jointly organized with Asian Council for Science Editors, Dubai, August 13-15, 2017, Keynote Speaker: Emerging Health Challenges and Treating with Functional Foods and Lifestyle/Dietary modification.



**Public Lecture at the Aga Khan University, Karachi, July 28, 2017, Title: Health Challenges of Modern Life and Treatment with functional foods and lifestyle/dietary modifica-**



9<sup>th</sup> Chemistry Conference, PINSTECH, Islamabad, Sept 19-21, Chief Guest in Inaugural session – Role of PCST in promoting and recognizing scientific output.

**1<sup>st</sup> meeting of the Board of Governors of the National University of Medical Sciences,** (chaired by the Chief of Army Staff). August 03, 2017 attended as the regular member of the BOG.



International Conference on Role of neuroscience in Health – Bridging the gap with Neurosciences, October 28, Aga Khan University,



Popular Science Lecture series at Pakistan Science Foundation, Sept 27, Islamabad  
Key Note Speaker: Health Challenges and Treating with Functional Foods and Lifestyle/ Dietary modification



**4<sup>th</sup> International Conference on Molecular Medicine and Drug Research**, Nov 7-10, International Center for Chemical and Biological Sciences, Karachi. Chief Guest at Closing Ceremony and Keynote Speaker – Role of Pakistan Council for Science & Technology in promoting and Recognizing Scientific output.



International Symposium on Health and Nutrition, Department of Biochemistry, University of Agriculture, Faisalabad, Oct 30, Chief Guest and Keynote Speaker - Health Challenges and Treating with Functional Foods and Lifestyle/Dietary modification



4th National Workshop on “Organic Food and Health Avenues of Innovation and Entrepreneurship”, December 21, 2017, University of Karachi, Patron in Chief and Keynote Speaker: Food Security and Wellness through Sustainable Agriculture.



3<sup>rd</sup> Invention to Innovation Summit, KP-2017, University of Engineering & Technology, Peshawar Nov 29, participated as Guest of Honor and addressed on “Role of PCST in promoting Innovation”.



3<sup>rd</sup> National Workshop on “Organic Food and Health - Avenues of Innovation and Entrepreneurship, Nov 30, UET, Peshawar Patron in Chief and Keynote Speaker: 1) Functional Foods and Health - Avenues of Entrepreneurship 2) Food Safety, Security and Sustainable Agriculture.

13<sup>th</sup> International Conference on Emerging Technologies, Dec 27-28, Islamabad, jointly by Capital University of Science & Technology and IEEE; Guest of Honor and Keynote Speaker: Nurturing a Scientific Culture in the Era of Knowledge Based Economy

**1<sup>st</sup> National Conference on Bioactivity of Phytochemicals, University of Lahore, Oct 6-7** Chief Guest and Keynote Speaker – Role of Natural products in the development of Pharmaceutical medicine.

## Past Eminent Muslim Scholar's Voice

**Abu Arrayhan Muhammad ibn Ahmad Al-Biruni**  
(973-1048 AD)



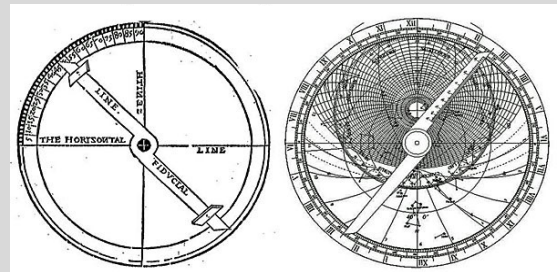
Abu Rayhan Al-Biruni was born on Sep 15, 973 in Khwarazm, a region adjoining the Aral Sea now known as Karakalpakstan (Uzbekistan). The two major cities in this region were Kath and Jurjaniyya. Al-Biruni was born near Kath and the town where he was born is today called Biruni after the great scholar. He began studies at a very early age under the famous astronomer and mathematician Abu Nasr Mansur who was a prince of the Banu Iraq's family, the rulers of the Khwarazm region. Al-Biruni's relatives also took interest in the studies of science as well, so he grew up in an environment encouraging his interests. He had ties to royalty as there are links in his family to the families of prestigious elites.

To conduct research, Al-Biruni used different methods to tackle the various fields he studied. Many consider Al-Biruni one of the greatest scientists in history, and especially of Islam because of his discoveries and methodology. He lived during the Islamic Golden Age, which promoted astronomy and encouraged all scholars to work on their research. Al-Biruni spent the first twenty-five years of his life in Khwarezm where he studied Islamic jurisprudence, theology, grammar, mathematics, astronomy, medics, philosophy, physics and most other sciences as well. He left his homeland for Bukhara, where he corresponded with Avicenna and there are extant exchanges of views between these two scholars. By the age of seventeen, Al-Biruni got engaged in serious scientific work.

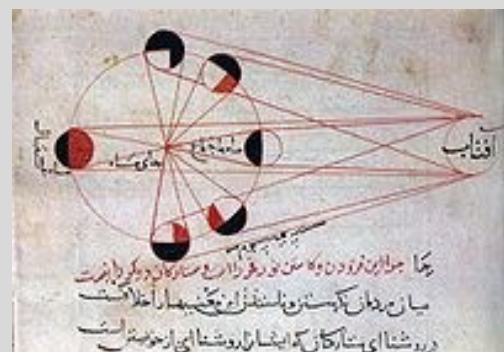
We know certain dates in Al-Biruni's life with certainty for he describes astronomical events in his works which allow accurate dates and places to be determined. He described an eclipse of the moon on May 24, 997 which he observed at Kath. The eclipse was an event that was

also visible in Baghdad and Al-Biruni had arranged with Abu'l-Wafa to observe it there. Comparing their timings enabled them to calculate the difference in longitude between the two cities. Biruni's eclipse data was used later in 1749 by Richard Dunthorne, an English astronomer and surveyor of Cambridge, to help determine the acceleration of the moon. His observational data entered the larger astronomical historical record and is still used today in geophysics and astronomy.

He sought to find a method to measure the height of the sun, and created an early version of an astrolabe that was an inclinometer, historically used by astronomers and navigators to measure the inclined position of a celestial body in the sky.



**A simple and a complex astrolabe**



**An illustration from Al-Biruni's astronomical works explaining different phases of the moon.**

Ninety-five of his 146 books are known to have been devoted to only to astronomy, mathematics, and related subjects like mathematical geography.

Important contributions to geodesy and geography were also made by Al-Biruni. He introduced techniques to measure the earth and distances on it using triangulation. He found the radius of the earth to be 6339.6 km, a value not obtained in the West until the

16<sup>th</sup> century. His *Masudic canon* contains a table giving the coordinates of six hundred places, almost all of which he had direct knowledge.

Al-Biruni also wrote a treatise on time-keeping and several treatises on the astrolabe and describes a mechanical calendar. He made interesting observations on the velocity of light, stating that its velocity is immense compared to that of sound. He also described the Milky Way as a collection of countless fragments of the nature of nebulous stars.

