



Sixteen telehealth clinics planned to be established in various parts of Azad Jammu and Kashmir (AJK).

The President of Azad Jammu and Kashmir with senior officials of COMSATS at COMSATS Internet Service Technology Park, Islamabad (January 31, 2018)

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From the Executive Director's Desk

The fundamentals of the present era are undergoing constant change due to continuous innovations in technology, which are reshaping the socio-economic milieu of societies around the world. The developing countries' inability to benefit from the fast expanding technology advancements is a matter of profound concern. The countries of the South are lagging far behind in adopting innovations arising from the modern day hi-tech revolution. COMSATS as a proponent of science and technology is making all out efforts to help bridge the development gap between the developed and developing countries. However, there is a dire need that the developing countries realize the importance of science and technology and invest in research and development to profit from the modern day scientific advancements.

COMSATS as an advocate of S&T-led development has been playing a leading role in S&T cooperation among the countries of the South for more than two decades. It has been endeavoring to keep the countries in the South sensitized about the importance and need for cooperation in S&T for development through a variety of mechanisms. Towards this end, groundbreaking initiatives are often taken to explore new avenues of cooperation with countries and institutions in the North. We are confident that our previous efforts and current endeavors will lead us to the future that the

forefathers of the organization envisaged. It is our utmost endeavor to keep the member organizations and the general readers abreast with the scientific activities being carried out in the member countries as well as elsewhere in the world. We are therefore obliged to regularly update the readers on important developments in various aspects of science and technology.

While a number of important activities were carried out at COMSATS during the reporting period, of particular mention are the signing of a Memorandum of Understanding (MoU) with the American Institute of Pakistan Studies (AIPS), on 4th January 2018 and a visit by Sardar Masood Khan, President, Azad Jammu and Kashmir (AJK) COMSATS to the Telehealth Facility at CIS Technology Park.

We expect that deliberations of the 21st Meeting of COMSATS Coordinating Council to be held in Almaty Kazakhstan on 3-4 April 2018 will fortify our efforts to furthering our global presence.

We hope the readers will find the contents of this newsletter as informative and useful. We will highly appreciate the readers' views and suggestions for improvement in future issues of the Newsletter and hope that this revamped issue will be appreciated.

HIGHLIGHTS FROM COMSATS SECRETARIAT

COMSATS Tele-health Captures Interest of Kashmir

Sardar Masood Khan, President Azad Jammu and Kashmir, upon invitation from the Executive Director COMSATS, Dr. S. M. Junaid Zaidi, who is the ex-officio Chairperson of CIS' Board of Management, visited COMSATS Telehealth (CTH) Centre, which is housed at COMSATS Internet Services (CIS) Technology Park in Islamabad.

The purpose of the invitation was to sensitize the AJK government to establish tele-health facilities in remote areas of Azad Kashmir to deliver specialized healthcare services to the general public.

Speaking on the occasion, Mr. Masood Khan expressed that universal access to modern health facilities for the general public was a priority of the government of Azad Jammu and Kashmir. He considered Basic Health Units (BHUs) of Telehealth as an integral part of the

relevant strategies for this purpose.

The Honorable President toured the data centre at CIS and witnessed a demonstration of Tele-consultations taking place at the Tele-health centre. The visit was followed by a detailed briefing by Dr. Zaidi on the services provided by COMSATS in connection with the initiatives on tele-health, remote medical consultation and treatment of patients.

The President, AJK, considered the CTH model beneficial for the resource constrained and marginalized communities living in far-flung areas of Azad Kashmir. This, he said, would help provide a cost-effective, time saving and easy access to basic clinical diagnostic facilities and expert opinion of medical specialists at leading hospitals of the country.

The discussions led to an understanding on turning the idea of CTH into practice in AJK. Accordingly, it has been initially planned to establish 16 Tele-Health

Clinics in various regions of Azad Kashmir. These clinics will be operated from the already established BHUs in rural areas. Using the latest means of video conferencing and database management, the patients will be investigated and information regarding hospital referrals and prescriptions will be provided at the spot.

The President praised the forward-looking approach by COMSATS and said that such facilities will prove to be an asset in providing healthcare to the underprivileged populations. He added that this will also provide a digital database of the patients on their updated medical records and facilitate future consultation and maintaining vital health related statistics for a particular region.

He commended COMSATS for its work and urged the senior management of COMSATS to visit AJK and work for betterment of the region through more projects like Tele-health services.

President AJK desired that COMSATS Institute of Information Technology (CIIT), a Centre of Excellence of COMSATS, should arrange interactive seminars in the Public Sector Universities of AJK to influence the students by integrating them in contemporary research activities. For this, he advised CIIT to explore collaborative programmes with Mirpur University of Science and Technology (MUST) especially in M.Phil and Ph.D courses.

Possibility of Cooperation with DFID-Pakistan Explored

On 7th February 2018, Ms. Joanna Reid, Head, Department for International Development (DFID) Pakistan, British





High Commission visited COMSATS Secretariat and held a meeting with Executive Director COMSATS, Dr. S. M. Junaid Zaidi and senior officials of COMSATS.

Dr. Zaidi introduced COMSATS as a brainchild of the first Nobel Laureate of Pakistan, Prof. Dr. Abdus Salam. Highlighting COMSATS as an apex forum with representation of 26 countries in Asia, Eurasia, Latin America and Africa, Dr. Zaidi elaborated the organizational structure, programmes, achievements, and future plans of the organization.

While discussing avenues of cooperation with institutions from the North, Dr. Zaidi mentioned that COMSATS is trying to reach an agreement with Commonwealth Secretariat on strengthening triangular cooperation, under which the two organizations would work for socio-economic development of their member states. He believed that COMSATS and DFID could jointly work

in areas of health, food security, climate change and SDGs.

Ms. Reid expressed her interest in the financial arrangements of COMSATS, in response to which Dr. Zaidi informed that the financial expenditures of COMSATS Secretariat were met by the Government of Pakistan. The member countries, he informed, make voluntarily annual contributions, which are kept as a separate fund and used for capacity building of the contributing countries.

