ISLAMIC WORLD ACADEMY OF SCIENCES

Newsletter

April 2023 *Volume 31* *Number 51*

UNDER THE HIGH PATRONAGE OF HIS EXCELLENCY PRESIDENT OF PAKISTAN IAS CONVENED ITS 24TH INTERNATIONAL SCIENTIFIC CONFERENCE

UNDER THE THEME

Challenges to Promote Science & Technology for Socio-Economic Development in OIC Countries

Under the High Patronage of His Excellency President of Pakistan, the Islamic World Academy of Sciences (IAS), which is patronized by H.R.H Prince El-Hassan bin Talal, in collaboration with COMSTECH and the International Center for Chemical and Biological Sciences ICCBS in Karachi, Pakistan, held its 24th Scientific Conference on *Challenges to Promote Science and Technology for Socio-Economic Development in OIC Countries* during 7-8 March 2023. The conference was held at the campus of the International Center for Chemical and Biological Sciences (ICCBS), University of Karachi, Pakistan. The conference identified gaps for the promotion of science, technology and innovation to address the contemporary challenges of development, poverty eradication, environment, education for all, climate change, human health, and energy and water resources. The conference was a hybrid event where some speakers and participants joined via Zoom and was co-sponsored by the Higher Council for Science and Technology (HCST), Jordan. Conference partner institutions from Pakistan were the Pakistan Academy of Sciences (PAS), Dr. Panjwani Memorial Trust, the Husein Ebrahim Jamal Foundation and the Government of Sindh. Fellows of the Islamic World Academy of Sciences attended the conference, as well as world-renowned lecturers and experts, invited speakers, academics, decision-makers, scientists, researchers.

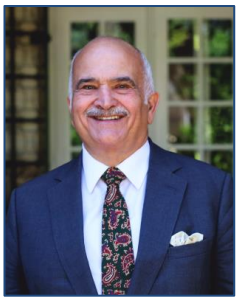
The inaugural ceremony of the conference started with the National Anthem of Pakistan and a recitation from the Holy Qur'an followed by a welcome address by **H.E. Prof. Muhammad Iqbal Choudhary**, Coordinator General, COMSTECH/ Director ICCBS, Pakistan. Prof. Choudhary stated that science for sustainable development is important and that the foundational tenant of the scientific enterprise is to benefit human society while protecting the ecosystem. He also said that it is globally recognized that only Science and Technology can help the goal to meet the enduring challenges of climate change, poverty and hunger among others.

Remarks of **Mr. Aziz Latif Jamal**, Chairman, Husein Ebrahim Jamal Foundation, Pakistan, were delivered by his representative. He said that the conference provides an opportunity for researchers and practitioners to network collaborate and form partnerships with stakeholders from academia industry government and civil society by bringing together experts from different fields and regions.

Ms. Nadira Panjwani, Chairperson of the Dr. Panjwani Memorial Trust, Pakistan, addressed the conference and said that on the subject of Muslims and science it is customary to take great pride in our past and to talk about the grandeur, the Golden Age of Islamic science which was at its peak from the 8th to the 13th Century a period of unprecedented Discovery and learning in all major capital cities of Islam.

H.E. Prof. Adnan Badran, President of the Islamic World Academy of Sciences, welcomed the Fellows and the conference participants and dignitaries and said that the IAS is back with vigor after the interruption of the pandemic and mentioned that our world is passing through a difficult time and crises of fragmentation and that wisdom is badly needed to overcome the fragmentation and confrontation between countries and that we are encountering global economic crises and climate change and floods among others. Prof. Badran also referred to the Davos 2023 declaration that stated that the world, more than ever, needs smart thinking and wise leadership and honest decision makers as citizens of the world to forge the pathways to cooperation, dialogue building bridges of peace to overcome poverty and to allow employability and to force success of socioeconomic development to develop stability rather than destroying bridges of our fragmented world with the power of collaboration.

In his address, **H.E. Prof. Atta-ur-Rahman**, Patron-in Chief, UNESCO Science Laureate, International Centre for Chemical and Biological Sciences, University of Karachi, Pakistan, focused on linkages between Academia and Industry that is vitally important and largely missing. He mentioned that in Western countries about 60% or even more in some cases the R&D expenditure is done by the private sector while in countries like Pakistan less than 1% percent is done by the private sector and it is done by universities and there is hardly any linkage. Prof. Atta-ur-Rahman also mentioned that he is in the process of establishing new kinds of universities in Pakistan for socio-economic development, and these are very different from the normal universities in the sense that they are focused on commercial development and the object or the success of these universities will not be just on the basis of PhDs produced or impact factors or citations, which of course will be a factor taken into account, but will be new products that they have developed, patented internationally and commercialized and that will be key performance indicator. Prof. Atta-ur-Rahman stated that the first such University is already operational, the Pakistan Austrian University, in Haripur with eight foreign universities participating. A second such university is under construction.



Prof. Adnan Badran, IAS President, delivered the message of **H.R.H. Prince El-Hassan bin Talal**, Founding Patron of the Islamic World Academy of Sciences (IAS) and started with conveying condolences to the families of victims of floods of Pakistan. H.R.H referred to the various disasters and conflicts our planet is facing like climate change and food security and stressed partnership and solidarity collaboration is badly needed between scientists to safeguard our future generations. H.R.H called for the development of Zakat, a foundation to coordinate the contribution of the Islamic world and Islamic people who are in urgent need and that Zakat is an effective tool for helping the needy people and community and that we have to strengthen the resilience of vulnerable groups while creating a sense of cultural affinity. The concept of human dignity is so important in the future to embrace the richness of diversity. "Zakat will not discriminate between people's ethnicity and gender, rather it is an umbrella for all people", he said.

Prof. M. Iqbal Choudhary, the Coordinator General, COMSTECH and Director ICCBS, delivered the message of **H.E. President of the Islamic Republic of Pakistan** and Patron of the Islamic World Academy of Sciences (IAS) and started by welcoming all the conference participants and expressed deep gratitude and thanks to his Royal Highness Prince Al Hassan bin Talal of Jordan for his precious patronage of the Islamic World Academy of Sciences. H.E also conveyed his appreciation to COMSTECH and ICCBS for hosting the 24th IAS conference on a subject of increasing importance for the Muslim woman who are facing major challenges in promoting sustainable and inclusive socio-economic development, these challenges relate to poverty

alleviation, food security, low literacy, youth employment, health and well-being and the impact of climate change. These challenges could be overcome successfully by making joint and cognitive efforts by Muslim countries by harnessing the potential of science, technology and Innovation for the benefit of the entire OIC region. The growing severity of these challenges demand efficient and effective actions based on strengthening capacity in the field of science technology and innovation. For this purpose, he said that we need to increase linkages and active collaboration among Academia, industry, governments and organization like COMSTEH, IAS and ICCB.

Prof. Khalid Mahmood Iraqi, Vice Chancellor of University of Karachi, said that we have to believe in science rather than fiction whatever problems we are facing in the Muslim World in terms of hunger in terms of starvation in terms of illiteracy it is because we don't believe in knowledge and in science and it's about application of knowledge and application of science for the betterment of the society; so whatever the research we are doing we have to link the research with the community. He mentioned that there are three triangles in terms of the development of any country; the government, Academia and private sector, and we have to work with these three triangles for the social economic development of any country but unfortunately these three triangles are not collaborating with each other and it is important to provide a platform where they can sit together and frame a policy which link to the betterment of the society.

Prof. Mukhtar Ahmed, Chairman of the Higher Education Commission, Pakistan joined the conference via Zoom from Islamabad. Prof. Ahmed praised the role of Muslim scholars and Muslim scientists and said that they were leaders from the 7th century to the 13th century. and that in any field of science today you can find the contribution of Muslim philosophers and scientists. He stressed that we need to find out why the Muslims have left that path because Muslim scientists are not less than other scientists in the world and people at the top need to do lobbying work for the Muslim society and to take education in science and technology seriously and make a real investment in education.

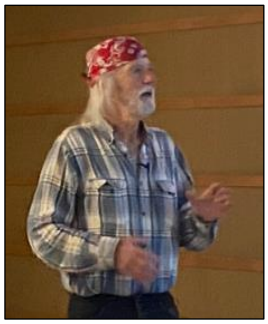
H.E. Syed Murad Ali Shah, Chief Minister, Government of Sindh, Pakistan, was the chief guest of the conference and concluded the inaugural ceremony by welcoming all the participants and scientists attending the conference. H.E stated that the 24th IAS conference is a major science event and is an important step towards a better understanding of how Science and Technology can be effectively deployed to solve enduring problems of poverty, food insecurity and climate change in the Muslim world and that the large conference gathering represents the growing interest and commitment of the Muslim Ummah towards science and technology for human well-being. Issues should not only be solved locally but in partnership with other nations to handle global challenges.

At the end of the ceremony, Prof. Adnan Badran and Prof. M. Iqbal Choudhary presented shields to the inaugural ceremony panelists.

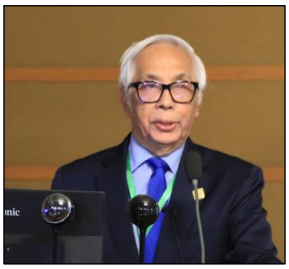
Prof. Choudhary, Prof. Badran and H.E. Syed Murad Ali Shah, Chief Minister, Government of Sindh, Pakistan.

Awarding of shields during the inaugural ceremony.

The first academic session of the conference included the keynotes presentations starting with a presentation by **Prof. Atta-Ur-Rahman** FIAS, *UNESCO Science* v *Laureate and Professor Emeritus, International Centre for Chemical and Biological Sciences, University of Karachi, Pakistan,* on **Higher Education, Science and Technology-Imperatives for Socio-Economic Development.**



Next was Mr. **Michael Wadleigh**, *Founder, The Homo Sapiens Foundation (UNESCO), Science Activist, Oscar-winning Director, USA,* with a presentation on **UNESCO Open Data to Stop Trends to Global Socio-economic Collapse.**



Prof. Zakri Abdul Hamid FIAS, *Founding Fellow, International Science Council, Science Advisor to the Sixth Prime Minister of Malaysia, Chairman, Atri Advisory, Malaysia,* presented on **The Role of Science, Technology and Innovation in Achieving the SDGs in OIC Countries**

Prof. Syed M. Qaim FIAS, *Institute of Neuroscience and Medicine, Nuclear Chemistry, Forschungszentrum Jülich, Germany,* presented on the topic of **Standardisation of Production Data of Medical Radionuclides under German-Pakistan Cooperation.**

Next **Prof. Ahmed Azad** FIAS, *Former Chief Research Scientist, CSIRO Division of Biomolecular Engineering, Melbourne Australia,* presented a paper on **Producing Affordable Biotech Medicines for the Islamic World: Opportunities and Requirements**

Last in the keynote's session, **Prof. Zulfiqar Bhutta**, *Professor and Founding Director of the Institute for Global Health and Development and the Centre of Excellence in Women and Child Health, Aga Khan University and Co-Director, Centre for Global Child Health, Hospital for Sick Children, Toronto, Canada,* through Zoom, presented on **Status and Progress in Health and Health-related Sustainable Development Goals in the Islamic World; Challenges and Opportunities.**

On the second day of the conference, session 2 started with a presentation by **Prof. Adnan Badran** FIAS, *President, IAS and Chancellor, University of Petra and Chairman of the Board of Trustees of the University of Jordan, Jordan,* where he presented on **Digital Transformation: Technology and Innovation for Socio-Economic Development.**

Next, **Prof. M. Iqbal Choudhary** FIAS, *Coordinator General COMSTECH/ Director ICCBS, Pakistan,* presented on **Combating the Drug Development Challenges with Sustainable and Inclusive Drug Discovery and Development - An Emerging Paradigm.**

Prof. Ali Moosavi-Movahedi FIAS, *Professor of Biophysics, University of Tehran, Inst of Biochemistry Biophysics, Iran,* presented on **Halal Products Biomolecular Science and Healthy Life**

Last in this session was **Prof. Ilkay Erdogan Orhan** FIAS, *Dean, Faculty of Pharmacy, Gazi University, Türkiye,* who presented on **Drug Research Through Nature - From Lab to Patent.**