Topics in physics that were studied by Al-Biruni included hydrostatics and made very accurate measurements of specific weights. He described the ratios between the densities of gold, mercury, lead, silver, bronze, copper, brass, iron, and tin.

The total number of works produced by Al-Biruni during his lifetime is quite impressive as he wrote around 146 works with a total of about 13,000 folios (a folio contains about the same amount as a printed page from a modern book) and the range of his work cover essentially the whole of science at his time. He was an impartial writer on customs and creeds of various nations, and was given the title *Al-Ustadh* ("The Master") for his remarkable description of early 11th-century India. He also made contributions to Earth sciences, and is regarded as the "father of geodesy" for his important contributions to that field, along with his significant contributions to geography.

One of the most important of Al-Biruni's many texts is *Shadows* written around 1021. This work includes the Arabic nomenclature of shade and shadows, strange phenomena involving shadows, applications of the shadow functions to the astrolabe and to other instruments, shadow observations for the solution of various astronomical problems, and the shadow-determined times of Muslim prayers. The *Shadows* is an extremely important source of knowledge of the history of mathematics, astronomy, and physics. It also contains important ideas such as the idea that acceleration is connected with non-uniform motion, using three rectangular coordinates to define a point in 3-space, and ideas that anticipate the introduction of polar coordinates.

In 1017 he traveled to South Asia and authored a study of Indian culture after exploring the Hinduism practiced in India. The *India* is a massive work covering many different aspects of the country. Al-Biruni describes the

religion and philosophy of India, its caste system and marriage customs. He then studies the Indian systems of writing and numbers before going on to examine the geography of the country. The book also examines Indian astronomy, astrology and the calendar. He was given the title "Founder of Indology".

Following are the titles of few of his most remarkable writings.

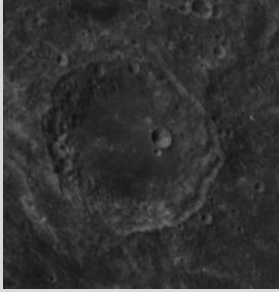
- ◆ The Book of Instruction in the Elements of the Art of Astrology.
- ◆ The Remaining Signs of Past Centuries –a comparative study of calendars of cultures and civilizations, with mathematical, astronomical, and historical information (Arabic).
- ◆ Melkite Calendar, or Les Fetes des Melchites - extract from The Remaining Signs of Past Centuries (Arabic text with French translation).
- ◆ The Mas'udi Canon –an extensive encyclopedia on astronomy, geography and engineering (Persian).
- ◆ Understanding Astrology—a question and answer style book about mathematics and astronomy (Arabic and Persian).

The personality of this great scholar is clearly reflected from his writings despite the fact that one fifth of his works have survived. Although he was not a great innovator of original theories, mathematical or otherwise, he was a careful observer who was a leading exponent of the experimental method. He was a great linguist who was able to read first hand an amazing number of the treatises that existed and he clearly saw the development of science as part of a historical process and his writings are therefore of great interest to historians of science. He died on December 13, 1048 in Ghazni, Afghanistan.

Al-Biruni's work was not built on, nor referenced after his death. It was only hundreds of years later in the West that his books became read and referenced again, especially his book on India which became relevant to the British Empire's activity in India from the 17<sup>th</sup> century. On the occasion of Millenary of Abu Raihan Muhammad ibn Ahmad Al-Biruni, an International Conference was held in Karachi, Pakistan, during Nov 26, 1973- Dec 12, 1973 and the proceedings of the conference were published as Al-Biruni Commemorative Volume with Hakim Mohammed Said (late) as the Editor.

A film about his life, *Abu Raykhan Beruni*, was released in the Soviet Union in 1974. In very recent times, the

lunar crater *Al-Biruni* and the asteroid 9936 *Al-Biruni* were named in his honor.



**Lunar crater Al-Biruni, on the far side of the Moon, as seen by Apollo 14**

In June 2009, Iran donated a scholar pavilion to the United Nations Office, placed in the central

Memorial Plaza of the Vienna International Center that features the statues of four renowned Iranian scientists, Avicenna, Abu Rayhan Biruni, Zakariya Razi and Omar Khayyam.



## Activities of PCST

### 1. Pakistan Council for Science and Technology Act passed by the Parliament



Pakistan Council for Science and Technology (PCST) is amongst one of the oldest institutions of Ministry of Science and Technology and was initially established as the National Science Council (NSC) in 1962 through Resolution under the Ministry of Education and Scientific Research, well before the establishment of the Ministry of Science & Technology, to propose national science policy for the approval of the government, to coordinate the work of various research councils, and to advise on all matters relating to the promotion of scientific efforts in the country. NCS was renamed as PCST in 1984. The charter of PCST was revised initially in 1973 and then in 1982, 1984 & 1987, with a view to making it more independent and effective in advising the government, based on studies and surveys, on matters and issues relating to science & technology (S & T). After 56 years of existence, the Act of PCST, for its establishment as an autonomous body, was passed by both the houses of the Parliament in 2017 giving Council the required legal

framework. The major functions of the council as described in the PCST Act (XIV of 2017) are to advise the Government on national policies on science, technology and innovation for building up a strong and self-reliant science and technology system and its effective working directed towards achievement of national goals and in particular the welfare of the people, economic growth and security of Pakistan. The copy of PCST Act (XIV of 2017) is available at [http://www.na.gov.pk/uploads/documents/1496293210\\_337.pdf](http://www.na.gov.pk/uploads/documents/1496293210_337.pdf).

### 2. Agenda and working paper for the 4<sup>th</sup> Meeting of National Commission for Science & Technology

The National Commission for Science & Technology (NCST) was established on 31<sup>st</sup> March 1984 with the main objective to provide leadership and guidance in the development of a strong and well-integrated system of Science & Technology (S&T) directed towards welfare of the people through socio-economic development, and enhancing security of the country. Ensuring proper linkages of S&T effort with the production sector and development plans, is one of the key functions of NCST. Prime Minister of Pakistan is head of the Commission which is composed of 26 members including Federal Ministers with representation of four Provinces and prominent scientists and industrialists. Three meetings of the Commission have been held so far. The last meeting was held on 1<sup>st</sup> December 2001. To coordinate, oversee and review the S&T policies and implementation of the policy decisions taken by the NCST, the Executive Committee of NCST (ECNCST) was

established on 5<sup>th</sup> April 1989.

Pakistan Council for Science and Technology (PCST) is the designated Secretariat of the NCST and ECNCST which prepares agenda for the meetings of NCST and ECNCST, in consultation with all major stakeholders. The 6<sup>th</sup> meeting of ECNCST was held on 09<sup>th</sup> March 2016; recommendations of which formed basis of the Agenda of the Commission.