Ms. Reid opined that technology for sustainable development was of interest to every country. She said that the DFID offered three groups of programmes in Pakistan, which focus on health, education, and nutrition; humanitarian work and economic growth. She mentioned that the DFID was engaged in humanitarian work in Pakistan in collaboration with the disaster management authority and provincial agencies. Ms. Reid also noted that the DFID was interested in collaborative projects related to economic growth in

Pakistan.

During the discussion, Dr. Zaidi sought Ms. Reid's advice for initiating work in the COMSATS' latest member, Somalia, which was keenly interested in telemedicine. He mentioned that DFID and COMSATS could collaborate in projects like development of entrepreneurship and SMEs. He further said that COMSATS could provide human resource to DFID for its disaster management programmes.

Views Shared with the Director of COMSATS' Centre of Excellence in Nigeria

Prof. Stephen E. Onah, Director of COMSATS' Centre of Excellence in Nigeria, National Mathematical Centre (NMC), Abuja, visited COMSATS Secretariat on 19th January 2018. Matters of mutual interest discussed included NMC's role in COMSATS' programmes especially International Thematic Research Groups (ITRGs), the Centre's academic, R&D and



capacity building activities as well as possibilities of upgrading the Centre as an international Centre.

Prof. Onah was also given a presentation with special emphasis on follow-up of the 20th Coordinating Council Meeting. The focus of the discussions was on collaboration between NMC and CIIT and other Centres of Excellence, and Member States of COMSATS. It was informed that the installment for the second phase of project being led by NMC under the umbrella of COMSATS' ITRG on Mathematical Modeling would be released by ISESCO on the submission of progress report and revised project proposal.

Prof. Onah noted that the ITRG on Mathematical Modelling being headed by Prof. Benjamin O. Oyelami has issued publications. Research work under the group has good implications in a number of different fields including: air and water pollution on human health, and climate change. He also identified some areas for useful application of Mathematical Modeling that needed further R&D, such as crime detection.

Further, views were exchanged on developing a database of relevant information and identifying potential partners to establish joint research projects in Mathematical Modelling. It was noted that NMC could act as an information hub of COMSATS in relevant fields by pioneering such projects.

With regard to collaboration between NMC and CIIT, he hoped to soon identify potential areas of collaboration in Mathematical Sciences to create relevant groups. In his view, such ground work could facilitate joint work by the

two Centres of Excellence by means of a Memorandum of Understanding (MoU).

Expressing his desire to uplift the research and development capacity of NMC, Dr. Zaidi noted that COMSATS was ready to provide all kinds of support in this regard. Dr. Zaidi encouraged NMC to prepare proposals for submission to institutions in the North for soliciting funds and expertise. He was of the opinion that NMC should be upgraded and developed into a world class institute for mathematical studies of equal benefit to North and the South.

He desired for NMC to establish linkages with institutions in the North, for which the Centre needs to be upgraded. He opined that the Centre should immediately be able to help other institutions of Africa by providing expertise and academic opportunities.

Contacts Strengthened with Al-Quds University

Prof. Dr. Radwan F. H. Qasrawi, Researcher, Department of Computer Science and Information Technology, Al-Quds University, Palestine, visited



COMSATS Headquarters and called on the Executive Director COMSATS, Dr. S. M. Junaid Zaidi. A meeting was held in company of relevant officials of COMSATS Secretariat. Prof. Qasrawi is serving as COMSATS' Liaison Officer at Al-Quds University (Palestine), which is a Centre of Excellence of COMSATS. He was visiting Islamabad in connection with attending a workshop on Techno-parks at COMSATS Institute of Information Technology (CIIT), Islamabad.

During the meeting, Prof. Qasrawi requested COMSATS to facilitate capacity building at Al-Quds University by helping it acquire PhD scholarships for its faculty members. In response, Dr. Zaidi assured to arrange about 100 scholarships in Pakistani universities, including CIIT and ICCBS. He encouraged Prof. Qasrawi to submit a detailed proposal on his request, which would be forwarded to potential international donor agencies for

funding.

Prof. Qasrawi also requested COMSATS to help in establishing Technology Incubation Centre at Al-Quds University, for which Dr. Zaidi pledged his support. Dr. Zaidi also invited Prof. Qasrawi to visit the incubation centres at COMSATS Internet Services (CIS) as well as CIIT. It was informed by Prof. Qasrawi that the honourable President of Al-Quds University would soon visit COMSATS HQs and CIIT to explore opportunities of collaboration.

COMSATS and American Institute of Pakistan Studies to Collaborate on Research and Capacity-Building

COMSATS signed an MoU with American Institute of Pakistan Studies (AIPS) on 4th January 2018. Dr. S. M. Junaid Zaidi, Executive Director COMSATS, and Dr. Farhat Haq, President AIPS signed on behalf of

their respective organizations. The agreement was reached through cooperation between COMSATS and Institute of Peace and Diplomatic Studies.

The Memorandum aims at promoting cooperation between the two organizations for enhancing research and capacity building activities. It focuses on supporting cooperation in higher education and research, faculty training by foreign scholars, academic placements of faculty, sharing information and the use of resources for COMSATS' member countries and AIPS affiliated centers.

Under this MoU, both the organizations have agreed to jointly organize trainings and workshops by US academics for scholars and researchers, co-organize series of academic talks and seminars by visiting US researchers and undertake programmes in areas of mutual interest.



SOME ACTIVITIES OF COMSATS' CENTRES OF EXCELLENCE

RSS-Jordan Organizes Strategic Partnership Workshop

On 28th February 2018, the British Embassy, Amman; the Royal Scientific Society-RSS; and the Higher Council for Science and Technology, Jordan, co-hosted a workshop at RSS in Amman-Jordan, to bring together British and Jordanian scientists, researchers and innovators under the Newton-Khalidi Fund.

The workshop was conducted under the framework of Newton Programme, which is an initiative of the UK Department of Business, Energy and Industrial Strategy providing funding globally to promote economic and social development through science and innovation partnerships. In Jordan, the fund is named the Newton-Khalidi Fund in honour of the renowned Jordanian scientist Dr. Usama al-Khalidi. The Fund focuses seven priority areas: Energy including low-carbon; Water management; Agritechology and food security; Nanotechnology; Biotechnology; Bio-security; and Cultural Heritage.