Session 3 started with **Prof. Mohammed Besri**, *Emeritus Professor, Hassan II Institute of Agronomy and Veterinary Medicine, Morocco,* who presented on **The Montreal Protocol and the Ozone Depleting Substances Phase-Out: Impact on Human, Plants and Environment.**

Second presentation was by **Prof. Zabta Shinwari** FIAS, *Vice President, IAS and National Professor and Professor Emeritus, Quaid-i-Azam University, Pakistan,* on **Plant Sciences: A Tool to Achieve Targets of SDGs.**

Next, **Prof. Liaquat Ali** FIAS, *Honorary Chief Scientist & Advisor, Pothikrit Institute of Health Studies (PIHS), Bangladesh,* with a presentation on **Health as an Ethical Issue: Lessons from the COVID-19 Pandemic.**

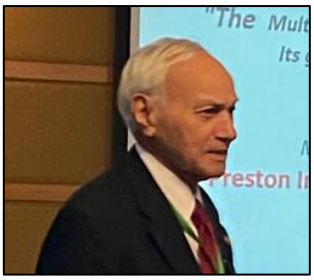
Last in this session was **Prof. Abdullah Al Musa**, *Secretary General, Higher Council for Science and Technology (HCST), Jordan,* who presented on **Biodiversity Economics.**

Session 4 started with **Prof. Hala El-Khozondar** FIAS, *Professor, Islamic University of Gaza, Palestine,* with a presentation entitled **Metamaterials and their Applications.**

Next in this session was **Prof. Irfan Ahmad**, *Assistant Dean for Research, Carle Illinois College of Medicine, University of Illinois at Urbana-Champaign, USA,* with a presentation entitled **Research and Innovation for Economic Development.**

Following was **Prof. Irshad Hussain**, *Professor, Department of Chemistry & Chemical Engineering, SBA School of Science & Engineering (SSE), Lahore University of Management Sciences (LUMS), Pakistan,* with a presentation on **Functional Nanomaterials for Biomedical Applications.**

Prof. Jackie Ying FIAS, *Founding Executive Director, NanoBio Lab, Institute of Materials Research and Engineering, USA* joined the conference through Zoom and presented on **Design and Synthesis of Nanomaterials for Biomedical and Energy Applications.**



Last in this session**, Prof. Noor M. Butt** FIAS, *Professor & Chairman, Preston Institute of Nano Science & Technology (PINSAT), Preston University Kohat, Pakistan,* presented his paper entitled **The Multidisciplinary BS Degree in Nanoscience and Nanotechnology: Its growing Academic and Socio-Economic Importance.**

Lastly, the conference included a Panel Discussion Session on **How STI can meet the Challenges of Socio-economic Development in OIC Countries**, chaired by Prof. Adnan Badran FIAS (Jordan) with panelists Prof. Atta-Ur-Rahman (Pakistan), Prof. M. Iqbal Choudhary FIAS (Pakistan), Mr. Michael Wadleigh (USA) and Prof. Hasan Mandal (Turkey) who joined on Zoom.

At the conclusion of the Conference, Prof. Atta-ur-Rahman made some closing remarks and read the adopted IAS 2023 Karachi Declaration on *Challenges to Promote Science & Technology for Socio-Economic Development in OIC Countries.*

The 24th Islamic World Academy of Sciences Conference
on
"Challenges to Promote Science & Technology for Socio-Economic Development in OIC Countries."

Conference Declaration

Adopted at Karachi, Pakistan
On Wednesday, 8 March 2023

The Islamic World Academy of Sciences (IAS), the International Center for Chemical and Biological Sciences (ICCBS), the Ministerial Standing Committee on Scientific and Technological Cooperation of the OIC (COMSTECH), and the Higher Council for Science and Technology (HCST) extend their appreciation and gratitude to His Excellency the President of Pakistan for his high patronage of the conference and to His Royal Highness Prince El Hassan bin Talal, the Founding patron of IAS.

1. Whereas, seeking knowledge is upheld in Islam.

2. Whereas, knowledge is derived from research observation and development on our planet sphere, geosphere, biosphere and ecosphere and cybersphere.

3. Whereas, the delivery of R&D in science, technology and innovation (STI) ecosystem is used for promotion of socio-economic development.

4. Whereas, OIC member states recognized education, science and technology as a vehicle for socio–economic transformation in 2020, reconfirmed in 2021 OIC summit conference.

5. Whereas, OIC countries and humanity in general are facing global, natural and man-made disasters; *i. e.*, earthquakes, floods, hurricanes, droughts, climate change, pollution of (drinking water, oceans, land and biosphere) resulting in loss of biodiversity, disrupting food chain supply, energy deficiency, poor health and hence increase in poverty.

We the Fellows of the IAS and participants in the IAS 24th conference entitled *"Challenges to Promote Science & Technology for Socio-Economic Development in OIC Countries."* Held in Karachi on 7-8 March 2023 in partnership with ICCBS;

1. Call on OIC member states for the inclusion of enquiry-based education to enhance creativity, curiosity and problem solving for building-capacity in STI and enriching human resources.

2. Call on OIC member states to formulate and implement National Innovation Policies in order to promote entrepreneurship targeted at manufacture and export of high technology goods.

3. Call on OIC member states to identify centers of excellence for the IAS network STIs leading to regional R&D delivery or **commons** scientific application, innovation and leading to socio-economic development and digital transformation.

4. Bridge the academia and industry for joint R&D leading to socio-economic development.

5. Create social and technology parks and incubators to commercialize the delivery of research and innovations into start-up SMEs and enhance diversification of new materials and quality control.

6. Create a consortium for a sustainable **triangle of energy-water-food security** linked to IAS platform to network reputable research centers in OIC countries for self-reliance and meeting the SDGs, and call on COMSTECH to increase their mobility grants to scientists from LDCs to centers of excellence for training and research in combating poverty and hunger.

7. Strengthen world class research institutions, such as the International Center for Chemical and Biological Sciences, at Karachi University, and use them for human resource development in frontier fields of science and technology in the OIC region.

8. Align cooperation and collaboration with private sector on achieving a sustainable triangle of food, water and energy security, for future generations.

9. Promote cooperation and collaboration of the private sectors for health security of vaccines and drugs to embark across borders, a joint enterprise of manufacturing vaccines and needed drugs for emerging pandemics in the OIC member states.

10. Academia and research centers of OIC member states should encourage interdisciplinary research to deal with **"common"** problems of the Islamic world, including fields of humanity and social sciences such as climate change, the triangle for sustainability, population, poverty, Medicare etc.

11. Urge the OIC member states to invest at least 1% of their GDP in research in science, technology and innovation (STI) for socio-economic development.

12. Encourage the OIC member states to provide sustained support to the OIC S&T institutions, such as COMSTECH and IAS so that they can fulfil their assigned mandate.

13. Encourage the OIC member states to venture into getting benefits of game changing technologies like nanotechnology. Artificial Intelligence (AI), and other emerging technologies, including radionuclide medical technology leading to the 4th Industrial Revolution.

Group photo of some IAS Fellows.

IAS Council holds its 45th Meeting in Karachi, Pakistan

The 45th Meeting of the IAS Council was held at the L.E.J. National Science Information Center in Karachi, Pakistan on 8 March 2023, after the conclusion of the IAS 24th Conference with the participation of IAS Council Members including IAS-President and DG, Prof. Adnan Badran, who outlined the activities undertaken by the IAS since October 2022. In his report to the Council, Prof. Badran talked about the various activities that the IAS has been involved in including organizing the 24th IAS Conference in Karachi and preparing for future Conferences and online activities like webinars and workshops. The Council undertook a thorough review of the activities of the IAS.

IAS General Assembly holds its 25th Meeting Karachi, Pakistan

The General Assembly of the Islamic World Academy of Sciences held its 25th meeting at the L.E.J. National Science Information Center, Karachi, Pakistan on 8 March 2023. The meeting was attended by a number of IAS Fellows as well as the IAS President. The General Assembly after approving the minutes of the previous meeting took note of the very detailed report presented by the IAS President on the various activities implemented by IAS from its headquarters in Amman. It went on to discuss an extensive agenda that included a review of financial statements, IAS programs, as well as a number of organizational matters related to the IAS. Prof. Elias Baydoun, Treasurer, IAS, talked in brief about the finances of the IAS.

Group photo of some IAS Fellows and conference participants.

MESSAGE FROM DR. ARIF ALVI
PRESIDENT OF THE ISLAMIC REPUBLIC OF PAKISTAN*

on the occasion of the 24th International Scientific Conference of the Islamic World Academy of Sciences (IAS) on "Challenges to Promote Science and Technology for Scio-Economic Development in OIC Countries"

I would like to warmly welcome all of you to the 24th International Scientific Conference of the Islamic World Academy of Sciences on "Challenges to Promote Science and Technology for Socio-Economic Development in OIC Countries" which is being jointly organized by the Islamic World Academy of Sciences (IAS), Organization of Islamic Cooperation Ministerial Standing Committee on Scientific and Technological Cooperation (COMSTECH) and the International Centre for Chemical and Biological Sciences (ICCBS).

I would like to express our deep gratitude and thanks to His Royal Highness Prince El-Hassan bin Talal for his gracious patronage of the Islamic World Academy of Sciences. I also wish to convey our appreciation to COMSTECH and ICCBS for hosting the Conference of the Islamic World Academy of Sciences on a subject of increasing importance for the Muslim Ummah.

As you are aware, Muslim Ummah is facing major challenges in promoting sustainable and inclusive socio-economic development. These challenges relate to poverty alleviation, food security, low literacy, youth employment, health and well- being and the impacts of climate change. These challenges could be overcome successfully by making joint and coordinated efforts by the Muslim countries by harnessing the potential of science, technology and innovation for the benefit of the entire OIC region. The growing severity of these challenges demands efficient and effective actions based on strengthening capacity in the fields of science, technology and innovation.

For this purpose, we need to increase linkages and active collaborations among academia, industry, governments and organizations like COMSTECH, IAS, and ICCBS. Business communities, IT professionals, scientists, and youth of OIC countries must be given more opportunities to interact, share their experiences, and learn from each other. Furthermore, they must undertake joint initiatives and projects in the field of Science and Technology, particularly in emerging fields of IT, like Artificial Intelligence, Cyber Security, Data Analysis, and Cloud Computing.

It is a matter of great satisfaction that COMSTECH has initiated a large number of programs for the development of science, technology and innovation in the Islamic countries. In this endeavour, COMSTECH has made valuable contribution in establishing the Islamic World Academy of Sciences. Another noteworthy action by COMSTECH is to align its programs with the Sustainable Development Goals (SDGs) of the 2030 Development Agenda.

In the end, I would like to call on distinguished fellows of the Islamic World Academy of Sciences to support COMSTECH in this noble mission to speed up scientific and technological progress in the Islamic countries as per COMSTECH's mandate of enhancing cooperation in science and technology and creating institutional structures for research, and development.

The challenges of promoting socio-economic development in the Muslim Ummah are significant. But I am confident that you will succeed in your objectives. I wish you a productive and successful meeting.

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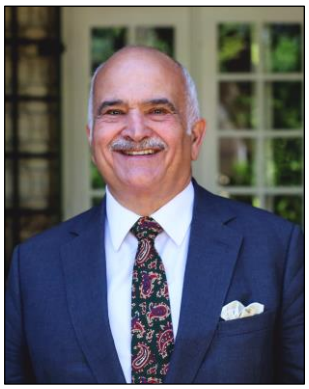
* *Presented by Prof. Iqbal Choudhary, Coordinator General, COMSTECH/ Director ICCBS*

BUILDING BRIDGES IN THE OIC COUNTRIES*

Statement by His Royal Highness Prince El Hassan bin Talal at the 24th Conference of the Islamic World Academy of Sciences (IAS)
"Challenges to Promote Science & Technology for Socio-Economic Development in OIC Countries"
7-8 March, 2023
Karachi-Pakistan



Dear Fellows of the Academy,
Dear Guests,

Disasters, whether elemental, foreseeable, deliberate, or accidental, carry incalculable harm to individuals, families, towns, cities, regions, and entire countries on a physical, social, emotional, and economic level that numbers and statistics cannot convey, as exemplified by the devastating floods in Pakistan and the earthquakes that have hit Syria and Turkey.