The final agenda and working paper for the 4<sup>th</sup> meeting of NCST submitted to the Prime Minister's office for suitable date and time for the meeting for final approval of the agenda. Following agenda items are included in the Agenda of NCST's meeting.

Agenda Item-1: National Research Priorities (National Research Agenda)

Agenda Item-2: National Science, Technology and Innovation Strategy and Action Plan

Agenda Item-3: Promotion of R&D and Innovation in Industry

Agenda Item-4: Increase in National R&D Spending up to 1% of GDP by the year 2020 and up to 2% by 2025

Agenda Item-5: Uniform Salary Structure for S&T Organizations

Agenda Item-6: Changes in the Composition of the National Commission for Science and Technology (NCST) & Its Executive Committee (ECNCST)

Due to some recent developments and after the 18<sup>th</sup> amendments in the Constitution, some Federal Ministries have been devolved and some new Ministries / Divisions have been created while nomenclature of some of the Ministries has also been changed. Suggestions have been made to reflect these changes in the compositions of NCST and ECNCST.

### 3. National Research Agenda

Pakistan Vision 2025 envisions Pakistan as the next Asian Tiger. To realize this vision, five enablers and seven pillars have been identified. Under the seven pillars, 25 goals have been set which would be accomplished by the year 2025. The Vision envisages that Pakistan could become one of the top 25 economies of the world by 2025. Innovation, through focused research and development, is one of the major thrust areas of the Vision 2025. Science & technology and research & development can play an important role to realize almost all the goals and targets of the Vision 2025, while some of the goals require direct interventions of science and technology. The National Research Agenda has been prepared 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 set in the Vision 2025. The main features of the National Research Agenda include problem statement, present state of development, relevance with the Vision 2025, focus areas of research, recommendations for overall development of the area and potential socio-economic impact. In the National Research Agenda, priority areas have been identified

**National Research Agenda 2017**  
*Pathway to Shaping the Future*

**Priority Areas**

1. Agriculture & Food Security
2. Water
3. Energy & Fuel Cell Technology
4. Health & Pharmaceuticals
5. Climate Change
6. Biotechnology
7. Information & Communication Technologies (ICTs)
8. Mineral Resources
9. Nanotechnology
10. Housing
11. Electronics
12. Space Technology
13. Marine Resources
14. Automobiles
15. Robotics

**Problem Statement**

**Present State of Development**

**Focus Areas of Research**

**Socio-Economic Impact**

 **Pakistan Council for Science and Technology**  
**Ministry of Science and Technology**  
**Islamabad**

Please click for further details.

which have been deemed important for achievement of goals and targets of the Vision. The priority areas include, i) Agriculture & Food Security, ii) Water, iii) Energy & Fuel Cell Technology, iv) Health & Pharmaceuticals, v) Climate Change & Environment, vi) Biotechnology, vii) Information & Communication Technologies (ICTs), viii) Mineral Resources, ix) Nanotechnology, x) Housing, xi) Electronics, xii) Space Technology, xiii) Marine Resources, xiv) Automotive, and xv) Robotics. It is hoped that the document of National Research Agenda will provide basis of initiation of well-directed, long-term & sustained R&D efforts to successfully achieve the Pakistan Vision 2025.

### 4. National Science, Technology and Innovation Strategy and Action Plan

The role of Science, Technology and Innovation (STI) in the economic transformation of countries is well recognized. However, it can play this role only if scientific advancement and technological development is governed by well-thought-out properly-defined and smartly-planned guidelines in the form of STI Strategies. The National STI Strategy 2014-18 of Pakistan was prepared by PCST. However, a need was felt to make it more focused with clear time bound targets and harmonize it with the Pakistan Vision 2025 and in-line with economic development agenda. Hence, a detailed review of the National STI Strategy 2014-18 was



undertaken and as a result the draft of the revised National Science, Technology and Innovation (STI) Strategy and Action Plan was prepared. 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. The Strategy and Action Plan has been categorized into important areas viz i) Promotion of Science in Society, ii) STI Policy and Management Infrastructure, iii) Science Education and Learning, iv) Enhancing Industrial Competitiveness through STI, v) Strengthening of Metrology, Standards, Testing and Quality (MSTQ) System, vi) Exploitation of Marine Resources, vii) Climate Change and Environment, viii) Improving Health and Pharmaceutical sector, ix) Focusing Emerging Technologies, x) Strengthening Metals and Metallurgy sector, and xi) Space Science and Technology Development.

## 5. Revision of RPA/PSP Criteria

### i. Meeting of the Sub-Committees to Review Criteria and Development of Draft Performa/Guidelines for “Innovation/Applied Research Output” for RPA/ PSP



A meeting of the sub-committees to revisit and review the innovation/applied research output component of the Research Productivity Award (RPA) and Directory of Productive Scientists of Pakistan (PSP) and to develop a draft performa / guidelines for this purpose was held on Aug 15, 2017 under the chairmanship of Prof. Dr. Anwar -ul-Hassan Gilani, Chairman PCST. The sub-committees comprised eminent scientists with representation both from public/private sector academia and R&D organizations as well as from the Ministry of Science & Technology (MoST), Higher Education Commission (HEC), Ministry of Planning, Development and Reform, Federal Seed Certification & Registration Department, Pakistan Engineering Council (PEC) and from Armed Forces . The Chair explained that it is the need of time to focus on the translation of scientific knowledge into products, processes and services for the socioeconomic

development of country. PCST fully appreciates this and through RPA/PSP schemes is contributing in promoting applied research output and innovation to bolster economic growth and to solve and find solutions to everyday, practical problems. For this purpose 10% weightage was allocated to this component. The sub-committees discussed separately in three categories namely Engineering, Medical/Biomedical and Agriculture and developed comprehensive criteria for evaluation. It was unanimously agreed by all sub-committees that to attract more scientists towards innovation and applied research, the criteria needs to be relaxed and its evaluation should not be on "all or none" basis.

### ii. Meeting of the National Committee to Peer Review Criteria for RPA/ PSP



A meeting of the Research Productivity Award (RPA) and Productive Scientists of Pakistan (PSP) National Review Committee was held on Sep 7, 2017 at Pakistan Council for Science and Technology (PCST), under the headship of Prof. Dr. Anwar ul Hassan Gilani, Chairman PCST. The committee comprised eminent scientists and heads of organizations with representation both from public/private sector academia and R&D organizations as well as from the Ministry of Science & Technology (MoST) ,Higher Education Commission (HEC), Pakistan Engineering Council (PEC) and Pakistan Medical and Dental Council (PMDC). The Chair explained that revision of RPA/PSP schemes is an annual exercise based on the feedback received from the scientific community. It was apprised in the meeting that PCST received positive feedback on the existing criteria of PSP/RPA from the scientific community with growing ownership, reflective from the highest number of participants/registrations i.e. more than 3000 in 2016-17 compared to 2257 in 2015-16. The major decisions of the committee included subject wise categorization in RPA to address cross discipline variations and rationalization of benchmarks using the mean of the highest scores in each subject for both RPA and PSP. The committee also decided to add citations per article to the existing criteria and reduce the weight of impact

factor from 30 % to 20%, keeping in consideration the growing trend globally of giving more importance to citations. Detailed criteria and minutes of the meeting are available at <http://pcst.org.pk/rpa.php>.