UK experts from Research Councils UK; the Met Office; the Arts and Humanities Research Council; British Council; and the Science and Technology Facilities Council came to Jordan to meet their counterparts in government, industry and academia.

The Newton-Khalidi Fund will allow researchers from both countries to envision; design and collaborate on projects that will contribute to Jordan's economic development; create decent and rewarding jobs, and strengthen UK-Jordan ability to tackle future global challenges.

RSS MINARET First Regional Platform on Water, Energy and Food NEXUS in Tunisia

The MINARET First Regional Platform on Water, Energy and Food NEXUS was organized in Monastir, Tunisia, from

13-15 February 2018. The event was attended by more than 200 participants including the mayor of Monastir, the ambassador of Sweden in Tunisia and Libya, parliamentarians from Jordan and Tunisia, heads of five municipalities, representatives from the government

First Humanoid Deployed in Princess Sumaya University for Technology, Jordan

A team of students from Princess Sumaya University for Technology has demonstrated the world's first commercial humanoid, named Pepper, in the eighth world science forum in the Dead Sea, Jordan. The cross functional team has programmed Pepper and has enabled it to interact with more than three thousand attendees. The team held sideline events in the World Science Forum where interested attendees had one on one interactions with Pepper, which was made in Japan. The robot demonstrated obstacle avoidance, laughing and walking capabilities. Pepper, which was later introduced into service as an employee in Princess Sumaya University for Technology, is designed to live with humans and is capable of recognizing emotions like joy, sadness, anger and surprise.

If properly programmed, the humanoid is able to adapt its attitude to suit humans as close as possible. Pepper is equipped with many sensors that include transmitters, receivers, six laser sensors and three obstacle detectors in addition to three cameras. Pepper introduces students to a world of possibilities in the field of robotics and solidifies the integration of multidisciplinary engineering disciplines that include artificial intelligence.

Working on the robot further enhances students' abilities to learn new programming techniques that target specific hardware elements like sensors and cameras. Due to the new nature of the challenge and limited support, students are pushed to innovate ways to work around technical issues. Finally, faculty and students can apply their developed artificial intelligence algorithms to verify their robustness and effectiveness.





and civil society organizations from Tunisia, Lebanon and Jordan.

MINARET project is being implemented by the Royal Scientific Society / National Energy Research Center, Future Pioneers for Empowering Communities (FPEC) and the International Union for the Conservation of Nature (IUCN). The project is targeting the municipalities of Karak and Sahab in Jordan, Jdaidet Chouf in Lebanon and Monastir in Tunisia with generous funding from the Swedish International Development and Cooperation Agency (Sida), for the project's implementation period until 2020.

Under the MINARET regional platform, a workshop on "Applying the Water-Energy-Food NEXUS Approach in Urban Planning" was held from 14-15 February 2018, conducted and supported by the German Agency for International Cooperation (GIZ) / Egypt Office. Participants of the workshop discussed the current national policies and the needed solutions. They also stressed the importance of regional cooperation to share experiences and face challenges related to water, energy and food in Jordan, Lebanon and Tunisia.

IROST-Iran Initiates Scientific and Technological Partnerships with Razavi Institute of Economics

On 8th January 2018, an agreement was signed for scientific and technological cooperation between Iranian Research Organization for Science & Technology (IROST), and Astan Quds Razavi Institute of Economics. According to the agreement, both parties will collaborate for the projects aimed for promotion of biotechnology, advanced materials and nanotechnology, electrical and electronic equipment, advanced machinery, water technologies, new energy, blood products, creative industries, development of advanced medical centres for high risk diseases, and food security.

CIIT-Pakistan Strengthens Linkages with Foreign Institutions

Ambassador of European Union delegation, His Excellency Jean Francois Cautain visited COMSATS Institute of Information Technology on 15th February 2018. First Secretary, Education and Culture, Dr. Nicole Malpas also accompanied the

Ambassador. Discussions were made on Erasmus plus programme and success stories of Erasmus alumni were shared. Dr. Qamar, Rector CIIT highlighted Erasmus programme as an excellent initiative to promote education as well as engender understanding and a spirit of peaceful co-existence among the people of different cultures from around the world. A number of students and faculty who had previously availed an opportunity under this programme were invited to reminisce about their experiences under EMMA/Erasmus programmes.

On 14th February 2018, Ambassador of Japan, His Excellency Mr. Takashi Kurai visited CIIT Islamabad. The ambassador was informed about the activities and achievements of the institute. It was discussed that the visit will enhance the ties of CIIT with Japanese embassy, which will help in achieving the long term goal of benefitting from the world class education and research taking place in Japanese institutions.

A two-member delegation comprising of Ms. Prem Minder, Head of International Student Support and Ms. Anushia Thamothers, Student Support Officer, from the International Office of the University of Nottingham, Malaysia

Campus (UNMC) visited CIIT-Lahore on 6th February 2018 and CIIT-Islamabad on 8th February 2018. The purpose of the visit was to promote the university's summer programmes to the youthful students of CIIT.

The Rector CIIT welcomed the delegates and briefly highlighted about the very vibrant internationalization agenda of the Institute linking it to the renowned universities in different countries including Malaysia.

Mr. Dan Herman, International Officer, International Development Division, the University of Manchester, UK visited CIIT Islamabad on 12th February 2018. The purpose was to promote the educational programmes of University of Manchester to the students of CIIT.

Prof Stephen E. Onah, Director /Chief Executive National Mathematical Centre (NMC), Abuja, Nigeria visited CIIT, Islamabad from 18-21 January, 2018. Prof. Onah showed keen interest in the research work being carried-out at CIIT especially in the areas of Mathematics to pave the way for enhanced future collaboration. The Director NMC was informed that overall 55 Nigerian students have benefited from CIIT, of which 25 are from NMC alone. He was hopeful that both institutions would keep on chasing new opportunities of mutual interest and growth of their respective organizations.