In memory of those who have passed away, let us observe a moment of silence. God almighty bless them all.
Man-made and natural disasters are transboundary and complex, and therefore require us to develop a critical mass of interdisciplinary and multidisciplinary science.

Even if emissions meet the 2015 Paris Agreement reduction pledges, children born after 2020 will, on average, face seven times more scorching heatwaves, almost three times more droughts, three times as many crop failures and river floods, and twice as many wildfires during their lives than their grandparents.

Choosing solidarity, interdisciplinary cooperation, and multilateralism is vital for the betterment of all. There is, therefore, a collective and intergenerational responsibility to advocate for the advancement of *regional commons* through evidence-based *policy*, rather than *politics*.

As a consequence, I encourage policy makers and members of the scientific community of OIC countries to recognise that science transcends political boundaries, making it an effective tool for collaboration.

As such, it is essential to encourage collaboration between centres of excellence in OIC member states.
Whether in the context of climate change, food security, biodiversity, or poverty reduction, all things falling under the umbrella of the water-energy-food security nexus, human welfare and dignity must be the guiding principles for collaboration.

Partnerships and cooperation within this nexus may contribute to self-reliance and quality of life, particularly for the most vulnerable and marginalized.

It may be tempting to view the pandemic or natural disasters as one-off events, but both shocks to the global system demonstrate that in the absence of intra-independence, interdependence and interconnectedness are just a recipe for fragility and insecurity.

For decades I have called for the development of a Zakat Foundation to coordinate the collection of zakat and direct it across borders to individuals and communities in urgent need. By institutionalizing Zakat, a transboundary cultural and religious duty, we can strengthen the resilience of vulnerable groups while creating a sense of cultural affinity.

The concept of human dignity, or karama insaniya (in Arabic), does not discriminate; it embraces the richness of diversity. Zakat, too, does not discriminate and would equally help anyone in need, regardless of their race, religion, social status, or anything else.

There is no doubt that science, technology and innovation all play a key role in socio-economic development of OIC countries, but policies must always be made with reference to human dignity and cultural affinity in order to improve people's lives in the long-term.

It is also essential that the "commons" for socio-economic development are created through an inquiry-based learning environment that encourages cooperation, critical thinking, and innovation.
My best wishes go out to you in this crucial endeavour, to which we are all dedicated.

* *Presented by Prof. Adnan Badran, President, IAS.*

ADDRESS OF H. E. SYED MURAD ALI SHAH
CHIEF MINISTER OF SINDH

Inauguration of the 24th Conference of the Islamic World Academy of Sciences on
"Challenges to Promote Science and Technology for Socio-economic Development in OIC Countries"

Prof. Dr. Adnan Badran, President of the World Academy of Sciences
Prof. Dr. Atta-ur-Rahman Patron in Chief
Prof. Dr. Muhammad Iqbal Choudhary, Coordinator General COMSTECH
Prof. Dr. Khalid Mahmood Iraqi, Vice Chancellor, University of Karachi
Mr. Aziz Latif Jamal, Chairman Husein Ebrahim Jamal Foundation
Ms. Nadira Panjwani, Chairperson Dr. Panjwani Memorial Trust
Distinguished Fellows of the IAS
Foreign and Local Delegates

Diplomats

Ladies and Gentlemen

Assalam o alaikum

It is indeed a great pleasure for me to inaugurate "the 24th Conference of the IAS on, "Challenges to Promote Science and Technology for Socio-economic Development in OIC Countries" at the International Center for Chemical and Biological Sciences. I am pleased to see a large number of distinguished fellows participating in this international event. This major science event is an important step forward towards a better understanding how science and technology can be effectively deployed to solve enduring problems of poverty, food insecurity, climate change, in the Muslim world. This gathering represents the growing interest and commitment of Muslim Ummah towards the science and technology for human wellbeing. Personally, for me, participation in the events of this type is always a reassuring and gratifying experience.

I am pleased to learn that this 24th Scientific Conference of the IAS is organized under the patronage of the HE President of Pakistan and HRH Prince Hasan bin Talal. I have been told that IAS, established by the COMSTECH, is rendering excellent services to science in several years through promoting understanding and appreciation of the role of science and technology in sustainable development of the Muslim world. The IAS is a world renowned science Academy based in Amman Jordan, established by the COMSTECH the OIC's Ministerial Standing Committee for Sciences and Technology Cooperation. It comprises 57 Ministers of Science & Technology of the 57 OIC member states, chaired by the President of Pakistan. I congratulate the IAS, COMSTECH, and the host institution ICCBS for their collective efforts in moving towards creating a renaissance of science and technology in the Muslim world.

Being a professional Engineer, I am very much aware of the importance of the need of research in science and technology. It is only through the applications of science and technology that we can handle the enduring challenges of poverty, climate change, food insecurity, increasing disease burdens, that world faces today. We need to not only solve many local issues, but also partner with other nations in handling global challenges. The theme of the event is therefore timely and significant.

Ladies and Gentlemen

In the enterprise of science and technology, strong research and development institutions play a key role. I am pleased to see that our premier research institution, the International Center for Chemical and Biological Sciences constantly is striving to upgrade its capacity and human resources for frontier research and graduate training in chemical, biomedical and biochemical sciences. This center is an excellent example of the strong commitment of our private sector, Federal and Provincial Governments, International donors and our scientists and researchers towards the science and technology based development in Pakistan.

It is heartening to learn that the International Center for Chemical and Biological Sciences has been recognized as the UNESCO and OIC Center of Excellence, as well as the WHO collaborating center. The ICCBS has received Best Science Institution in Muslim World Prize from the Islamic Development Bank twice in 2004 and 2010. The ICCBS is also the only center where over 200 scientists from all over the world, including western countries, are annually visiting for research training and joint projects. These

are indeed unique honors on which our nation take pride. I understand that it was only possible through the internationally recognized academic status and excellent leaderships of Prof. Atta-ur-Rahman and Prof. Iqbal Choudhary. I must acknowledge here the vision and patriotism of Nadira Panjwani Sahiba, Chairperson Dr. Panjwani Trust, and Mr. Aziz Latif Jamal, Chairman Husein Ebrahim Jamal Foundation, which led to the establishment of the world research centers at the ICCBS. Their role in the promotion of higher education and scientific research in Pakistan will always be cherished. Personally, for me, visiting a center of excellence of this stature is always a reassuring and gratifying experience.

We at the Sindh Government have placed the ICCBS in the center of our science and technology based initiatives. Various Ministries of my government are working closely with the ICCBS management to establish research centers, upgrade existing laboratory infrastructure of the province, as well to conduct some of the enduring issues in health and agriculture which province is facing today. This includes the establishment of Sindh Serology and DNA Forensic lab., upgradation of Chemico-bacterial lab in Karachi, and establishment of Traditional Medicine Research Center. I am also delighted to learn that my idea of the establishment of seamless learning platform for the universities has been implemented as the SIREN (Sindh Innovation, Research, and Education Network) by the ICCBS which connects leading universities of Sindh. My Government has also decided to declare five centers of the ICCBS as Sindh Health Care Research facilities in fields such as regenerative medicine, disease genomics and pharmaceutical research.

At the end I must thank the COMSTECH, with Prof. Iqbal Choudhary as its Coordinator General, for organizing this major international event at the ICCBS in collaboration of the Islamic World Academy of Sciences and the ICCBS, University of Karachi, for having me invited to this prestigious occasion. I also assure you of the firm commitment of my Government towards protecting and strengthening Universities and research centers in the province and linking them to production sector for the benefit of common people.

Ladies and Gentlemen

Thank you very much for your presence here this morning.

ADDRESS OF H.E. PROF. ADNAN BADRAN PRESIDENT, IAS

Opening Address on the occasion of the 24th Conference of the Islamic World Academy of Sciences (IAS) on "Challenges to Promote Science & Technology for Socio-Economic Development In OIC Countries" Karachi-Pakistan, 7-8 March, 2023

Dear Fellows of the Academy,
Ladies and Gentlemen,

Since our 23rd IAS conference which was held in Rabat under the Patronage of His Majesty King Mohammad VI of Morocco, two fellows of our academy Prof. Abdul Salam Majali of Jordan and Prof. Abdul Latif Ibrahim of Malaysia, have passed away, our condolences and God bless their souls. May I ask for a moment of silence.

Our academy is back with vigour after its interruption by the pandemic. Our world is passing through crisis of fragmentation. Wisdom is so badly needed to meet the interconnected challenges.
We are encountering a global economic crisis, climate change, income inequality, tension between East and West, loss of trust and lack of resilience.

As stated in Davos 2023 declaration, that the world more than ever need, smart thinking, wise leaders, honest decision makers, academia responsible citizens to forge the pathways to cooperation, dialogue, building bridges of peace and stability, rather than destroying bridges of our fragmented world.

With the power of collaboration, innovation and ingenuity, we have the capacity to turn challenges into opportunities particularly in the Islamic world.

UNESCO after world war II in 1945 was created to end all wars, with preamble of its constitution stating: "If wars start in the minds of men and women, then we can build the defences of peace in the minds of men and women through the

pillars of **education, science, culture** and **communication**.

One great pillar of education is "**Learning to live with others**", respect other cultures, other traditions and other values, and respect differences among human beings. Diversity is the virtue of life diversity of fauna and flora of our planet, diversity of minds and thought and expression, not to discriminate against others' beliefs, color, gender, ethnicity or who differs in his thought accept differences.

So, science is the **common ground,** is the **meeting place** for us in the Islamic world as pathway to socio-economic development. Cooperation and collaboration among scientists and scientific centers are essential to achieve progress and to migrate OIC countries from developing into a developed world.
Such cooperation to become effective requires governance and management of STI to speed up the catalysis to its climax for socio- economic development.

A consortium of centers of excellence in OIC countries is required to work on a **common problem** shared and cared by all countries as for example, **energy-water-food security** for a sustainable triangle, and this is for one and cooperation and collaboration in **frontier area of sciences,** and this is for two.

In the Islamic world we should bridge the delivery of R&D into socio-economic development. The linkage between academia and industry is absent and there is a gap in most member states. Partnership with the private sector is essential for commercialization.

Finally, with those remarks, I wish you a successful conference of deliberations and declaration.

WELCOME REMARKS OF PROF. M. IQBAL CHOUDHARY

Coordinator General, COMSTECH
Director, ICCBS, University of Karachi, Pakistan

Honorable Syed Murad Ali Shah, The Chief Minister
Prof. Atta-ur-Rahman FRS Patron in Chief
Prof. Adnan Badran, President of the Islamic World Academy of Sciences
Prof. Khalid Mahmood Iraqi, The Vice Chancellor
Mr. Aziz Latif Jamal Chairman Husein Ebrahim Jamal Foundation
Ms. Nadira Panjwani, Chairperson Dr. Panjwani Memorial Trust
Mohtaram Mureed Rahimon sahib
Dignitaries, Diplomats, Distinguished Fellows
Ladies and Gentlemen

Assalam o alaikum

1. I am very pleased to welcome the Honorable Chief Minister, distinguished fellows of the Islamic World Academy of Sciences, and other valued guests on behalf of the ICCBS and OIC-COMSTECH.

2. The theme of the event "sciences for sustainable development" is timely and important. The foundational tenant of scientific enterprise is to benefit the human society, while protecting the ecosystem we live in. It is now globally recognized that only science and technology can help the world to meet the enduring challenges of climate change, poverty, and hunger.

3. We are fortunate to have with us outstanding scholars to speak on various aspects of the topic (Dr. Michael Wadliegh Oscar winning film maker and climate activist as the representative of UNESCO).

4. Science and technology has played a central role in global transformation. On the brighter side scientific breakthroughs, such as Green

revolution and biotechnology has protected us against widespread famine, and antibiotics and antivirals have saved millions of lives. According to McKincy's report on "Next Big Things", post-industrial economies of the world will be driven by 12 emerging technologies, including big data, block chain, robotics, IOT, advanced energy storage devises, autonomous vehicle, third generation genomics, etc. These disruptive technologies will drive massive economic transformation and collectively generate wealth of 14 to 33 trillion USD by 2028.