### 6. Technology Foresight Exercise

Technology Foresight (TF) is a systematic approach for the national planning of science and technology that focuses on the future of science and technology, both as a driver of change and as a response to the needs of society. It is a collective thinking and wisdom to look into the longer-term future of science and technology and its potential impact on society i.e. national capacity to think ahead. During the year 2017, PCST conducted Technology Foresight Exercise (TFE) in three different sectors namely Mineral Sector, Automotive Sector and Robotics.

#### Mineral Sector

The Expert Panel on Mineral Sector was headed by Prof. Dr. Muhammad Qasim Jan, President, Pakistan Academy of Sciences. Other members included distinguished geologists, mining engineers, academicians and industrialists from across the country.



The Panel carried out several meetings and brainstorming sessions to identify the priority areas, key issues, strengths and areas of technological intervention, focused areas of research and policy recommendations. 1<sup>st</sup> Technology Foresight Expert Panel meeting on Mineral Sector was held on January 9, 2017 while the 2<sup>nd</sup> meeting was held on May 25, 2017. Both the meetings were held at PCST under the chairmanship of Prof. Qasim Jan. Two Sub Committee meetings of the Technology Foresight on Mineral Sector were also held with the meeting on July 4, 2017 at PCST under the chairmanship of Engr. Khalid Parvez, President, Mines Owner of Pakistan and the second meeting on July 18-20, 2017 in University of Karachi.

#### Automotive Sector

The Technology Foresight on Automotive Sector has also been carried out by PCST during the year 2017. The Panel was constituted having representation of top level experts from academia, R&D organizations, industry and private sector. The Panel was headed by Mr. Suhail P. Ahmed, Chairman, Pak-Japan Business Forum.



Three Technology Foresight Expert Panel Meetings on Automotive Sector were held, respectively on Apr 5, May 16 and Sep 12, 2017 at PCST under the Chairmanship of Mr. Suhail P Ahmed. After several meetings and brainstorming sessions, the panel finalized the report having a detailed overview of automotive sector, key issues, strengths, areas of technological intervention, policy guidelines, focused areas of research and recommendations. The report is being finalized and will be published shortly.

#### Robotics

PCST also initiated Technology Foresight studies on Robotics by constituting an Expert Panel having representation of top level experts from around the country. The First Panel meeting in this regard was held on Aug 17, 2017. Dr. Abdul Ghafoor, Dean/ Principal SMME, NUST (Islamabad) was unanimously selected by all members of the Panel as Panel Chair whereas, Dr. Yasir Ayaz, NUST was selected as Dy. Chair.



## Housing

The expert panel formation on Housing Sector has been completed. A letter has been sent to the potential members for their inputs/recommendations on housing sector and the way forward for the panel activities.

## 7. Visits of delegations from China

A three member delegation comprising senior scientists and officials namely; Dr. Tan Xiangyong, Dr. Zhang Xiaotang, and Mr. Luo Chaoneng from Beijing Technology and Business University (BTBU), China visited PCST on May 4, 2017. The delegation met with the Chairman PCST, senior officers of PCST and Ministry of Science & Technology (MoST) for future collaboration on S&T between the two countries.



Another four member delegation of senior scientists and officers from China Association for Science and Technology (CAST) namely; Mr. Wang Qinglin, Deputy Director General, Department of International Affairs, Mr. Li Biao, Deputy Divisional Director, Division of International Organizations, Mr. Li Pan, Program Officer and Ms. Zhu Yekun, Program Officer, Division of Bilateral Cooperation, Department of International Affairs, visited PCST on May 19, 2017. The delegation met the Chairman PCST, senior officers of PCST and MoST. A draft MoU for collaboration was also prepared for signing with the Chinese counterparts.



## 8. Funding for PSDP Projects

PCST initiated following two projects that were approved by the Government of Pakistan under Productivity, Quality and Innovation (PQI) Program.

S. #	Project(s)	Total Cost (in Rs.)	Duration (Months)
1	First National Industrial Innovation Survey	45.041 Million	24
2	Need Assessment of S&T Human Resources for Driving Innovation and Achieving Vision 2025	20.372 million	18

## 8. Conferences/Workshops organized

**Consultative Workshop on Collaborative Interactions: Policy and Practical Implications for Pakistan, in Islamabad University of Manchester, UK (Jan 4, 2017)**



The main objective of the workshop was to have a better understanding of university-industry linkage in Pakistan and explore the extent and nature of these linkages. Identification of factors that motivate and hinder successful University-Industry collaboration along with success stories to act as role model for others.

**The Role of PCST in Promoting and Recognizing Scientific Output in Pakistan-A Deeper Insight into Application Process and Evaluation Criteria of RPA/ PSP (July 28, 2017)**

A half-day Workshop on “The Role of PCST in promoting and recognizing scientific output in Pakistan was jointly organized by PCST and International Center for Chemical and Biological Sciences (ICCBS), University of Karachi. The workshop included interactive lectures on the role of PCST in promoting and recognizing scientific output in Pakistan and a deeper insight into the application process and evaluation criteria of RPA/PSP.

**3<sup>rd</sup> National Workshop on Organic Food and Health: Avenues of Innovation and Entrepreneurship, Peshawar (Nov 30, 2017)**

PCST has planned to organize a series of national workshops on the subject of significance of organic food and health in major cities of the country. The basic motivation is to help in creating awareness regarding organic food for a healthy life and more importantly to explore new avenues of entrepreneurship and value addition. The 1st and 2nd workshops on the subject were organized by the Council in Islamabad and Lahore that attracted a large number of dignitaries including Heads of R&D organizations, VC’s of universities, eminent scientists, representatives of foreign missions, international donors, representatives of private sector/ industry & civil society.

The 3<sup>rd</sup> workshop of the series was organized by PCST on Nov 30, 2017 at University of Engineering and Technology (JET), Peshawar as part of 3<sup>rd</sup> Invention to Innovation Summit KP-2017. Prof. Dr. Zahoor Ahmed Swati, Vice Chancellor, The University of Agriculture, Peshawar, was the Chief Guest during the inaugural

session. Mr. Muhammad Israr, Secretary, Agriculture Department, Government of Khyber Pakhtunkhwa, graced the occasion as Chief Guest of the closing session. The workshop attracted a large participation from KPK.