EMBRAPA Agrobiologia Develops Application for Identification of Pests

One of the greatest difficulties for farmers is to identify natural enemies of the pests of a particular crop. This gives a challenge in bio-control of pests. To combat this problem, during



the reporting period, scientists from EMBRAPA Agrobiologia developed a mobile application for identification of pests and their enemies. With this mobile application, it is possible to access images of most common natural control agents. The application is named as InNat guide and is freely available on Google playstore. Now with a smartphone in hand, the farmers can compare the insects with image gallery, which includes 13 families of predatory insects, plus parasitoids and spiders. In addition to the photos, the application also contains information about each natural enemy group and its role in nature.

ICCBS-Pakistan Scientist Declared as the most Productive Scientists of Pakistan

Pakistan Council for Science and Technology (PCST) has declared Prof. Dr. Muhammad Iqbal Choudhary, Director, International Centre for

Chemical and Biological Sciences (ICCBS) as the most productive scientist of Pakistan.

Dr. Choudhary was selected from 4154 productive scientists of Pakistan. Under the umbrella of ICCBS, he also heads HEJ Research Institute of Chemistry, and Dr. Panjwani Center for Molecular Medicine and Drug Research.

TÜBİTAK MAM-Turkey Strengthens its Cooperative Ties

The President of Shota Rustaveli Georgian National Science Foundation (SRGNSF), Prof. Manana Mikaberidze, and the Vice President, Dr. Nino Gachechiladze, visited the campus of TÜBİTAK in Gebze upon the invitation of the President of TÜBİTAK, on 26th January 2018. The meeting in Gebze Campus started with a speech by the President of TÜBİTAK, emphasizing the importance of international cooperation in science. The President stated that visiting the research centers and institutes in Gebze Campus would allow the Georgian delegation to figure out the majority of TÜBİTAK's research infrastructure. Directors of Business Development Units delivered presentations on the research infrastructures and the products and services offered. The program ended with on-sight visits to the laboratories of the Institutes in Gebze Campus.

A delegation from Tanzania visited TÜBİTAK Marmara Research Center (MAM) on 17th January 2018. The parties discussed the opportunities of cooperation between Tanzania and TÜBİTAK MAM. After the meeting, the delegation visited TÜBİTAK MAM's laboratories at Food, Materials, Energy and Chemical Technology Institutes.



Marmara Research Centre provides technical services to Russian Federation

TÜBİTAK Marmara Research Center (MAM) expanded its customer service portfolio abroad by getting service requests from Russian Federation for "cytotoxicity, irritation and sensitization" tests in accordance with the test protocol of the international standard ISO 10993 in medical device and material sector.

In addition, another request was received for "jet fuel" analysis from a private aviation company operating in Russia. Thus, the number of countries provided with test and analysis services by TÜBİTAK MAM has reached 24 in 4 continents. TÜBİTAK MAM's Vice President Assoc. Prof. Murat MAKARACI expressed that MAM's strategic vision is "to become a world-leading R&D center" and that they aim to prevent the outflow of funds and information by offering special quality tests and analyses needed by Turkey through an advanced infrastructure of tools and equipment. He also stated that they received test and analysis requests from Europe, Asia, Africa and America. TÜBİTAK MAM offers test services in 1,200 types through its 7 Institutes with different fields of specialization.

KazNU-Kazakhstan Offers Technologies for Telemedicine

KazNU launched test mode work in the field of telemedicine in December 2017. Since January 22, 2018, video consultations started regularly. Consultations are conducted on 8 profiles: cardiology, neurology, surgery, otorhinolaryngology, family medicine, internal medicine, dermatology, and orthopedics. KazNU uses two methods of providing consultations, which include provision through transferring medical information via telecommunication channels, and by conducting actual consultation in delayed mode as well as real time.



Prof. Tlekkabul Ramazanov, Vice-Rector for Research & Innovations of Al-Farabi KazNU, Recipient of "Parasat"

KazNU uses TheCure TMS program, developed by the Pusan National University Hospital. Telemedicine equipment is a unit consisting of 2 displays. One of the displays is connected to a Windows OS computer, in which the specified program is running. The 2nd display is used for the visual contact between a consultant in Korea and a patient or doctor at KazNU. Video communication is provided on the business Skype platform.

COMSATS Secretariat plans to benefit from telemedicine activities and technologies at Al-Farabi KazNU.

Research and Capacity Building Activities in KazNU

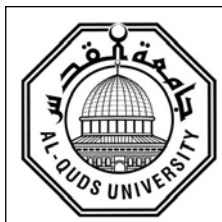
During the reporting period, KazNU published research on inhomogenous jet and ancient genomes in horses. Al-Farabi KazNU is preparing to launch Annual International Farabi readings from 3rd to 13th April 2018. The Readings is a special, KazNU branded scientific event, which this year includes seventeen conferences, round tables, etc., will be attended by more than 300 academics, scientists and scholars from Kazakhstan and abroad alike. One of the events in the Readings is 21st meeting of COMSATS Coordinating Council. Besides the meeting, KazNU will hold 15 conferences under the framework of Readings.

During the reporting period, academican of National Academy of Sciences of the Republic of Kazakhstan, Vice-rector for Research & Innovations of Al-Farabi KazNU, Prof. Tlekkabul Ramazanov, was awarded the order "Parasat" for his great personal contribution to the development of the intellectual potential of the Republic of Kazakhstan.

PROFILE OF COMSATS' INTERNATIONAL S&T CENTRE OF EXCELLENCE

AL-QUDS UNIVERSITY (AQU), PALESTINE

Al-Quds University, Palestine, joined COMSATS' Network of International S&T Centres of Excellence as its 21st Member in 2017



during the 20th Meeting of COMSATS Coordinating Council, held in National Research Centre, Egypt on 14-15 May 2017.

Founded in 1984, Al-Quds University provides higher education and community services to Jerusalem and neighboring towns, villages, and refugee camps in the West Bank.

The main campus of the university is located in Abu Dis with four other campuses in Jerusalem, Sheikh Jarrah, Beit Hanina and Rammalh (Al-Bireh).