5. On the other hand, in many cases the fruits of human ingenuity have not reached to the people who needed them the most. This has led to unprecedented inequality, and social distortion. Dissymmetry in scientific development and their applications has created an inherent conflict between the haves and have-nots.

6. Therefore, development in science and technology is important but more important is to develop a science which is socially responsible, economically inclusive, and environmentally sustainable. Science with values of benefiting humanity, bringing ease in the lives of masses, and ensuring lasting peace and prosperity, while in complete harmony with the nature.

7. Unfortunately, the OIC region, home to over 1.9 billion people, is faced with daunting challenges of conflicts, poverty, and environmental degradation. Despite these challenges, it is the youthful population that would provide unprecedented opportunities and hope if their creative potential is fully unleashed.

8. The International Center for Chemical and Biological Sciences, established in 1966, is an excellent example of private-public partnership where leading philanthropic organizations have generously contributed in the development of world's finest research infrastructure. The ICCBS, since its inception, has contributed in global human resource development in frontier fields of science. Its thousands of alumni in five continents of the world are the permanent ambassadors of Pakistan. Currently over 600 Ph. D. students from home and abroad are benefiting from the excellence of the ICCBS. The center is also serving the industrial sector and federal and provincial governments in critical areas of national needs.

9. *Ladies and Gentlemen*

I also serve as the Coordinator General of the OIC Standing Committee COMSTECH. The COMSTECH, comprise of 57 Ministers. In my tenure, COMSTECH has initiated major programs including:

1. OIC's largest research fellowship programs
2. Health Africa initiatives
3. Capacity building in food security
4. 500 Fellowships for Palestinians
5. Program for refugee scientists
6. OIC Technology Portal
7. Research grant programs with IFS and ICGEB
8. Yemen, Sudan, Somalia, Kirghizstan, and Somalia programs.

COMSTECH has established various institutions, including the Islamic World Academy of Sciences and 13 inter-Islamic networks for the S&T development in different fields.

At the end I would like to express my gratitude to our Chief Minister for the sustained support he has provided to the ICCBS for all these years, and our distinguished and valued guests for their presence here this morning.

Assalam o alaikum Wa rahmatullah

REMARKS OF
PROF. KHALID MAHMOOD IRAQI
Vice Chancellor, University of Karachi, Pakistan

Honorable Chief Minister Syed Murad Shah, Chief Minister Sindh
Prof. Dr. Atta-ur-Rahman FRS, Patron in Chief ICCBS
Prof. Dr. Adnan Badran Former Prime Minister of Jordan, and President of The Islamic World Academy of Sciences
Prof. Dr. M. Iqbal Choudhary, Coordinator General OIC-COMSTECH and Director ICCBS
Mr. Aziz Latif Jamal, Chairman Husein Ebrahm Jalam Foundation
Ms. Nadira Panjwani, Chairperson Dr. Panjwani Memorial Trust
Diplomats
Distinguished Delegates
Ladies and Gentlemen,
Assalam o alaikum

1. On behalf of the University of Karachi, I am pleased to welcome the Honorable Chief Guest Syed Murad Ali Shah, distinguished fellows of the World Academy of Sciences, and valued guests at the inauguration of this prestigious pan Islamic event.

2. Science and technology are important aspects of our lives as the play a central role in socioeconomic development of any nation.

3. I am happy to note the IAS is organizing its 24th international conference on the application of science and technology for sustainable socioeconomic development in the OIC region.
4. The Muslim world faces numerous challenges, including food, energy and water scarcity, overwhelming disease burden, and huge negative impact of climate extremities. As a result, poverty, conflicts, deprivation and unemployment are effecting the lives of millions of people all across the Muslim lands.

5. In such a gloomy situation, science and technology and modern day innovation are the only way towards a sustainable and inclusive socioeconomic development.

6. In this context the event like this with brightest minds of the Muslim world, present at one platform, can guide the policy makers, politicians, production sector and universities towards coherent, bipartisan, and long term policies and plans of action.

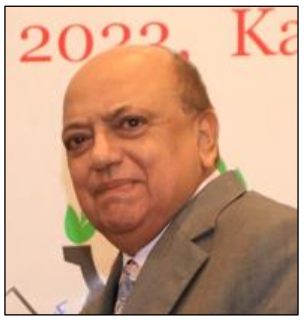
7. *Ladies and gentlemen,*
   The International Center for Chemical and Biological Sciences of University of Karachi is committed to not only build human capacity but also to provide necessary technological basis for science based development of Pakistan. The ICCBS is premier institution of excellence with global recognition. We at the University of Karachi are proud to host this world class institution which is also playing key role in global capacity building.

8. The excellence of the ICCBS is internationally recognized, and impact of its services for the nation is far beyond the scope of these short remarks. This legendary institution owes its phenomenal success to tireless, and sincere leadership of Prof. Salim uz zaman Siddiqui to Prof. Atta-ur-Rahman, and now my dear brother Prof. Muhammad Iqbal Choudhary and their outstanding teams.

9. *Ladies and Gentlemen*,
   Allow me at this moment to recognize The Islamic World Academy of Sciences, COMSTECH and ICCBS for jointly organizing this major international event at the University of Karachi. The largest public sector and second oldest university of Pakistan.
10. As I conclude I wish this event an immense success and looking forward to the outcome which I promise to highlight at all the major fora.
11. Thank you very much Honorable Chief Minister and Ladies and Gentlemen for your presence here this morning.

REMARKS OF
PROF. AZIZ LATIF JAMAL

Chairman, Husein Ebrahim Jamal Foundation, Pakistan



Honorable Chief Minister Syed Murad Ali Shah
Vice Chancellor Prof. Dr. Khalid Mahmood Iraqi
Prof. Dr. Atta-ur-Rahman FRS, Patron in Chief ICCBS
Prof. Dr. Adnan Badran, President of the Islamic World Academy of Sciences
Prof. Dr. Muhammad Iqbal Choudhary, Director ICCBS and Coordinator General COMSTECH
Mohtarma Nadira Panjwani sahiba, Chairperson Dr. Panjwani Memorial Trust
Distinguished Delegates
Excellencies
Ladies and Gentlemen
Assalam o alaikum

1. It is with greatest pleasure that I welcome the Honorable Chief Minister, and all of you to the inauguration ceremony of the 24th **International Conference on Science and Technology for Sustainable Socio-economic Development of the OIC Region.**

2. This major event is jointly organized by the OIC Standing Committee on Science and Technology (COMSTECH) and International Center for Chemical and Biological Sciences. Over 50 participants, including over 30 fellows of the IAS from some 19 countries, are here to attend this important event.

3. The IAS is one the key organization established by COMSTECH General Assembly. I am pleased to learn that IAS is working closely with the COMSTECH and ICCBS for the capacity building of the young scholars from OIC countries for the science and technology based socio-economic development of the OIC region.

4. *Ladies and Gentlemen*

   National capacity in science and technology has an strategic importance, and thus establishing, nurturing, and strengthening worked class research institutions are imperative for sustainable science based socioeconomic development. With this vision my late father Mr. Latif Ebrahim Jamal, has decided to invest in the establishment of Husein Ebrahim Jamal Research Institute of Chemistry, an institution which is now a global center of excellence in frontier research in the field of chemical and biochemical sciences. The HEJ Foundation since then has continued the traditions of legendary Latif Ebrahim Jamal sahib, and has established another two large centers at the International Center for Chemical and Biological Sciences. Our commitment remains firm and strong, as we fully appreciate that magnificent institution, led by three generations of most committed eminent scientists, is helping our beloved country Pakistan at every time of need. This institute has laid a strong skill base for the nation and produced much needed Ph. D. level manpower. In future too, I and next generation of Jamal family will continue to support this magnificent institution for the greater good of the country.

5. There are three major contours of this S&T capacity building initiatives. First and foremost is the human capacity building for which the Husein Ebrahim Jamal Foundation has established a myriad of institutions, from schools to colleges, vocational training centers, as well to university campuses. The second important contour is the establishment of high quality research and development institutions in frontier technologies. We are glad that along with the world famous H. E. J. Research Institute, we have also contributed a research building for the nanotechnology center, the only one of its kind in the country. The third is the linkages between the academic research with industrial sector. For this purpose, our foundation is working very hard to bring top industrialists of the country to the ICCBS and providing them platform to benefit from the excellence of this premier research establishment.

6. At the end I would like to express my gratitude to the leadership of the ICCBS Prof. Dr. Atta-ur-Rahman FRS and Prof. Dr. M. Iqbal Choudhary, for their life long struggle to strengthen, nurture and protect this world class institution. We are committed to stand by them at all turbulent times as this institution is both a national asset and national pride.

7. I would like to thank once again Excellency the Chief Minister for gracing the occasion and for his sustained support and patronage to the ICCBS.

8. *Ladies and Gentlemen*
   I am indebted to your presence here this morning as well.

REMARKS OF MS. NADIRA PANJWANI

Chairperson, Dr. Panjwani Memorial Trust, Pakistan

Excellency Syed Murad Ali Shah Sahib,
Dr Azra Fazal Pecheou Sahiba,
Distinguished Panel
Ladies & Gentlemen,

Assalamun Alaikum & Good Morning

On behalf of myself and all members of the Panjwani Trust which is the founding body of the Dr Panjwani Center for Molecular Medicine & Drug Research at ICCBS, it is my pleasure, it is my privilege to welcome all of you to today's inaugural session for the 24th Scientific Conference of the Islamic Academy of Sciences.

As you know, and this is also for the information of our foreign guests here, this center is one of the premier scientific establishments of Pakistan and a hub for frequent scientific gatherings.

The opportunity of hosting this prestigious international event of the Muslim World of science is indeed a unique honour for all of us.

Ladies & Gentlemen,

On the subject of Muslims and Science, it is customary to take great pride in our past and to talk about the grandeur of the Golden age of Islamic science which roughly speaking was at its peak from the 8th to the 13th century AD.

This was a period of unprecedented discovery and learning in all major capital cities of Islam like Baghdad, Cairo and Cordoba, which became citadels of science, philosophy, medicine and education.

However, the intellectual decline that set in after the Mongolian invasions, the splintering of the Abbasi dynasty, the misplaced religious intolerance towards the spirit of scientific inquiry, the shifting of focus from science to religious dogma and the consequent surge in the political power of religious leaders, gradually converted the blossoming garden of Islamic science into a dry desert which has remained parched and barren to this day.

There may be the occasional examples of personal or organizational excellence here and there, but this does not address the larger problem of our failure in the fields of technology, innovation, R&D and the production of ideas.

57 Muslim countries of the world since 1901 have received only 3 Nobel awards in the fields of science and all three did their award-winning research outside their home countries.

Muslim countries on average spend far less than 1% of their GDP on research and development and their contribution to global scientific literature is a meagre 1.2%.

Today we are in a state of permanent dependence on the West which thrives on the dynamism of its scientific and technological advancements.

It is evident that lack of political will, lack of a futuristic vision and the failure to keep up with the rapid pace of change are responsible for this disappointing situation. Whenever a speech is censored, whenever a thought is forbidden and whenever a freedom is denied, the chains of intellectual captivity are cast. To break these chains, we need to awaken our minds, our hearts and our collective conscious.

To those of you, who are thought leaders and decision makers, I submit that the time for a ruthless introspection is upon us.

Today, a nation of 230 million and more, like Pakistan, is pleading for handouts from international lenders.

Looking further afield, with a few notable exceptions, majority of the Muslim states are in a state of neo-colonial and indirect subjugation. Even the economically affluent Muslim countries are client states of the major foreign powers for their protection and survival. This disgrace is a testimony of our collective failure.

The theme of this conference is Socio-Economic Development in OIC Countries therefore Assemblies such as this must be used to cut through the chase and confront our existential challenges.

We need to rethink the reason and the purpose for our existence.

In closing let us draw inspiration from the words of our Holy prophet, may peace be upon him, "Whoever walks in the pursuit of knowledge, Allah facilitates for him the way to heaven".

Ladies and Gentlemen, I wish you a great conference with meaningful and productive outcomes for the greater good of the Ummah.