**4<sup>th</sup> National Workshop on Organic Food and Health: Avenues of Innovation and Entrepreneurship, Karachi, Dec 21, 2017**

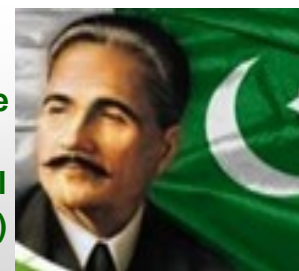
4<sup>th</sup> workshop of the series was held at University of Karachi, Karachi. Prof. Dr. Memon Mujeeb-uddin Sahrai, Vice Chancellor, Sindh Agriculture University, Tandojam was the Chief Guest during the inaugural session. In view of importance of the subject the workshop attracted a province wide participation from major higher education institutions, S&T/R&D organization and from other walks of life.

Following are few more events organized by PCST in collaboration with different national institutions.

- ◆ 6<sup>th</sup> International Symposium and Expo-2017, University of Veterinary and Animal Sciences, Lahore (Feb 8-9, 2017)
- ◆ 1<sup>st</sup> International Conference on Mathematics and Physics, Air University, Islamabad (Feb 14-16, 2017)
- ◆ 2<sup>nd</sup> Invention to Innovation Summit-2017 Balochistan, University of Balochistan, Quetta (Apr 25 -26, 2017)
- ◆ International Conference on Mining and Fuel Industries (CMFI-2017), Federal Urdu University of Arts, Science and Technology, Karachi, together with the Department of Geology, Department of Mining Engineering, Dumlupinar University, Kutahya, Turkey, Society of Economic Geologists and Mineral Technologists (SEGMITE), Inspectorate of Mines, Department of Mines and Mineral Development, Sindh (Oct 19-21, 2017)

**"The scientific observer of Nature is a kind of mystic seeker in the act of prayer".**

**Allama Mohammad Iqbal  
(1877-1938)**



## Nobel Laureates' Voice

Awarded annually by the Nobel Foundation and the Royal Swedish Academy of Sciences, the Nobel Prizes in physics, chemistry, and medicine have been given to the most accomplished individuals in science. Here is a brief account of the tremendous achievements of this year's winners.

### Nobel Prize for Chemistry

**“Development of Cryo-Electron Microscopy for the high-resolution structure determination of biomolecules in solution.”**

The Nobel Prize in Chemistry 2017 has been awarded to *Jacques Dubochet*, *University of Lausanne*, Switzerland, *Joachim Frank*, *Columbia University*, New York, USA and *Richard Henderson*, *MRC Laboratory of Molecular Biology*, Cambridge, UK for the development of cryo-electron microscopy (cryo-EM) which simplifies and improves the imaging of biomolecules. This method has moved biochemistry into a new era.



Jacques Dubochet Joachim Frank Richard Henderson

A picture is an important key to knowledge and understanding and most scientific breakthroughs are built upon the successful visualization of objects invisible to the human eye. However, biochemical maps have long been filled with blank spaces because the available technology has had difficulty generating images of much of life's molecular machinery. With the advent of cryo-EM, researchers can now freeze biomolecules mid-movement and visualize processes they have never previously seen, which is decisive for both the basic understanding of life's chemistry and for the development of pharmaceuticals.

Electron microscopes were long believed to only be suitable for imaging dead matter, because the powerful electron beam destroys biological material. But in 1990, Richard Henderson succeeded in using an electron microscope to generate a three-dimensional image of a protein at atomic resolution. This breakthrough proved

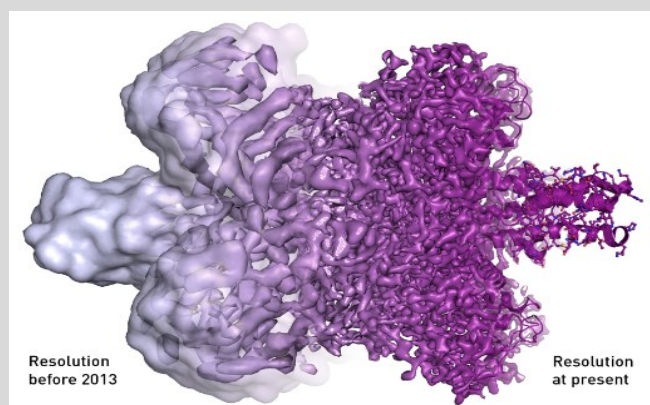
the technology's potential.

Joachim Frank made the technology generally applicable. Between 1975 and 1986 he developed an image processing method in which the two dimensional images were analyzed by electron microscope and merged to reveal a sharp three-dimensional structure.

Jacques Dubochet added water to electron microscopy. Liquid water evaporates in the electron microscope's vacuum, which makes the biomolecules collapse. In the early 1980s, Dubochet succeeded in vitrifying water – he cooled water so rapidly that it solidified in its liquid form around a biological sample, allowing the biomolecules to retain their natural shape even in a vacuum.

Following these discoveries, every nut and bolt of the electron microscope has been optimized. The desired atomic resolution was reached in 2013, and researchers can now routinely produce three-dimensional structures of biomolecules.

The method developed by Dubochet, Frank, and Henderson allows scientists to build 3D images of biological molecules, which may help provide new insight into the inner workings of our cells. Over the last few years, numerous astonishing structures of life's molecular machinery are reported in literature; *Salmonella's* injection needles for attacking cells, proteins that confer resistance to chemotherapy and antibiotics and molecular complexes that govern circadian rhythms are just a few examples of biomolecules that have now been imaged using cryo-EM. The method has already helped scientists study diseases like Zika virus.



Visualization of proteins at atomic resolution

As Henderson believed that cryo-EM would routinely provide images that show individual atoms hence resolution has improved Angstrom by Angstrom as shown in 2013 compared to what it is today. Biochemistry is now facing an explosive development and is all set for an exciting future.

*“Soon there are no more secrets “Now we can see the intricate details of the biomolecules in every corner of our cells, in every drop of our body fluids.”*

Prof. Sara S. Linse  
Sweden’s Lund University

### Nobel Prize for Physics

**“Decisive contributions to the LIGO detector and the observation of gravitational waves”**

Three Americans, Rainer Weiss, Barry C. Barish, and Kip S. Thorne win Nobel Prize in physics. One half of the prize went to Weiss (born in Berlin), Professor of Physics at the Massachusetts Institute of Technology. The other half was split by Barish, a Nebraska native, and Thorne, who was born in Utah. Both work at the California Institute of Technology.



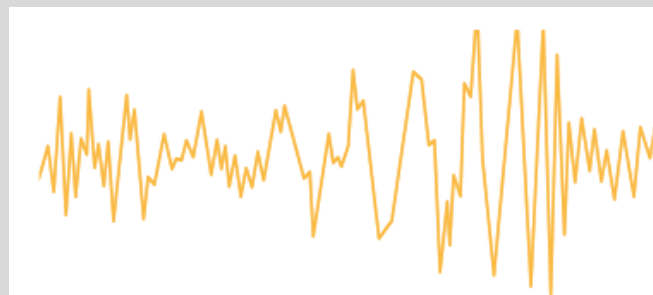
**Rainer Weiss      Barry C. Barish      Kip S. Thorne**

Over a century ago, Einstein had this wild idea that the collision of two immensely dense objects could create ripples in the very fabric of space time. He never saw these “gravitational waves.” No one had. But last year, physicists and astronomers at LIGO (a specially designed facility for detecting cosmic gravitational waves) and Virgo Scientific Collaboration announced what the Royal Swedish Academy now calls “a discovery that shook the world.”