With over 13,000 students, AQU has outreach to the members from all over the West Bank. With fifteen academic faculties including Arts, Medicine, Dentistry, Law, Qur'an and Islamic Studies, and Engineering, AQU offers huge academic diversity. AQU is a hub of creativity and offers a vibrant learning environment by encouraging exchange of ideas and freedom of expression, as well as leading innovative research to encourage students to be active and engaged citizens, who are open and cooperative, and well-informed and interested in different cultures of the world.

The mission of AQU is to equip students with the tools to shape a successful future through promotion of academic research and professional excellence.

The University comprises of over 30 centres and institutes with committed

faculty members, which have earned a reputation for high-quality and innovative research and development as well as using progressive teaching methods that seek not only to adapt to but also to initiate social change.

While the University encourages purely scholarly and research activities, where the end is "knowledge for its own sake," the institution balances its support for the pursuit of pure knowledge with its dedication to a strong interactive role in society, whether through: practice oriented degrees it offers; practical credit-hours students are required to invest in their given industry or profession; University's research activities in public health, social science, environment, agro-chemicals, etc. or its outreach programmes and institutes.

AQU ranks top in the entire Arab world in the number of peer-reviewed publications per faculty members per year. Among its many faculties and departments are the first Palestinian schools of law and medicine; museums of mathematics, science, and prisoners' affairs; research centers in nanotechnology, biotechnology, information technology, and environmental sciences, as well as centers for community action; legal aid clinics; and an educational television station and media laboratory.

AQU employs approximately 1,300 staff, which provides educational

services for almost 12,000 students up to the master's degree level. Each year, approximately 1,700 undergraduate students and a transfer class of about 30 students are admitted to programmes at Al-Quds University. More than 45 departments and programmes offer post-graduate education.

The deanship of scientific research at Al-Quds University (AQU) is committed to excellence in academic research, which constitutes a major component of the University's mission as an institution of higher education. The University's strategic priorities are to proactively connect with local, national, regional, and global educational sectors by enhancing its academic work both at home and abroad.

As part of this strategy to nurture a research-friendly environment for the University's researchers and academics and to enhance AQU's participation in research activities worldwide, funded research projects are being implemented through collaboration with other national and international institutions.

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BIODEGRADATION OF TEXTILE INDUSTRIAL WASTE EFFLUENT: A PIVOTAL REMEDY TO WATER POLLUTION

According to the UN Sustainable Development Goals, access to safe water and sanitation, and sound management of freshwater ecosystems is essential to human health and environmental sustainability. Apparently, there is wide spread concern about the safety of potable drinking water. Although some countries have effectively tackled the unavailability of healthy water, others have issues with the provision of sustainable water supply, having high as above 60% water stress level. Water pollution is one of the environmental pollutions, which directly and/or indirectly poses health risks to almost, particularly aquatic animals. Industrial effluents are a major source of this pollution as they usually enter the environment in the form of dispersion or a true solution and often in the presence of other organic compounds originating from operational processes, thus, altering the aquatic ecosystem, and, in turn, the availability of potable, healthy, and fresh water^[1,2].

Textile industry is one of the oldest industries in the world. The effect of effluents from these textile and dye stuff industries discharged into water bodies is causing significant health concerns to environment, especially in developing countries. On the whole, textile and dyestuff wastewaters are characterized by their unfixed dyes (visible colour), organic pollutants (much higher than regular domestic wastewater), high biochemical and chemical oxygen demand (BOD and COD), high conductivity due to salts, high amounts of sulphide and heavy metals due to chlorinated bleaching agents and halogens, suspended solids and alkaline pH (9 – 11), thus, effluent discharge from these industries into the environment is a major cause for concern [1,2]. As dyes are designed to

colour various substances and solutions, there is a great potential for these dyes to accumulate in the environment as many of them are recalcitrant to normal bioremediation.

Taking into account the volume and composition of the effluent, the textile wastewater is rated as the most polluting in the industrial sector. The untreated textile wastewater can cause rapid depletion of dissolved oxygen if it is directly discharged into the surface water sources due to its high BOD value^[1,2]. The effluents with high levels of BOD and COD values are highly toxic to biological life. Environmental problems such as appearance of colour in discharges from various industries, combined with the increasing cost of water for industrial sector, have made the treatment and reuse of effluents increasingly attractive to the industry and a growing priority to the affected countries at large.

Dyeing, desizing and scouring are the major sources of water pollution in textile effluent. Reactive and disperse dyes are the most utilized dyes for colouring cellulosic fibres. Azo dyes that account for 60 – 80% of the dyes consumed in textile processing are characterized by a typical double azo bond linkage (-N=N-), which is the most common chromophore of reactive dyes. However, the delivery of colour onto fabrics is not an efficient process and up to 40% of dyes are lost during the dyeing process^[1,2]. The high alkalinity and traces of chromium, which is employed in dyes adversely affect the aquatic life and also interfere with the biological treatment processes. It induces persistent colour coupled with organic load, leading to disruption of the total ecological/symbiotic balance of the receiving water stream.

In view of the earlier mentioned adverse effects, the textile industry effluents should be discharged after proper treatment. The dyes are stable to light, heat and oxidizing agents, and it is difficult to remove the dyes from effluents. This makes the effective and economic treatment of the effluents containing various dyes an important environmental problem. Traditionally, both physical and chemical methods such as coagulation, ozonation, precipitation, adsorption by activated charcoal, ultrafiltration, nanofiltration, electrochemical oxidation, and electrocoagulation were used in the treatment of the textile industrial effluents, but both methods have many short comings^[1,2]. Chemical methods such as coagulation often produce excess amount of chemical sludge, which creates problems when disposed. Most of the physical and chemical methods of effluent treatment are not accepted by the industries due to their high cost, low efficiency and inapplicability to a wide variety of dyes.

Researchers are diverting the focus from physical and chemical processes to biodegradation of these industrial effluents, which mainly shows research interests towards the pollution control using bacteria, fungi, albeit in combination with physicochemical methods. The biomass can absorb the chromophores and reduce them into low redox potential environments^[1,2]. The attractive features of biological treatment are low cost as well as renewability and sustainability.