CHIEF MINISTER OF SINDH, SYED MURAD ALI SHAH, MEETS IAS DELEGATION

Chief Minister of Sindh, Syed Murad Ali Shah, meets with a delegation of scientists from the Islamic World Academy of Sciences (IAS) at the Chief Minister House on 8 March 2023. The delegation was led by former Prime Minister of Jordan and IAS President, Prof. Adnan Badran. The delegation members included IAS Fellows; Prof. M. Iqbal Choudhary, Coordinator General, COMSTECH/Director ICCBS, Pakistan, Prof. Elias Baydoun, Department of Biology, American University of Beirut, Lebanon, Prof. Ahmed Azad, Former Chief Research Scientist, CSIRO Division of Biomolecular Engineering, Melbourne Australia., Prof. Moosavi- Mohvadi, Professor of Biophysics, Institute of Biochemistry and Biophysics, University of Tehran, Iran and Ms. Najwa Daghestani, Programs Manager, IAS.

CONSUL GENERAL OF MOROCCO HOSTS IAS DELEGATION AT HIS RESIDENCE

Mr. Ishtiaq Baig Hon. Consul General of Morocco hosted a dinner reception in honor of H.E. Prof. Adnan Badran former Prime Minister of Jordan at his residence and was attended by a delegate of the 24th Scientific Conference of the Islamic World Academy of Sciences including Prof. Abdelhafid Lahlaidi, FIAS, Prof. Abdullah Al Musa, Secretary General, HCST, Prof. Muhammad Besri, Hassan-II Institute Morocco and Ms. Taghreed Saqer, Secretary General, IAS. Dr. Mirza Ikhtiar Baig, Hon. Consul General of the Republic of Yemen in Karachi also attended among others.

UNDER THE PATRONAGE OF HRH PRINCE EL HASSAN, THE 13th INTERNATIONAL SYMPOSIUM ORGANIZED BY INWRDAM

Under the patronage of H.R.H. Prince El Hassan Bin Talal, the 13th International Symposium was organized by the Inter-Islamic Network on Water Resources Development and Management (INWRDAM) in Amman, Jordan on 13th March 2023. The Symposium focused on the **WEFE Nexus as a Catalyst for Policy Making and Regional Cooperation in the Levant, the Gulf, and Africa.**

His Highness Prince El Hassan bin Talal, Chairman of the Higher Council for Science and Technology, stressed the importance of translating sciences related to water, energy, food, and environmental systems into effective and sustainable policies in order to enhance human security.

His Highness called for the need to create research centers in the Levant to enhance the sharing of data and ideas on sustainable solutions, and to involve communities in decision-making to build capacities and empower and activate societies. Participants in the conference addressed topics such as political conflicts and their impact on water resources, cooperation mechanisms between the member states of the network to achieve the desired results in the optimal use of energy, in addition to renewable energy, management of water resources and resources, agriculture, training programs, the Blue Peace Initiative in the Middle East, and the Saudi Green Initiative to cultivate a billion A tree, and the development of legislation in some countries to pay attention to renewable energy.

The forum was attended by 150 international water policymakers from the region, relevant government ministries, water specialists and experts, ambassadors to Jordan and representatives of the international community representing 25 countries, including the OIC member states.

Some photos from the 13th International Symposium organized by INWRDAM.

BLUE PEACE LAUNCHES NEW PHASE COMMITTED TO WEFE NEXUS

The meetings of the Blue peace initiative concluded its work in Amman During the INWRDAM 13th International Symposium, where the new phase was launched under the auspices of the chairman of its advisory committee, HRH Prince El Hassan bin Talal, and with the support of the Swiss Agency for development and cooperation, after the Inter-Islamic Network on Water Resources Development and Management (INWRDAM) in Jordan was chosen to host the Coordination Office for the next four years, according to the concept of expanding the interconnection between water, food, energy and the ecosystem Nexus

The regional Blue peace initiative in the Middle East is on its way to launching a new phase that seeks to build capacities and take concrete actions, as the power of water represents a way to build a peaceful future for the region, while the consequences of cross-border water challenges are growing regionally.
The participants in the launch ceremony announced the new phase of the Blue peace initiative in the Middle East during the meetings to expand the scope of its activities, starting from a limited focus on water, to adopt a more comprehensive vision of the intersection point between water, energy, food and ecosystems.
The Blue peace initiative is a regional initiative dedicated to strengthening cooperation in the field of water and peace, and the new phase of the initiative has been based since the beginning of this year, while it was launched more than 12 years ago.

The conference participants confirmed the absorption of the activities of the next phase of the initiative, which is the first of its kind in the region, as the building blocks of the regional dialogue platform have been developed since its establishment in 2010, under the umbrella of the interconnection program.
As part of the program, the initiative conducts an assessment of the interrelation of water, energy, food and ecosystems, opportunities for the development and implementation of cross-border pilot projects of the interrelation of water, energy, food and ecosystems.

UNIVERSITY OF JORDAN AWARDED MEMBERSHIP IN COMSTECH CONSORTIUM OF EXCELLENCE

Under the patronage of the Minister of Higher Education, the University of Jordan (UJ) on Sunday, 12th March 2023, held a ceremony announcing the university's membership in the COMSTECH Consortium of Excellence (CCoE), a network of top universities in the Muslim world.

The signing ceremony was held at the University of Jordan on. His Excellency Prof. Dr. Nathir Obeidat, President of the University of Jordan, signed the agreement on behalf of the University of Jordan with H. E. Prof. M. Iqbal Choudhary, Coordinator General of COMSTECH.

"We at the University of Jordan are more than happy to host such scientific and research activities, because we believe in the power of knowledge to change the world for the better," UJ President Prof. Nathir Obaidat said during his opening remarks.

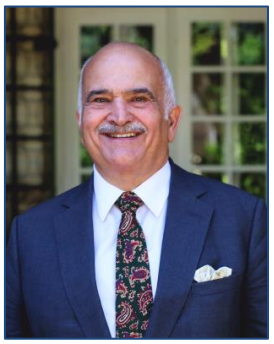
COSMETCH coordinator general, Muhammad Iqbal Choudhary, said that Jordan has made "great strides" in higher education over the years, despite difficult circumstances and limited resources.
"As we celebrate this milestone achievement today, it is imperative for the University of Jordan to keep in mind that the responsibility has increased and, consequently, it should appreciate the importance of fostering and strengthening partnerships with other universities and research institutions across different countries, particularly those in the Islamic world," Choudhary said during his remarks.

The University of Jordan, as a member of the consortium, will have access to a network of top-ranked universities from the OIC member states and will be able to participate in collaborative research projects and exchange knowledge and expertise with their fellow members to promote higher education and the advancement of science and technology in the OIC member states.

The core mandate of COMSTECH is to strengthen cooperation among OIC member states in science and technology, and enhance their capabilities through training in emerging areas, undertake follow-up-actions and implementation of the resolutions of the OIC, and to draw up programs and submit proposals designed to increase the capability of the Muslim countries in science and technology, according to a statement from the consortium. The ultimate aim is to build and nourish a scientific culture in addition to using science and technology as a major contributor to socio-economic development and rapid industrialization, the statement said.

CLOSING REMARKS BY HRH PRINCE AL-HASSAN, PRESIDENT OF HCST AND PATRON OF IAS

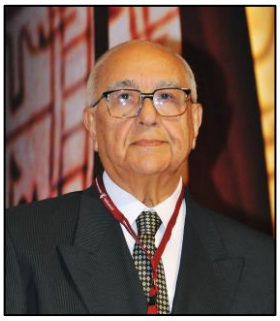
On the Conference: The Red Sea Ecosphere: Aspects of Conservation and Management of Marine Environment against Climate Crisis



- For years, I have called for the healing of the Great Rift Valley that runs from the eastern Mediterranean southeast through the Dead Sea and Red Sea, then south across East Africa. It is my belief that healthy basins provide the first line of defence against climate crises for communities.
- As we have concluded at this conference, business as usual is not an option for the future anywhere, but especially in West Asia and North Africa.
- The most recent report from the Intergovernmental Panel on Climate Change (IPCC) tells us that we have a vanishingly small window remaining to prevent a global temperature rise of 1.5°C, as set out in the Paris Agreement.
- Even if emissions meet the 2015 Paris Agreement reduction pledges, children born after 2020 will, on average, face seven times more scorching heatwaves, almost three times more droughts, three times as many crop failures and river floods, and twice as many wildfires during their lives than their grandparents.[1]
- As discussed in the Conference's official concluding recommendations, preventing further damage to our already fragile ecosphere is to make a pledge to an intergenerational contract; to help protect the generations ahead. Our policies and decisions transcend geographic space and time.
- In our region specifically, increasing air pollution and climate change-induced heatwaves and droughts may make parts of the region uninhabitable by 2050, according to the Max Planck Institute. (**And we are joined by Prof. Jos Lelieveld, the Director of the Max Planck Institute for Chemistry in Mainz, Germany).
- To face these challenges, we *need* regional cooperation.
- Regional cooperation, whether it takes the form of a Red Sea Barometer, a data-sharing policy, or a specialised Commission along the lines of the Danube Commission and the European Coal and Steel Community, is a critical step forward.
- Having a Red Sea Commission, for instance, would allow Red Sea littoral states, along with neighbouring countries, to come together to not only deliberate, but more importantly to *listen* to each other's interests and concerns, and then fashion common solutions; thus, advancing our *regional creative commons*.
- Earlier this year, we put forward the effort of introducing "*ecocide*" as a fifth crime in the International Criminal Court. Ecocide involves committing vicious acts knowing that they will likely cause serious and long-term damage to the environment.
- As such, a regional framework based on the notion of showing equal concern for the well-being of all people and our environment is an act of safeguarding human dignity and is central to the health of our ecosphere; therefore, helping us avert *ecocide*.
- During this conference, funding shortages were a recurring topic, whether they were large sums dedicated to climate change adaptation and mitigation for developing countries at COP27 or smaller amounts for research projects.
- We collectively recalled how, at the UN climate summit in 2009, wealthy countries pledged $100 billion a year to help developing countries adapt to climate change.
- Twelve years later, that promise is still unfulfilled.
- It may nevertheless be that these unfulfilled pledges point us to an untapped regional and cultural opportunity: Zakat's potential impact in climate change adaptation and mitigation and fostering sustainable development in the region and beyond.
- Shifting to a circular green economy that prioritises human welfare and dignity and better utilises existing resources is urgent to decouple economic growth from environmental degradation.
- In other words, we need to move away from the view of human progress as the *conquest* of nature.
- As we all very well know, academic research aims to push the frontiers of science forward.
- Our main challenge, however, remains translating science into practical policies that transform our quality of life and the environment. It is my hope that this conference has shed some light on how to move forward in this regard.
- Choosing solidarity, interdisciplinary cooperation, and multilateralism is vital for the betterment of all. There is, therefore, a collective and intergenerational responsibility to advocate for evidence-based *policy*, rather than *politics*.
- Thank you.

[1] *Thiery, W., Lange, S., Rogelj, J., Schleussner, C.F., Gudmundsson, L., Seneviratne, S.I., Andrijevic, M., Frieler, K., Emanuel, K., Geiger, T. and Bresch, N. (2021). Intergenerational inequities in exposure to climate extremes. Science, 374(6564), pp.158-160.*

PROF. ABDEL SALAM MAJALI (JORDAN), IAS PRESIDENT EMERITUS PASSES AWAY



It is with a sense of sadness and sorrow that the Secretariat of the Islamic World Academy of Sciences (IAS) in Amman, Jordan, announces the passing away of IAS President Emeritus, the eminent scientist Prof. ***Abdel Salam Majali*** *FIAS (Jordan).*

Prof. Abdel Salam Majali, was a former Prime Minister of Jordan. He was born in Karak, Jordan, in 1925. He received his MD from the Medical College, Syrian University, Damascus, in 1949; Diploma of Laryngology and Otology, Royal College of Surgeons and Physicians, London, 1953; Fellowship, American College of Surgeons, 1960; "Doctor Honoris Causa," Hacettepe University, Ankara, Turkey, 1974; "Doctor Honoris Causa," University of Selangor in Malaysia, Malaysia, 2011; and Fellowship of the Royal College of Physicians, London, 1986; and an Honorary Professorship from L.N. Gumilyov Eurasain National University, Astana, Kazakhstan.