From their sophisticated observatories on Earth, scientists recorded gravitational waves from the collision of a pair of massive black holes some billion light years away. Who would have thought Einstein was right?

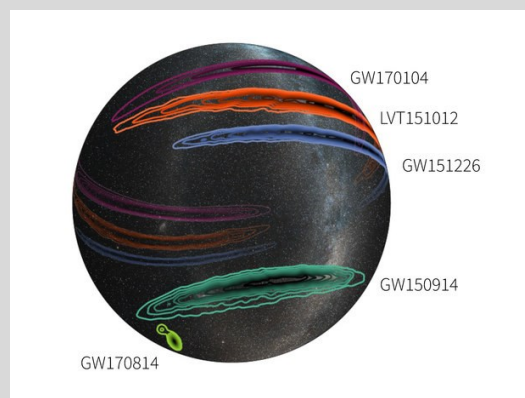
Although thousands of scientists were involved in the gravity wobbling study, Weiss, Barish, and Thorne were awarded the honor due to their leadership in developing LIGO. Besides validating a seemingly crazy and century-old prediction made by Einstein, the greatest scientist to

ever live, the gravitational wave study also offers a fascinating glimpse at the foundation of our physical reality. On Sep 14 2015, the LIGO detectors in the USA saw space vibrate with gravitational waves for the very first time. Although the signal was extremely weak when it reached Earth, it is already promising a revolution in astrophysics. Gravitational waves are an entirely new way of following the most violent events in space and testing the limits of our knowledge.



**The first gravitational wave ever detected**

The gravitational waves that have now been observed were created in a ferocious collision between two black holes, more than a thousand million years ago. Albert Einstein was right again. A century had passed since gravitational waves were predicted by his general theory of relativity, but he had always been doubtful whether they could ever be captured. LIGO, the Laser Interferometer Gravitational-Wave Observatory, is a collaborative project with over one thousand researchers from more than twenty countries. Together, they have realized a vision that is almost fifty years old ensuring that more than four decades of effort led to gravitational waves finally being observed.



**Gravitational wave source areas as mapped across the sky.**

The LIGO researchers set several records with their very first discovery; besides the first ever observation of gravitational waves, the entire course of events was the first indication that space contains medium-sized black holes of between 30 and 60 solar masses and that they

can merge. For a short moment, the gravitational radiation from the colliding black holes was many times stronger than the collected light of all the stars in the visible universe.

### Physiology / Medicine

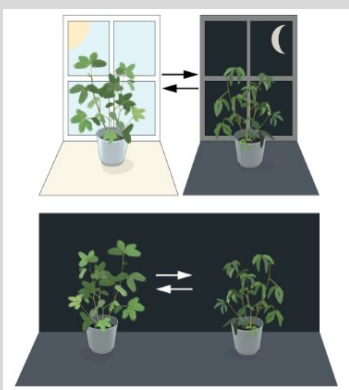
#### “Discoveries of molecular mechanisms controlling the circadian rhythm.”

Three American scientists, Jeffrey C. Hall and Michael Rosbash, (both of Brandeis University) and Michael W. Young (Rockefeller University) have been awarded the Nobel Prize for Medicine for the year 2017.



The prize has been awarded for their work uncovering the mechanisms behind the biological clock called the circadian rhythm present in the cells of all living things. A “*circadian rhythm*” is any biological process that displays an endogenous oscillation of about 24 hours of the day. These 24-hour *rhythms* are driven by a *circadian clock*, that have been widely observed in plants, animals, fungi, and cyanobacteria.

Most living organisms anticipate and adapt to daily changes in the environment. During the 18th century, the astronomer Jean Jacques d’Ortous de Mairan studied mimosa plants, and found that the leaves opened towards the sun during daytime and closed at dusk. He wondered what would happen if the plant was placed in constant darkness. He found that independent of daily sunlight the leaves continued to follow their normal daily oscillation (Plants seemed to have their own biological clock

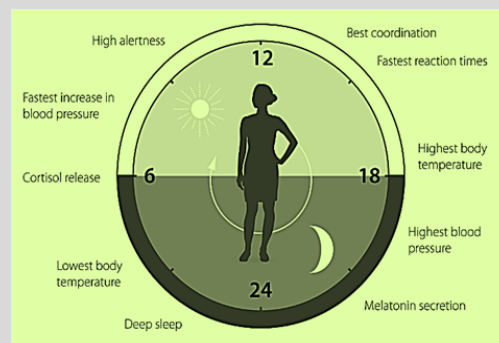


An internal biological clock

Other researchers found that not only plants, but also animals and humans, have a biological clock that helps to prepare our physiology for the fluctuations of the day. This regular adaptation is referred to as the *circadian* rhythm, originating from the Latin words *circa* meaning “around” and *dies* meaning “day”.

These biological clocks play a vital role in nearly everything we do, influencing physiological functions like managing our body temperature, brain wave activity, and hormone production. Known as the circadian rhythm, this process is present to different degrees in every living being. And although it’s always there, science hasn’t always understood how it works.

Jeffrey C. Hall, Michael Rosbash and Michael W. Young were able to peek inside our biological clock and elucidate its inner workings. Their discoveries explain how plants, animals and humans adapt their biological rhythm so that it is synchronized with the Earth’s revolutions.



Impact of circadian clock on different aspects of human physiology.

Using fruit flies as a model organism, they isolated a gene that controls the normal daily biological rhythm. They showed that this gene encodes a protein that accumulates in the cell during the night, and is then degraded during the day. Subsequently, they identified additional protein components of this machinery, exposing the mechanism governing the self-sustaining clockwork inside the cell. We now recognize that biological clocks function by the same principles in cells of other multicellular organisms, including humans.

Other scientists have since identified dysfunction in the circadian rhythm as a contributing factor to metabolic disorders and neurological disease. And research is starting to show that when things like artificial light and long overnight shifts disconnect us from the natural day-night cycle, the desynchronization can cause a host of health problems, from depression to obesity.

Since the seminal discovery by the Laureates, elucidating a fundamental physiological mechanism circadian biology has developed into a vast and highly dynamic research field with important implications for our health and wellbeing.

### Harvard scientists created metallic hydrogen

Since 1935, when it was first theorized, scientists have been trying to create metallic hydrogen, a new material with revolutionary potential applications. Now scientists from Harvard University published a paper in *Science* where they claim to have created it. If confirmed by further tests, the metallic hydrogen could become not only the rarest, but also one of the most valuable materials on Earth. Unfortunately, that precious metallic hydrogen sample – potentially the first of its kind – has just disappeared in the Harvard lab.