The most common technology used for aerobic or anaerobic secondary treatment of wastewater relies on microbiological conversion of oxygen consuming substances such as organic matter, represented as

BOD or COD, and Kjeldahl-N. The aerobic or anaerobic technologies can be classified as mechanised or non-mechanised depending on the intensity of the mechanised input required. The Upflow Anaerobic Sludge Blanket (UASB) process is the most cost-effective anaerobic industrial wastewater treatment while Bio-film reactors (trickling filter and rotating bio-discs) and Suspended growth reactors (activated sludge system and extended aeration) are used for aerobic treatment [3].

Textile wastewaters exhibit low BOD to COD ratios (< 0.1) indicating their difficulty to bioremediate or breakdown. Hence, the best way of water treatment is through the isolation of adaptive organisms from the site of pollution, with subsequent mutagenesis – modification of their natural ability to degrade pollutant(s) – and re-incorporation of the mutagenised organisms or modification of the polluted environment to trigger mutagenesis of the organisms. This method of pollution prevention (P2) is called in-situ biodegradation, and mutagenised strains of *Bacillus* and *Pseudomonas* species are the major organisms which play a profound role in this process [1,2]. Other organisms that have been used for this purpose include *Achromobacter xylooxidans*, *Sphingomonas* sp., *Xanthomonas* sp., *Flavobacterium*, *Corynebacterium*, *Escherichia coli*, *Neurospora*, *Aspergillus*, *Candida tropicalis*, *Alcaligenes*, *Acinetobacter*, *Nocardia*, *Citrobacter*, *Cladosporium*, *Clostridium resinae*, *Micrococcus*, *Azotobacter* etc.

For effective biodegradation, the microbes needed are either already present in the industrial waste or added through engineered treatment system (synthetic chemical degradation). The treatment of the effluents may occur via bioaugmented activated sludge, a trickling filter, rotating biological contactors and ion exchange, among other possible systems [3].

Biodegradation of textile effluents is not without pros and cons. The advantages of this process include its cost effectiveness and the fact that it's dependent solely on the metabolic activities of the microorganisms. Furthermore, there is no need to transport large quantities of effluent off-site as biodegradation can be done at the site of pollution. However, the off-site biological treatment system is a means to completely mineralize many toxic compounds due to its ecologically sound natural process that completely detoxifies target compounds into harmless intermediates, and finally, assimilating them forming carbon dioxide and water [4].

The major disadvantage however, is that dyes are not easily biodegraded due to their complex nature. Biodegradation of dyes is limited by oxygen availability [4], hence, only mixed culture consortium with combined anaerobic and aerobic treatment system have more chances of being effectively decolorized/ biodegraded, as the right consortium of organisms is central to optimizing the degradation activities. Another challenge is that free cells in the treatment systems are not as efficient

as immobilized cells. Biodegradation is also a slower process that physico-chemically processes and requires environmental operational parameters optimal for the growth of microbial culture.

The extrapolation of worldwide increase in water consumption rates over the last ten years is an indicator that huge shortages will likely occur in many populated areas of the world, particularly in the arid and semi-arid world regions in the nearest future. Therefore, biodegradation of textile effluents as a means of tackling water shortage and sustainable water resources management for the future cannot be overemphasized.

References

1. John, W. C., Anyanwu, N. C. J., Akande, D and Ayisa, T. T. Biodecolourization of textile effluent using mutagenised strains of *Pseudomonas* and *Bacillus* species isolated from dyed contaminated soil. *IOSR Journal of Environmental Science, Toxicology and Food Technology*. 2013; 6(3):69-74.
2. John, W and Anyanwu, N.C.J. Effect of Environmental Factors on Biodecolourization of Textile Effluents Using Mutagenised Strains of *Pseudomonas* and *Bacillus* Species. *Journal of Applied Life Sciences International*. 2016; 5(2): 1-17; Article no.JALSI.24928.
3. Metcalf and Eddy Inc. *Wastewater Engineering. Treatment Disposal and Reuse*. 3rd edition, Mc-Graw Hill Book Co, Singapore. In: United Nations Environment Programme and World Health Organization (1997). *Water Pollution Control - A Guide to the Use of Water Quality Management Principles*. Richard Helmer and Ivanildo Hespanhol (Ed.). E. & F. Spon. 1991. ISBN 0 419 22910 8.
4. Jilani, S. Bioremediation Application for Textile Effluent Treatment. *Middle-East J. Sci. Res*. 2015. 23 (1): 26-34.

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SCIENCE & TECHNOLOGY NEWS FROM MEMBER STATE

Elsevier Foundation Recognizes Scientist from Bangladesh

A mathematician from Bangladesh was awarded the 2018 OWSD Elsevier foundation award for early career woman scientist in developing world for her research in physical sciences (*Asian Scientist*, 26th February 2018).

Dr. Hasibun Naher, of BRAC University, Bangladesh, received the award for her work in nonlinear partial differential equations. Naher's significant academic contributions to this field include her most recent work on tsunami simulation and her research on travelling waves.

The awards are part of a seven-year partnership between OWSD and the Elsevier Foundation. OWSD chairs a panel of distinguished scientists to select the winners, and the Elsevier Foundation supports a cash prize for each winner.

Scientists from China successfully Clone Monkeys

A pair of identical long tail macaques was recently born in China. These monkeys are a product of ground breaking experiment, which has for the first time ever successfully cloned primates using non embryonic cells (*Reuters*, 25th January 2018).

Researchers at the Chinese Academy of Sciences Institute of Neuroscience in Shanghai relied on a process known as somatic cell nuclear transfer (SCNT), which has been used to clone several mammals, including Dolly the sheep. SCNT involves removing the nucleus from the egg cell of one individual, and replacing it with the nucleus



of a differentiated body cell from another individual. The reconstructed egg, which is implanted into a third individual, develops into a clone of the individual that donated the replacement nucleus.

The primary goal of the study was to advance medical research. Having access to genetically identical animals can help scientists better understand the mechanisms of certain diseases. It also eliminates questions about genetic variability that arise when testing new drugs or therapies on animals. The results of this remarkable experiment were published in the journal 'Cell'.