Prof. Majali was President Emeritus of the Islamic World Academy of Sciences (IAS) since October 2022.
He was a Founding Fellow of the Islamic World Academy of Sciences (1986).
He was President of the Islamic World Academy of Sciences (1999 - October 2022).
President of the World Affairs Council (Jordan) and Member of the InterAction Council.
He was a Fellow of The World Academy of Sciences (TWAS) (1985).
He was an ENT Consultant and Director General, the Royal Medical Services, Jordan Armed Forces, Amman, 1960-1969; Minister of Health of Jordan, 1969-1971; President of the University of Jordan, Amman, 1971-1976 and 1980-1989; Minister of Education, 1976-1979; Minister of State for Prime Ministry Affairs, 1970-1971 and 1976-1979.
He had been a Professor of Medicine at the University of Jordan, since 1973.
He was Chairman, University Council, United Nations University, Tokyo (Japan), 1977-1982; Member of the Executive Board of UNESCO, 1985-1990.
Prof. Majali served as the Prime Minister of Jordan for two terms during 1990s, 1993-1995 and 1997-1998.
Prof. Abdel Salam Majali received Jordan's highest decorations as well as decorations from most Arab and European countries.

We pray to Allah (Subhanahu Wa Taala) to grant his soul eternal peace and give his family the courage and strength to bear this huge loss. Ina Lillah Wa Ina Ilaihi Raj'oon.

HIGHEST CHINESE GOVERNMENT AWARD BESTOWED TO H. E. PROF. DR. M. IQBAL CHOUDHARY

The People' s Republic of China has awarded the Chinese Government's Friendship Award to the eminent Pakistani scientist, Prof. Dr. M. Iqbal Choudhary Mustafa (PBUH) Prize Laureate, H. I., S. I., T. I. Prof. Choudhary, Distinguished National Professor /UNESCO Chair on Medicinal and Bio-Organic Natural Product Chemistry/Fellow of Islamic World Academy of Sciences, currently serving as a Director International Center for Chemical and Biological Sciences (H. E. J. Research Institute of Chemistry, and Dr. Panjwani Center for Molecular Medicine and Drug Research), University of Karachi, Pakistan, and Coordinator General of COMSTECH (the Ministerial Standing Committee on Scientific and Technological Cooperation of the OIC (Organization of Islamic Cooperation. The Friendship Award of China is the highest award of the Chinese Government to commend foreign experts who have made outstanding contributions to China's modernization drive. His Excellency Mr. Nong Rong, Ambassador of the People's Republic of China in Pakistan presented the Chinese Government's Friendship Award to Prof. Choudhary in the Chinese Embassy in Islamabad.

HIS EXCELLENCY PROF. M. IQBAL CHOUDHARY'S BUST INSTALLED IN THE "SCIENTISTS' GARDEN" AT PTP, IRAN

Mustafa (PBUH) Science and Technology Foundation (MSTF), Iran, has constructed a sculpture of 2021 Mustafa (PBUH) Prize Laureate eminent scientist Prof. Dr. M. Iqbal Choudhary, aimed at valuing efforts and endeavors made by the well-known scientists of the world. The sculpture was unveiled in a graceful ceremony held at the Pardis Technology Park (PTP) in Tehran on December 17, 2022. The monument was dedicated to Prof. Choudhary, who is serving mankind in the field of natural product chemistry, and has brought pride and honor for his country Pakistan. Prof. Choudhary has skillfully used his deep understanding of chemical principles and biological processes in the discovery of a large number of fascinating molecules with potential therapeutic applications. More specifically his research group has discovered and studied new inhibitors of clinically important enzymes, which can be used to stop the molecular processes involved in the enzyme-related disorders. As a result, several new classes of lead molecules were introduced to the world of science along with associated understanding of their mechanism of action. The most notable contribution of Prof. Choudhary is in a broad area of Bioorganic Chemistry where he used structural diversity of natural and synthetic compounds combined with biological targets to discover lead molecules with the potential to be developed as effective pharmaceutical agents. Some of his internationally recognized discoveries include the discovery of novel classes of antiepileptic natural products, acetylcholinesterase, urease, and alpha glucosidase inhibitors. His research group has discovered and developed the potent antiepileptic natural products (isooxylitones), patented in USA, from a local medicinal plant Delphinium denudatum, which has attracted a major attention internationally. Preclinical studies of isoxylitones and its active pure isomeric analog is completed. Novel class of AED drug candidates were developed with higher potency, greater efficacy and minimal side effects than existing AED as established in their preclinical studies. His research group has developed herbal health supplements to provide people with a cost-effective treatment/ management for Parkinsonian symptoms. His research group studies have led to the identification of natural steroidal lactones i.e., physalins as potential drug candidates against cutaneous Leishmaniosis. Many of the structurally novel compounds, discovered by his research group, were found to have interesting pharmacological profiles, and are in different stages of drug development.

FRONTIERS IN PHARMACOLOGY ISSUE THEME "RE-EMERGENCE OF NATURAL PRODUCTS FOR DRUG DISCOVERY" IN HONOR OF PROF. DR. M. IQBAL CHOUDHARY

About this Research Topic: This Research Topic will honor Prof. M. Iqbal Choudhary for his pioneering contribution in the field of Bioorganic, Synthetic, and Natural Product Chemistry. Prof. M. Iqbal Choudhary is Director and Professor of Bioorganic and Natural Product Chemistry at the International Center for Chemical and Biological Sciences (H. E. J. Research Institute of Chemistry and Dr. Panjwani Center for Molecular Medicine and Drug Research), Pakistan and Coordinator General COMSTECH. Since 1990, Prof. Choudhary has been among the world leaders in the field of natural product chemistry, and has made pioneering contributions in the discovery of novel natural products. Prof. Choudhary has 1,212 publications (cumulative impact of > 2500) with 33,550 citations (h index 76) in the fields of organic and bioorganic chemistry. He also published 94 patents (64 US Patents), 90 books and 40 chapters in books, published by major U.S. and European presses. He discovered many potent anti-epileptic and anti-leishmanial compounds from indigenous medicinal plants that are under clinical trials. His contributions to reverse bacterial resistance to antibiotics represent seminal contributions in this important field. He has trained hundreds of young researchers, especially women, from across the Afro-Asian region in natural product chemistry and established several research centers in Pakistan, and helped to setup research units in Africa, and South and Central Asia. His scientific contributions have been recognized by prestigious

national and international awards and honors, and fellowships of several academies of science. Nature has always been a notable source of lead compounds and provided unprecedented opportunities for medicinal chemists in order to continuously provide the drug candidates. Natural products (NPs) and their derivatives have historically made a major contribution to pharmacotherapy, in particular for cancer and infectious diseases. NPs are characterized by fascinating scaffold diversity together with structural complexity and due to this NPs have long been the key source of new drugs for the treatment of numerous human diseases. This Research Topic welcomes original articles, communications and reviews dealing with the isolation and/or the investigation of mechanisms of action of natural products and pseudo natural products (synthetic analogs of natural products) for the treatment of cancer, diabetes, infectious diseases, microbial diseases, cardiovascular diseases and other human diseases. In addition, this Research Topic also welcomes articles about the target-identification of natural products (with biological assays together with computational studies), in vivo studies and the design of novel natural product derivatives with improved biological effects.

PROF. ZABTA SHINWARI FIAS ELECTED AS A FELLOW OF TWAS

The World Academy of Sciences (TWAS) elected Prof. Zabta Shinwari as a Fellow starting January 2023. His election is a clear recognition of his vast experience and outstanding contribution to science and its promotion in the developing world.

He was recommended for Fellowship based on his academic excellence, administrative acumen, integrity, incorruptibility, and rationality. Formulation of policies leading to the development of strategies for quality assured education; monitoring & control, organizational change, and optimum use of human and financial resources.

Prof. Dr. Zabta Khan Shinwari was born in the remote area of Pakistan Kohat (tribal area) and got his Ph. D. from Kyoto University, Japan. His main interest in Ph.D. was on DNA bar codes in land plants and was able to report 300 gene sequences for wild plants for the first time. He has several studies of international significance on floristic and ecological aspects on temperate elements and presented data in international forums.

He was inducted as Post Doc Fellow and visiting Scientist in Japan International Research Centre of Agricultural Sciences (JIRCAS) where he worked on environmental stress induced genes and reported two new family of genes (DREB) that response to drought, cold and salt stress. This data was published in well-known journals e.g. (Plant Molecular Biology 42 (4):657-665, Biochemical Biophysical Research Communications 250: 161-170, The Plant Journal 34(2): 137-149; Plant Physiology 151(4). These genes are now being used by various international research organizations. He deciphered the signal transduction pathways of these genes to maximize the expression and using this technology developed a drought-resistant tobacco/ Arabidopsis (GM) crop which can withstand prolonged dry periods and thrive on 70% less water than ordinary tobacco plants.

One important roadblock to progress is that there are few major life scientists in any country who have made it their priority to be a champion of dual-use ethics education. That is where Professor Shinwari's work at national and international levels deserves recognition. He has shown what can be done with the desire, intellect and energy to make a difference. He has demonstrated time and again that others can be motivated to engage with the important objective of protecting the life sciences from misuse because what is required is simply that the current narrow 'internal' conception of Responsible Conduct of Research is expanded to include ethical consideration of the potential societal impacts of the results of research. These 'external' consequences obviously include the problem of dual-use and the future governance of emerging technologies. While solutions with not be easy or come quickly, I believe that we can do much better than has been demonstrated recently both nationally and internationally as more life scientists become aware, educated and engaged in this effort.

As for his scientific experience, Dr. Shinwari has worked in scientific organizations like PARC, PSF; WWF, JIRCAS and COMSTECH. In the realm of academics and administration. He helped develop three new universities in Pakistan, in tribal areas close to the Afghanistan border. He had been instrumental in developing industrial and commercial linkages of KUST and Qarshi Industries. He was able to establish links to many industrialized countries including USA, UK, Italy, Germany, Japan and China.

He had been the moving spirit behind the instrumental formulation of Biotechnology Strategic Plan for National Commission of Biotechnology & ISESCO for the OIC countries.

Dr. Shinwari has published several books (including policy documents) and more than 450 publications in journals of international repute with high impact factor and citation.

COMSTECH Science, Technology and Innovation (STI) Profiles of OIC Member States

Published on comstech.org

The member countries of the OIC are vigorously engaged with science, technology and innovation, both as a pursuit of knowledge and in harnessing the forces of nature for human betterment. Depending on their circumstances they have advanced to different levels, but much needs to be done, in general, to catch up with the attainments of the more advanced countries. However, there exists a well-defined need to catalogue national efforts in this direction. In particular, to identify respective strengths, achievements and shortcomings, as well as the institutions and policies that are shaping the scientific research and development profiles of OIC member states.

It is with the above goals and purposes that COMSTECH has ventured on this ambitious task viz. preparing a summarized version of the science, technology and innovation landscape of each member state. COMSTECH has initiated this effort starting with the profiles of countries leading in this area, and will be continuing and sharing.

The profiles can be found on:
https://www.comstech.org/science-technology-innovation-sti-profiles-of-oic-member-states/

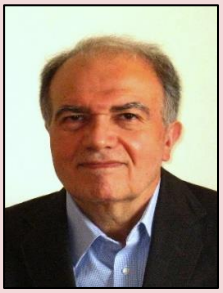
The Triennial Conference of the InterAcademy Partnership (IAP) and the Worldwide Meeting of Young Academies

The well-being of communities depends on valuing and engaging the rich diversity of all community members. This is especially true for the international research community, highlighted the Triennial Conference of the InterAcademy Partnership (IAP) and the Worldwide Meeting of Young Academies, a gathering that took take place on 1-3 November 2022 online and at the University of Arizona's Biosphere 2.

Over 220 participants from 60 countries registered for this hybrid conference that explored the theme 'Inclusive Excellence: Harnessing Knowledge for Sustainable Societies' and considered how research can address global challenges, how current research structures and processes exclude valuable voices and knowledge systems, and how to make these structures and processes more equitable and sustainable.