The scientists Isaac Silvera, Thomas D. Cabot Professor of the Natural Sciences, and post-doctoral fellow Ranga Dias, believe that what they created via high-pressure physics could be used as a superconductor, able to conduct electricity without loss at room temperature. If a reasonable way to produce this material will be found, its uses can extend to the electrical grid, maglev trains and superfast space travel.

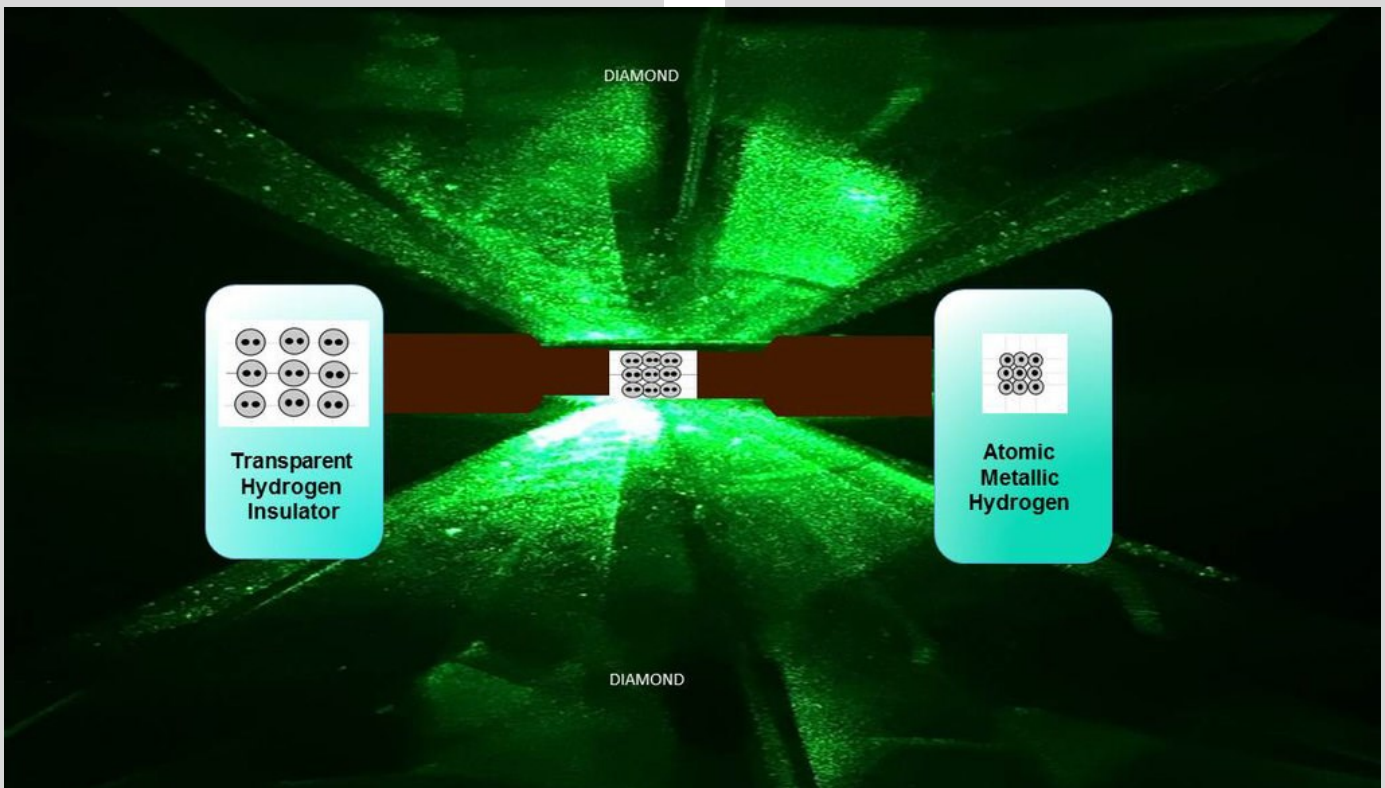
Isaac Silvera has been working on this problem for 45 years. What he and Ranga Dias did to produce their groundbreaking atomic metallic hydrogen was to compress hydrogen gas in a diamond anvil. They then solidified it at very low temperatures and kept slowly

*"This is the holy grail of high-pressure physics," said Silvera. "It's the first-ever sample of metallic hydrogen on Earth, so when you're looking at it, you're looking at something that's never existed before."*

Now the scientists will wait a few weeks until beginning to test whether the new material is stable at normal pressures and room temperatures. Basically, it needs to remain in metallic form once the special conditions that produced it are removed. Right now you can only see this tiny piece of metal through the diamonds used to create it. Once they ease the pressure, they will know if the material will remain stable, something predicted only in theory.

*"That means if you take the pressure off, it will stay metallic, similar to the way diamonds form from graphite under intense heat and pressure, but remains a diamond when that pressure and heat is removed," explained Silvera.*

increasing the pressure on the anvil by turning the screw. As reported by *Harvard Magazine*, once they reached 4 million atmospheres, greater than the pressure at the center of Earth, the transparent hydrogen turned black. At 4.95 million atmospheres, it had become a metal, reflecting 90% of light the scientists shined at it.





## 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 two young scientists has been made on the basis of the ranking of Productive Scientists of Pakistan (2017), under the age of 40, by PCST.

### Dr. Hassan Imran Afridi (Chemistry)



Dr. Hassan Imran Afridi received his B Sc (Hons), MSc (Hons) (Chemistry) as well as PhD from University of Sindh Jamshoro, Pakistan in 1999, 2000 and 2007 respectively. He joined National Center of Excellence in Analytical Chemistry, University of Sindh Jamshoro as Lecturer in 2008. During 2010-11, he obtained Post-Doctoral fellowship from HEC for Dublin City University, Ireland where he also worked as Foreign Visiting Professor for 6 months. He has expertise in multidisciplinary research particularly related to the role of electrolytes and essential trace and toxic elements in different physiological disorders. Dr. Afridi has published more than 330 research papers, two review articles in ISI listed journals and one book chapter. His impact factor is 722, citations are 5,776 and h-Index is 42 according to Scopus. So far he has successfully supervised 17 MPhil and 13 PhD scholars.

He has established collaborations with 27 local and foreign scientists from USA, Ireland, China, England, Turkey, Bangladesh, Iran, Malaysia and France. He has presented his research work at numerous national and international platforms namely Pakistan, Turkey, Iran, and Malaysia both as invited and session speaker. He has been the Organizing Secretary of five international chemistry conferences. He is an active referee for many ISI listed journals.

Dr. Afridi is a well decorated scientist in quite young age. In 2012, he was awarded the prestigious "Dr. Raziuddin Siddiqi Prize" in Chemistry from Pakistan Academy of Sciences. He won the "Best Research Paper Award" 2013 of HEC. He is also the recipient of HEC "Best Researcher Award" twice in 2008 and 2015. In the years 2009- 2012 and 2014, he was ranked as Category-A Scientist by PCST and has been receiving Research Productivity Award since 2009.