Biomedical Smart Jacket Diagnosing Pneumonia, developed by Ugandan Inventor

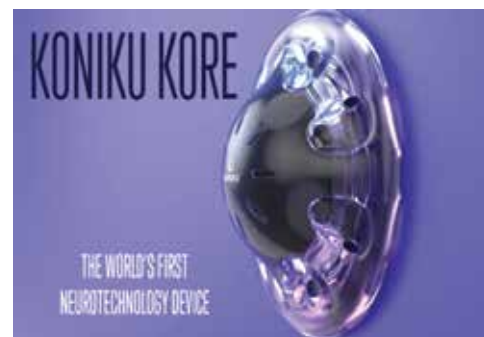
A Ugandan inventor has created a biomedical smart jacket that can diagnose the pneumonic condition four times faster. The jacket is more accurate as it analyzes the chest and then sends the information via Bluetooth to smartphone app (*CNN*, December 2017). The technology is similar to a stethoscope. It stretches across the whole chest and the side of a patient's body. It surveys specific points on the lungs for symptoms of pneumonia, characterised by a swelling of the lungs caused by infection.

The jacket is connected to a mobile phone app via Bluetooth which sends, records and analyses the medical data, ready for a healthcare professional to make an informed diagnosis. It is claimed that the jacket mitigates almost all human error and can diagnose pneumonia three to four times faster than a doctor.

Scientists at Nigeria Create Device that Detects Explosives and Cancer Cells

A Nigerian scientist has developed a device which can not only be used to detect smell of explosives, but also cancer cells (*TED Global*, December 2017). The scientist worked to merge synthetic neurobiology with traditional silicon technology in order to fix real world problems. The device, called Koniku Kore, is the first to fuse live neurons from mice stem cells into a silicon chip. The device is expected to revolutionize airport security. The invention could also be used to sniff out illnesses in the same way dogs can detect cancerous cells via smells.

Many artificial technology projects attempt to model its systems on the human brain, hoping to take advantage of its capacity for complex analysis. The Koniku Kore goes one step further, bringing together silicon components with living neurons sourced from mice.



SCIENCE, TECHNOLOGY AND DEVELOPMENT

World's Biggest Smog Tower Developed in China

To curtail China's smog challenges, researchers through collaboration, between Roosegaarde, Delft Technology University and European Nano Solutions, a green tech company in the Netherlands, tested world's biggest smog tower near the city of Xian. A 100-metre high air purification tower in Xian, Shaanxi has assisted in reducing smog levels in the city, preliminary outcome suggest (*South China's Morning Post*, January 16, 2018).



During a routine testing, researchers at the Institute of Earth Environment at the Chinese Academy of Sciences observed that 10 square kilometers (3.86 square miles) area in the city has made significant improvements in air quality over the past few months and the tower has managed to produce more than 10 million cubic metres (353 million cubic feet) of clean air a day since it was launched.

On severely polluted days the tower was able to reduce smog close to moderate levels. The system works through greenhouses covering about half the size of a soccer field around the base of the tower. Polluted air is sucked into the glasshouses and heated up by solar energy. The hot air then rises through the tower and passes through multiple layers of cleaning filters, and barely requires power input during daylight to operate.

Strategic Plan for Developing a Universal Influenza Vaccine

One of the fundamental priorities of the public health sector is development of a universal influenza vaccine (*ScienceDaily.com*, February 28, 2018). This is a vaccine that provides protection which spans for a good time period; administered for all age groups; and against variety of strains including those that may be epidemic. In view of this, an institute in Maryland, National Institute of Allergy and Infectious Diseases (NIAID) has mapped out strategies for addressing and repositioning the research areas pivotal to creating a safe universal influenza vaccines with great efficacy.

Scientists aim at focusing on three pivotal fronts: Improving the understanding of transmission, natural history and pathogenesis of influenza infection, and supporting the rational design of universal influenza vaccines.

Conclusively, the scientists echoed the need for an extensive and all-inclusive collaboration between Government, Academia and philanthropists for achieving the mandate of developing universal influenza vaccines

Development of Cancer-Killing Virus as Tumor Immunotherapy

A study leading to the breakthrough of cancer-killing ("Oncolytic") virus, which is at present in clinical trials, will soon be launched according to new UC San Francisco research findings (*ScienceDaily.com*, January 13, 2018). The virus kills not only directly by annihilating cancer but also alerts the immune system with the presence of tumor and thereafter awakening a strong widespread immune response that kills cancer cells.

The research unveils how a viral

infection can unite with the immune system to attack cancer cells. In this regard, the study highlights the chances to combine this form of therapy with cancer immunotherapy drugs such as check point inhibitors, which provide the immune systems full cancer-fighting power. Researchers have been developing oncolytic virus since 1980s. Amgen's Lmlygic (T-Vec) is the first oncolytic viral therapy in the U.S., and such viruses are a closely watched aspect of therapeutic innovation and development.

Developments in Agriculture and Farming

A survey carried out on how information services based on mobile phone technology can improve the lives of farmers has found sketchy success (*SciDev.net*, January 31, 2018). The researchers aim to develop robust app and information sources that address wider community problems, which will encompass not only the farmers but transport providers and market brokers to create a chain to enable farmers gain access to bigger companies, for transactions.

In order to halt plastic pollution, Kenya has completely banned sales, usage and production of plastic bags with heavy penalty for none compliance (*SciDev.net*, 8th January 2018). Researchers pioneered a new technique for afforestation and reforestation method, using small portable seed balls instead of plastic bags.



PROFILE OF A MEMBER OF COMSATS' TECHNICAL ADVISORY COMMITTEE

PROF. DR. SOK CHING CHEONG, HEAD AND NECK CANCER RESEARCH, CANCER RESEARCH, MALAYSIA

Prof. Dr. Sok Ching Cheong is a member of COMSATS' Technical Advisory Committee that emerged as an outcome of the 20th Coordinating Council Meeting held in National Research Center (NRC), Cairo, Egypt. Presently, Prof. Cheong is a Senior Group Leader, Head and Neck Cancer (HNC) Research Team, Cancer Research, Malaysia; Adjunct Professor, University of Malaya; and Co-chairs the TWAS Young Affiliate Network (TYAN).



that are currently in preclinical testing, and the ability to test putative biomarkers of response.