Source: https://www.interacademies.org/news/senior-and-young-academies-call-more-inclusive-effective-and-sustainable-research-environment

Prof. Ali Moosavi-Movahedi FIAS designated as IAS Anchor in Iran



Prof. Ali A .Moosavi-Movahedi, Professor of Biophysics, University of Tehran, Inst of Biochemistry Biophysics, Iran, has been designated as IAS Focal Point (Anchor) in Iran. Prof. Moosavi-Movahedi will represent IAS in local activities and events and prepare an annual report of activities to the IAS Secretariat.

HOW STRESS LEADS TO DIABETES

S. Behjati, F. Taghavi, M. Nourazaran and Ali A. Moosavi-Movahedi[2] FIAS

Abstract:
Balance is the factor of establishing and sustaining life at different systemic levels. This balance in biological sciences is referred to as homeostasis, which guarantees the maintenance of a stable set of chemical interactions, correct signaling, and efficient internal processes leading to the health of organisms and their continuity. Establishing health comes from a natural function with controlled commands that are entirely in chemical language and with the benefit of elements and factors that in their lowest amounts, provide the most positive impact on the biological system. This normal chemical language and its related system can homeostasis self-regulation and finally, provide a comprehensive and efficient functional system. Any kind of change in this chemical language within the controlled boundaries and every corner of this comprehensive system is considered as a signal so that this system network can try to adjust it with a correct understanding of the concept of these changes and still maintain the health and system performance. The interesting thing is that all these wonderful adjustments are made at the cellular, tissue, and organ levels with incredible accuracy. The departure from the controlled boundaries of the regulatory factors in the system, which is caused by any internal (physical, chemical, psychological) and external imbalance factor, disrupts the very valuable homeostasis and, in conditions beyond self-control, creates a destructive chemical language for the occurrence of perilous molecular and cellular process. These events lead to diabetes and loss of health. Oxidative stress is a new and chemically rebellious language beyond the state of balance and uncontrolled, which is the result of a long-term disruption of homeostasis or the influence of a high concentration of transformative environmental factors in a short time. This language can easily activate the domino of destructive molecular and irreversible cellular processes which happen in a wide, worrying, and sometimes irreparable field. Diabetes as a child of stress (which means unbalanced free radicals in any case) is one of the destructive metabolic diseases with different forms and resulting from an aggressive chemical language due to the acute loss of homeostasis and the creation of widespread oxidative stress beyond the adaptive capacity of a living structure. This situation can be caused by various internal (psychological and biological stresses) and external stimulating factors (environmental stress as the mother of internal stresses) and due to result in individual incapacitation and heavy economic pressures on societies, health, and sustainable development face with serious risks. Climate changes and global warming caused abnormal pressures on nature and biodiversity, each of which extreme climate changes originates stress in the society and arouses various diseases including diabetes. Solving such a health challenge requires changing lifestyle approaches. In this regard, the first effective step in regulating internal and external stress is maintaining the body's normal chemical language by imitating nature and changing the lifestyle to receive correct and constructive commands from the environment to the body. These commands can guarantee health through paying attention to sleep improvement, increased mobility, using antioxidant (edible and non-edible) fasting, and happiness.

Keywords: Stress, Diabetes, Oxidative stress, Climate changes and global warming, Chemical language, Biological system, Unbalanced free radicals, Homeostasis, Antioxidants

Introduction:
Diabetes is a chronic metabolic disease characterized by increased blood sugar levels beyond the body's physiological tolerance. This disease can be caused by the lack of insulin production by the pancreatic cells or the inability of the cells to use it. Over time, diabetes can cause severe damage to the organs and lead to other chronic diseases, including cardiovascular failure and kidney diseases, leading to the patient's death. It is defined and introduced diabetes scientifically in 1770. The definition of diabetes was divided into two categories in 1936, including type 1 (insulin-dependent diabetes) and type 2 or Mellitus (1). Although today other types of diabetes, such as gestational and diabetes insipidus, are also defined as subsets of diabetes. Type 1 diabetes is an autoimmune disease. Autoimmune diseases are a group of more than 100 different diseases that arise from the body's immune system, but up to now are not yet clear, cannot distinguish its cells from invading foreign cells, and attacks the tissues and organs of the body. Malfunctions of the immune system by the destruction of pancreatic beta cells lead to the decrease of insulin hormone levels as a regulator of blood sugar levels and the occurrence of type 1 diabetes. Type 2 diabetes is a lifestyle-related disease associated with pancreatic beta cell dysfunction, rather than their destruction, as well as varying degrees of cell resistance against insulin function, especially fat cells, skeletal muscle, and liver which have a unique role in glucose homeostasis. Various factors such as improper diet, obesity, and high blood pressure can be effective in developing various degrees of this type of diabetes (2).

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Statistics of diabetes in the world:
According to the report of the International Diabetes Federation (IDF), 537 million adults (people aged 20-79) have been diagnosed with diabetes until 2021, which is more than 3 out of every 4 people living in low or average-income countries. As, 206 million sufferers live in the West Pacific, 90 million in Southwest Asia, and 73 million in the Middle East and South Africa. Also, according to this report, diabetes has led to the death of 6.7 million people in 2021, which is equivalent to 1 death every 5 seconds (3). It is worth considering that according to the report of the World Health Organization, more than 95% of these patients have type 2 diabetes and the number of sufferers is increasing at a significant rate. Therefore, special attention should be paid to human lifestyle for health (4).

The relationship between stress and diabetes:
As mentioned earlier, type 2 diabetes is closely related to a person's lifestyle. Different interpretations of the word "lifestyle" usually come to mind, but in the meantime, often the effect of stress is less noticed as a constant companion of today's humans who are immersed in industrial life. In the eyes of the public, "stress" usually is known as unpleasant mental feelings that may cause short-term or long-term physical problems but the meaning of stress is not limited to this extent. Until now, various definitions of stress and its types have been presented. Until now stress divided into three types. 1) environmental stress which arises from the events surrounding the human being, 2) psychological stress which is related to problems and inappropriate experiences that a person faces and his mental ability to face these problems, 3) biological stress which is caused to the activation of a specific unfavorable physiological pathway which requires special adjustments to deal. It is stated that when the effect of the stressor exceeds the adaptive capacity of a living structure at different aspects of stress lead to physiological and biological changes which may expose a person to various diseases (5). Considering that psychological and biological stress is generated by the environment around the living organism, perhaps environmental stress can be mentioned as the mother of other types of stress and the cause of many diseases.

The importance of homeostasis:
The life of any living organism depends on maintaining a stable set of chemical interactions and internal processes that ensure its continuation. The processes that resist the fluctuations of the internal environment of the organism against the conditions imposed by the external environment are known as homeostatic processes. These processes are made of a set of three parts including receptors that detect environmental signals, nuclei that process the range of changes and adjust and send the appropriate response, and agents such as cells, tissues, and organs that they receive and execute the necessary commands. Factors that disrupt homeostatic processes can lead to the development of various diseases, including diabetes (6).

Indirect environmental effects:
A group of stressors that are received from the environment and play a role in diabetes has a supramolecular structure. For example, when a person is exposed to certain physical or mental conditions such as anger, panic, anxiety, etc. sympathetic adrenomedullary system produces epinephrine and norepinephrine hormones to deal with such situations. In a normal state, with the disappearance of the stimulating factor, the level of these hormones returns to normal, but in a situation where the stress-causing factor is stable for a long time or is constantly repeated, the hypothalamic pituitary adrenal axis comes into action. One of the side effects of the long-term activity of this system will be the increase of fat around the abdomen, which is one of the factors increasing the probability of type 2 diabetes. Also, the continuation of such conditions can cause problems such as hypertension, depression, inactivity, obesity, and behaviors such as smoking or alcohol consumption that have close relationships with the risk of type 2 diabetes. These conditions can repeat and strengthen in a cycle and along with the occurrence of inflammatory diseases increase the risk of diabetes (7).

Direct environmental effects:
Another group of stressors, which is induced by the environment, causes to start the molecular mechanisms, which play an important role in diabetes. One of the most important of these mechanisms is oxidative stress, which many pieces of evidence show plays an important role in the pathogenesis of type 2 diabetes. Naturally, many endogenous processes in the body, such as energy metabolism in mitochondria, which is necessary for the life of eukaryotic cells, leading to the production of factors called free radicals. Due to unpaired electrons in the Orbitals/Valence shell, these molecular agents have a high tendency to interact with neighboring molecules and repair the outer shell and achieve stability, which creates potential risks for all kinds of molecules in the surrounding environment. Among the types of free radicals that are produced in endogenous pathways are superoxide ($\cdot O_2^-$), non-radical species such as hydrogen peroxide (H_2O_2), active nitrogen species such as nitric oxide (·NO) and its non-radicals forms such as peroxynitrite (-ONOO) pointed out which are called reactive radical oxygen species (ROS). Living organisms have adapted to these conditions by maintaining the balance between the production and elimination of free radicals via equipping with advanced enzymatic antioxidant systems such as catalase and peroxidase, and similar non-enzymatic systems like ascorbate (vitamin C) and α-tocopherol (vitamin E). Also, considering that environmental stressors are always present, antioxidant systems are prepared to deal with a certain amount of free radicals created by them. However, various conditions can cause a phenomenon called oxidative stress by

increasing the number of free radicals to such an extent that the antioxidant system was not able to deal with it. Endogenous and exogenous free radicals that are not removed from the environment can attack lipids, proteins, and nucleic acids, affecting the metabolism of sugars and causing damage to pancreatic β-cells. These activities lead to a decrease in the expression of the insulin gene which next to an increase in apoptosis of beta cells as the core of insulin production can cause a decrease in blood insulin and an increase in blood sugar levels and get type 2 diabetes. On the other hand, the increase in blood sugar will in turn intensify the production of ROS species, thus creating a cycle that will ultimately lead to the aggravation of the disease. An abnormal increase in blood sugar can increase the amount of ROS from six pathways including sorbitol metabolism, hexosamine metabolism, dicarbonyl formation and glycation, enolization and alpha-ketoaldehyde formation, oxidative phosphorylation and protein kinase C activation. Also, the exposure of beta cells to the vicinity of levels higher than the physiological tolerance limit of glucose causes two insulin gene promoters, namely Pancreatic and Duodenal Homeobox (PDX-1) and Macrophage Activating Factor A (MaFA), to disruption of activity, which along with increasing the level of the transcription factor C/EBP as a suppressor of insulin promoter activity leads to a decrease in the level of this hormone and a further increase in blood sugar. Various environmental factors can lead to oxidative stress that air pollution (8), monoxide, chlorine, formaldehyde, ozone, tobacco smoke, toluene, adhesives, cleaners, paints, some special drugs such as cyclosporin, gentamicin, bleomycin, alcohol, heavy metals, cooking, industrial solvents, and types of radiation, are just several factors that humans face in their industrial daily life, and it is natural that increases human exposure to environmental stressors over time can increase the probability of developing type 2 diabetes. Accordingly, modifying the lifestyle and avoiding the factors that cause free radicals can be effective as a solution to deal with diabetes or delay it (6,9).

Ways to modify lifestyle and reduce stress:

Many factors can be effective in preventing or delaying the onset of type 2 diabetes, which are only briefly mentioned a number in the following.

1- Sleep: adequate and quality sleep is an important part of life but although it has an effective role in maintaining health, it is less considered. During sleep, the hormone melatonin as the best antioxidant is produced which protects the body against age-related diseases and activates antioxidant enzymes (superoxide dismutase, glutathione peroxidase, and glutathione reductase) that indirectly deal with oxidative stress (10).

2- Fasting: This health-enhancing behavior and highly recommended and can help reduce oxidative stress by improving the neuropathic and endocrine systems. Also, β-3-hydroxybutyrate, which is produced as a liver metabolite during fasting, inhibits the binding of sugar to protein, which leads to the inhibition of diabetes complexities (11).

3- Mountain climbing: the balance of positive and negative ions play an important role in physical and mental health. negative ions have an antiserotonergic effect, which leads to the reduction of anxiety. Also, negative ions can decrease environmental pollutants. The fresh mountain air is rich in negative ions, so it is possible to breathe clean air and increase relaxation.