### Dr. Noreen Sher Akbar (Mathematics)



Dr. Noreen Sher Akbar is the top ranking women scientist in Category A in the field of Mathematics. She did her MSc, MPhil and PhD from Quaid-i-Azam University during 2006-2012 and received University Merit Fellowship during this period.

Her research areas include Newtonian and non-Newtonian fluids which has wide applications in engineering sciences. Dr. Akbar has published more than 280 research papers in ISI international journals of high repute. Most of her research papers have been published in USA, UK, Germany and Netherlands etc.

She has also published an international book "Numerical Simulation" Volume 2 as an Editor. Her impact factor is more than 350 and citations are more than 4000.

She has won several research grants as Principal Investigator from HEC, Pakistan. So far she has supervised 7 MPhil students. Currently she is supervising 3 MPhil and 3 PhD students. She has active research collaboration with professors of leading universities of USA, Turkey, Tunisia and Germany. She is the only PhD student who has published 87 papers in highly reputed impact factor journals during her PhD.

Her outstanding performance has already received recognition from both national and international organizations. She is the recipient of two International awards from Elsevier International Journal for top cited articles "Communications in Nonlinear Science and Numerical Simulation" during 2007-2011. BY National Academy of Young Scientists, Dr. Akbar was awarded the "Best Young Scientist" award for the year 2012. In 2013, Pakistan Academy of Sciences, PAS selected Dr. Noreen as "Young Associate" of the academy. Higher Education Commission declared her the "Best Young Researcher" consecutively for the years 2014 and 2015. In 2015 NUST awarded her the "Best Researcher" award for the year 2014. COMSTECH declared Dr. Akbar as the "Top Pakistani Nano Scientist" for the year 2016. Pakistan Academy of Sciences awarded "Dr. M. Raziuddin Siddiqi Gold Medal 2017" for scientist under 40 in the field of Mathematics. She has been receiving Research Productivity Awards RPA from PCST since last 7 years and her name is included in the Directory of Productive Scientists of Pakistan. Currently she is working at DBS& H,CEME, NUST, Islamabad.

**PCST congratulates these young scientists and wishes them continued success in their academic pursuits.**

## Staff's Voice

### American Society for Microbiology (ASM) Training Program in Publishing Life Science Research II (Feb 14-16, 2017), Bangkok, Thailand

American Society for Microbiology (ASM), one of the most prominent publishers of life science research, knows the value of strong editorial and publishing processes. In this regard, ASM offered a training course on scientific journal best practices to Pakistani journal editors-in-chief and editors, as phase II of the course conducted in 2016. The workshop focused on the peer review process and the role of journal editors in fostering a culture of responsibility. Dr. Saima Nasir, Senior Research Officer/Editor of PCST Journal of Science, Technology and Development, was invited by ASM to attend the training. The training program was highly interactive, equipping participants to build up their journals and local scientific community simultaneously. The training provided an opportunity for the participant from PCST in achieving organizational objective of bringing the journal at par with international standards by providing the opening to knit together different elements of the scientific publishing landscape and to identify different paths as to how to improve quality, linkages and access.

The three- day training ended with a certificate distribution ceremony for participants, speakers and facilitators and a group photo of all attendees.

### First National Graduate Conference, Allama Iqbal Open University, Islamabad (Mar 15-16, 2017)

Prof.Dr.Farzana Latif Ansari, Adviser, PCST delivered a plenary lecture titled *The Holy Quran and Biomimicry*.



### International Training Workshop on STI Policy and Management for Developing Countries (ITPS) at Kuala Lumpur, Malaysia (Jul 31 –Aug 4, 2017)

Mr. Khalid Pervez Bhatti, SRO from PCST participated in the international training workshop, ITPS, organized in collaboration with Ministry of Science, Technology and



Innovation (MOSTI), Malaysia, UNESCO, ISESCO and IDB. The aim of this training was to enhance participants' role in national development and their contribution to the economic wealth and well-being of the nation. This training provided the participants with the necessary skills and knowledge in STI policies and management that may enhance their participation in decision-making and in shaping the STI agenda of their respective countries.

### 2017 China-ASEAN Disaster Prevention and Mitigation & Sustainable Development Forum, Nanning, China, Sep 12-15, 2017



Dr.Tariq Bashir, SRO from PCST, participated in the "2017 Forum, which was held in Nanning, China. The visit was made on the invitation of China Association for Science and Technology, Beijing and the local organizer of the Forum, the Guangxi Association for Science and Technology. The cooperation and facilitation of the China Centre for International Science and Technology Exchange which works under the China Association for Science and Technology, needs a special mention. He also delivered a plenary lecture titled "Disaster Management System in Pakistan" besides participating in the "Closed Door Roundtable Meeting on Establishment of the China-ASEAN Disaster Prevention and Mitigation Science and Technology Innovation Alliance".

### Model United Nations Assembly Sessions, ACE Academy, Bahria Town, Rawalpindi (Oct 18, 2017)

Prof. Dr. Farzana Latif Ansari, Adviser, PCST was honored to be the Chief Guest on the occasion of MUN sessions.

## Women's Voice

### Meeting of the ISESCO's Women Chairs in Science, Technology and Innovation: For Elaboration of Common Guide Action Plan

Islamic Educational, Scientific and Cultural Organization (ISESCO) is one of the largest international Islamic organizations established by the Organization of the Islamic Countries (OIC). Its objectives include strengthening, promoting and consolidating cooperation among Member States (OIC) in the fields of education, science, culture and communication.



The "ISESCO Chairs for Women in Science, Technology and Innovation" were established to empower women in Science Technology and Innovation. The main objective was to promote knowledge and scientific expertise among women scientists and researchers in the Member States by organizing events in various scientific fields and by highlighting the scientific contributions of the Muslim women as well as by strengthening women's work at the individual and institutional levels.



A joint meeting of the presidents of ISESCO Women Science Chairs was held in ISESCO's Headquarters, Rabat, Kingdom of Morocco in order to elaborate an Action Plan by women chairs at ISESCO's Member States. The meeting was held during Mar 7-9 which coincided with the Women's International Day.

Dr. Bushra Mirza, from Quaid-i-Azam University, Islamabad participated in the meeting as the president of ISESCO Women Chair in Pakistan.

A comprehensive Road map was developed in this meeting and an action plan was proposed for next 5 years on the following identified objectives:

- ◆ Promotion of sustainable leadership of women scientists and technologists.
- ◆ Cultivation of a new generation of women scientists and technologists.
- ◆ Development and maintenance of a mechanism for the efficiency of the Program of women Chairs

**"The death of the heart is ignorance, so avoid it. Your best provision is true devotion, so provide it. This advice of mine is enough for you, so heed it".**

**Imam Al Ghazali  
(1058-111)**