Prof. Cheong is also working to identify novel therapeutic targets by using CRISPR/Cas9 essential screens on HNC cell lines. To date, Prof. Cheong has published 49 articles in peer-reviewed international journals.

She collaborates extensively with research groups both nationally and internationally. Her work has been supported by national grants including those from the Ministry of Science, Technology and Innovation (MOSTI) and Ministry of Higher Education (MOHE). Further, her team has also been competitive in winning international grants including those from the Medical Research Council (MRC), United Kingdom, Global Challenges Research Fund (GCRF), United Kingdom, Honjo Foundation, Japan and Union for International Cancer Control (UICC), that have enabled her team to grow steadily in terms of size and expertise.

Prof. Cheong is passionate about developing scientific talent and has supervised researchers at all levels including 16 postgraduate students (4 PhD and 12 Masters), 7 postdoctoral scientists and more than 30 research associates. She leads the "Science Leadership" working group in the Young Scientist Network, Academy of Sciences Malaysia (YSN-ASM) from 2013-2016 and is a regular speaker at university career events.

Recently, she was appointed the co-chair of the Young Affiliate Network of The World Academy of Sciences (TYAN), where she is required to develop strategies for encouraging cross-border collaborations aimed at training scholars and promoting scientific excellence.

Prof. Cheong serves as a review panellist for grant, journals and professorial promotions. Grant review committees that she has participated in, include International Union Against Cancer (UICC) International Cancer Technology Transfer Fellowships (UICC/ICRETT), South African Medical Council, Croatian Science Foundation, The World Academy of Sciences (TWAS) Research and Advance Training Fellowship Programme, Australian Dental Research Foundation Inc.,

and L'Oréal For Women in Science Award. She has been invited as a plenary and keynote speaker in national and international conferences and also has served as a key member of the organizing committees of some international conferences.

Prof. Dr. Sok Ching Cheong additional and professional commitment for External Assessor (Grants and Promotions) at international level include:

- International Union Against Cancer (UICC) International Cancer Technology Transfer Fellowships (UICC/ICRETT)
- South African Medical Council
- Croatian Science Foundation
- The World Academy of Sciences (TWAS) Research and Advance Training Fellowship Programme
- Australian Dental Research Foundation Inc.
- Commission on Science and Technology for Sustainable Development in the South (COMSATS), Technical Advisory Committee
- Ad Hominem Professorial Promotion, Faculty of Health Sciences, University of Cape Town, South Africa

Prof. Cheong has always nourished her knowledge, research potentials, views and contribution by imparting to imbibe knowledge transfer in many appointment and calls which among the few are:

- Guest lecturer, Department of Biomedical Sciences, Faculty of Medicine (Cancer Biology, Y3, undergraduate) (2017);
- Visiting Professor, Faculty of Dentistry Khon Kaen University, Thailand (2015);
- Adjunct Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Malaya (Cancer Biology, Y1-3 postgraduate) (2009-till date).

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Prof. Dr. Cheong completed her PhD degree in Biochemistry with specialty in Cancer biology at the National University of Malaysia (University Kebangsaan Malaysia), Malaysia, in 2002. During her PhD, she investigated the p53 status of patients with Skin Disorders.

Shortly after her PhD degree, she joined the group of scientist in Cancer Research Initiative Foundation, Malaysia for her Post-doctoral activity. There on, Prof Cheong has 20 years of experience in molecular and cell biology, and over 15 years of experience in working within multi-disciplinary teams to set up tissue and data banks and conduct research in the area of head and neck cancer.

Using current technologies and head and neck cancer (HNC) as a disease model, her research focuses on developing innovative therapies for cancer. Having identified cancer-associated antigens that are immunogenic from genomic analyses of HNC, her team has developed a therapeutic vaccine for this disease, which is currently in preclinical testing. Toxicology studies and first-in-man clinical trials for this vaccine are in planning phase and based on this track record, her team has received two international grants in Cancer Immunotherapy, and is now poised to expand this program to include the development of preventative vaccines.

Secondly, to increase the repertoire of cancer drugs for HNC, her team developed a bioinformatics pipeline to prioritize existing drugs that can be repositioned for the treatment of HNC. Of particular interest is the identification of potential drugs for HNC

Scholarships offered by COMSATS' Centres of Excellence for Member States

Students from COMSATS' Member States are welcome to benefit from the following offers from COMSATS Centres of Excellence:

- Hundred scholarships for students/researchers for postgraduate studies and ten scholarships for post-doctoral fellowships at all campuses of COMSATS Institute of Information Technology (CIIT), Pakistan.
- Seven Ph.D scholarships [4 fully paid and 3 partially paid (50%)] and five-postdoctoral fellowships at the Iranian Research Organization for Science and Technology (IROST), Iran.
- Ten doctoral scholarships/post-doctoral fellowships at the International Center for Chemical and Biological Science (ICCBS), Pakistan.
- Five post-doctoral fellowships at the National Research Centre (NRC), Egypt, and International Centre for Climate and Environment Sciences (ICCES), China, each.
- One post-doctoral fellowship at Bangladesh Council for Scientific and Industrial Research (BCSIR), Bangladesh.

For further details on the scholarships, please visit www.comsats.org or write to tajammul@comsats.org.

Registrations open for Horizon 2020 Seminar

Registrations are now open for Horizon 2020 Seminar being conducted by COMSATS on 7th May 2018, in collaboration with Service Facility Wing of the European Union. The Horizon 2020 seminar will provide an overview to the programme, the application procedure, proposal preparation and submission, as well as the success stories of former applicants.

Horizon 2020 is one of the biggest European Union research and innovation programme. The programme (<https://ec.europa.eu/programmes>) revolves around three key areas: excellence in science, industrial leadership and societal challenges.

For further details on the seminar, please visit www.comsats.org or write to mehwish.durani@comsats.org.

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CERTE-Tunisia
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TÜBİTAK MAM-Turkey
www.mam.gov.tr

Honourable mentions: Ms. Isra Mahmood, Mr. Kehinde Musodiq Sanni, and Mr. Anya Augustine Igwebuike



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