4- Nutrition: Revising foods as a source of energy that is vital for human survival and constitutes an important part of daily life can also be considered one of the most important factors in reducing oxidative stress. Less use of foods with preservatives such as Quaternium-15, which by releasing the formaldehyde leads to oxidative stress, followed by a decrease in glutathione and an increase in lipid peroxidation as a cause of type 2 diabetes, can be an example of this. Less use of these preservatives in foods, as well as fewer uses of high-fat food sources or carbonated and industrial drinks rich in sweeteners and replacing them with vegetables and fruits can play an important role in preventing type 2 diabetes (4,6).

5- Happiness: Serotonin is a neurotransmitter that is also known as the happiness hormone. Despite its known neurotransmitter effect, most serotonin is made in intestinal enterochromaffin cells. The simultaneous release of serotonin with insulin has led to the investigation of the relationship between serotonin and diabetes (12). The results of studies show that serotonin plays an important role in regulating energy balance and glucose metabolism, and its depletion leads to hyperphagia (excessive ingestion of food), obesity, and type 2 diabetes (13). On the other hand, serotonin is the precursor of melatonin and is an antioxidant like melatonin. So, it can reduce oxidative stress and the complications of diabetes such as cataracts (14). Being happy, less stressed, get more sunlight, exercise leads to increasing the body's serotonin will reduce food intake, decrease body weight, increase energy homeostasis, and prevent type 2 diabetes.

In the end, it can be said that the human body is a well-organized system that works based on the chemical and biological principles that are most beautifully defined in creation. Although all the internal reactions of the human body are regulated by chemical language and precise interactions, external stimuli can cause various diseases by disturbing this balance. Accordingly, avoiding all types of stress as agents that can lead to problems in the body's homeostasis and get all kinds of diseases, will play an important role in preventing or delaying type 2 diabetes, and paying more attention to improving lifestyle can reduce the incidence of diabetes and other industrial diseases in the future.

Acknowledgment:
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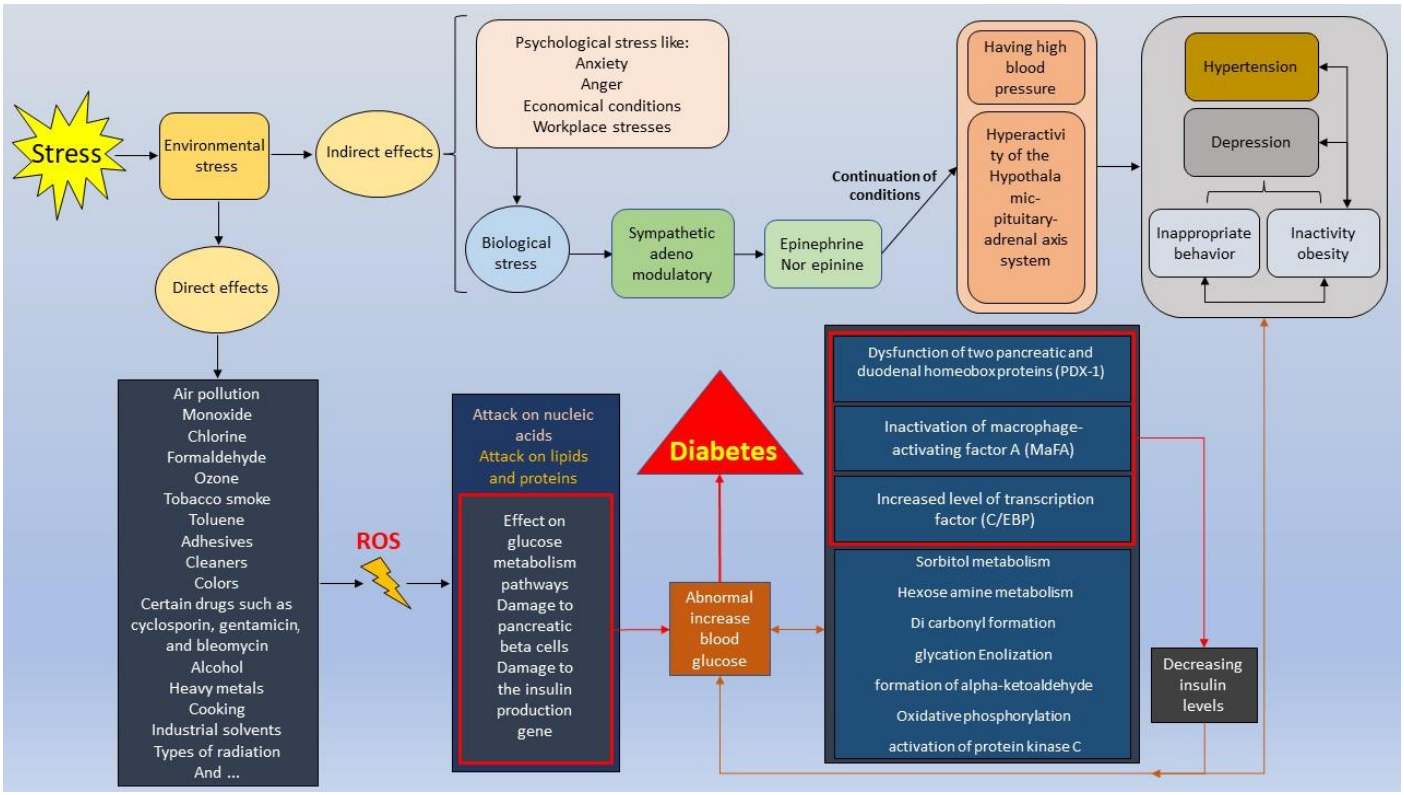
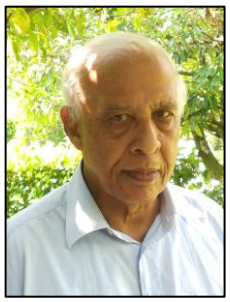
Graphical abstract:



CP VIOLATION IN NEUTRAL KAONS

M. Asghar FIAS



Abstract: This write-up describes the basic weak interaction-based formalism needed for describing and measuring the "indirect" and "direct" weak interaction caused CP violation in the neutral kaons, their experimental values, and the presence of a complex phase in the CKM matrix along with a flavor change in the particle Standard Model as the source of this CP violation.

The Kaons are the lightest strange mesons. They contain either an s quark or an s^- antiquark along with u and d quarks and antiquarks:
$K^+ (u^- s)$, $K^- (s^- u)$, $K^0 (d^- s)$, $K^{-0} (s^- d)$,

These are called the strong eigenstates since they are created via the strong interaction that expresses the Kaons in terms of q, q^-, their quark content, and have well-defined strangeness S = -1 or S =+1

For the CP case only the neutral and its anti-neutral kaons are considered. These kaons oscillate back and forth into each other.

Since these Kaons are pseudoscalars with intrinsic parity is negative: $P|K> = -|K>$,
with P as the parity operator.

For charge conjugation, the convention is that the charge conjugation operator C transforms a particle into antiparticle and antiparticle into particle, and acts as $C|K^0> = |K^{-0}>$,

Since the strong eigenstates are not the CP weak interaction mass (energy) eigenstates of the neutral kaons, one sets them up as:
$|K_1> = 1/(2)^{1/2}[|K^0> - |K^{-0}>]$,
which under CP operation transforms as $CP|\mathbf{K_1> = 1/(2)^{1/2}[|K^0> + |K^{-0}>] = +|K_1>.}$
Since it results in $|K_1>$with positive sign, hence, it is a weak interaction CP eigenstate.
Similar is the case for $|K_2> = 1/(2)^{1/2}[|K^0> + |K^{-0}>]$
under the CP operation $CP|\mathbf{K_2> = 1/(2)^{1/2}[|K^0> + |K^{-0}>] = -||K_2>,}$
but with negative sign

Hence, one has two CP weak interaction eigenstate equations with structure similar to the Schrodinger's equation:

$$CP|K_1> = +|K_1> \quad (1)$$
$$CP|K_2> = -||K_2> \quad (2)$$

The neutral Kaons decay via the weak interaction into pions (πs) with negative intrinsic parity. These pions are the lightest mesons composed of up and down quarks and antiquarks. Under the constraint of CP symmetry:
$|K_1>$ can decay into two pions
and
$|K_2>$ cannot decay into two pions and requires three pions.

In the case of $K_2 = |K_2>$, the three pions have about the same total energy as one kaon, leaving only a small amount of kinetic energy for the resulting pions, which prevents the decay process from happening often and takes a longer time indicated by putting $K_2 = K_L$ (L for "long")

For $K_1 = |K_1>$, a decay into two pions, whose kinetic energy has a much higher range rendering the process more probable and faster and shorter indicated by putting $K_1 = K_S$ (S for "short")

The experimental results confirm this classification:
K_L has a decay time $T_L \approx 0.5 \times 10^{-7}$ s,
which is about 600 times longer than
for K_S, with $T_S \approx 0.9 \times 10^{-10}$ s

It is worth noting that these CP symmetric eigenstates exist only for the neutral kaon and antikaon mesons, and not for other types of neutral mesons such as B^0 - B^{-0} and D^0-D^{-0}. For these systems, one has to measure separately the decay of a neutral meson and its antineutral meson to get directly the CP violation probability.

Since the CP mass eigenstates can propagate in time quantum mechanically as is the case for the Schrodinger wavefunction via an imaginary phase as $|\psi(t)> \approx e^{-i\omega t}|\psi, (0)>$, one can measure their decay-evolution.

In their experimental work, in 1964, Christenson et al. **(1)**, let a neutral kaons beam travel along a long tube. Since the K_L travel much farther than the K_S, they reach the detector as a pure K_L beam and should decay only into three pions. However, sometimes they measured a decay into two pions indicating a violation of the CP symmetry represented by K_L.

There are two ways that can cause this CP violation:
1. The CP violation results from the K_L decay not only into three pions, but also weakly with a relative probability ε' into two pions. This type of decay would violate the CP symmetry in weak interaction and has

been called **the direct CP violation**, because the K_L has a CP eigenvalue of (-1) and two pions have a CP eigenvalue of (+1). In fact, for the direct CP violation, one measures directly the ratio of decays of K^0 and its antiparticle K^{-0}

2. The propagating eigenstate K_L could include a small part of the K_1 CP eigenstate:

$K_L \approx K_2 + \varepsilon K_1$,

where the ε is the mixing parameter,

Then, the K_L can decay mostly into 3 pions, but also sometime into two pions. However, then, the K_L is no longer a CP eigenstate, since a part of it transforms with a minus sign, but the other does not. Here, the K_L is no longer a CP eigenstate due to what is called the **indirect** CP violation.

The experimental value of the ε parameter for the indirect CP violation for the neutral Kaons **(2):**

$\varepsilon = (2.28 + - 0.01) \times 10^{-3}$,

and for the ε' parameter for the direct CP violation:

$Re\ (\varepsilon' / \varepsilon) = (14.7 + - 2.2)\ 10^{-4}$

In the context of the particle Standard Model (SM), the unitary CKM matrix can explain the phenomenon of CP violation or at least part of it. The 3× 3 CKM matrix based on the three families of quarks describes the weak charge-changing from the mass states to the flavor states. This matrix can be treated in terms of three mixing angles and a complex phase that mixes different quarks and is the source of CP violation in the weak interaction. The indirect CP violation is caused through a flavor F change of $\Delta F = 2$, while the direct CP violation is through flavor change of $\Delta F = 1$, **(3).** Note that the dimension is crucial, as a 2×2 unitary matrix can always be made real by a suitable adjustment of the phase of basis vectors.

Moreover, under certain conditions on the CKM matrix, one can set up what is called the "unitary triangle" with three angles, whose surface directly represents the amount of CP violation.

I am grateful to Jean-Marc Richard for his valuable feedback.

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PROTECTING SOIL AND WATER FROM CONTAMINATION THROUGH BIOCHAR

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Engineering Biochar

Rajapakshas' work has mainly focused on modeling the specifications of biochar—its exact chemical and physical make-up—in order to better-suit varied situations in the environment. For example, she recalled, sometimes Rajapaksha's team increased the size of pores in the biochar material by varying the materials and methods used to create it, thus increasing its surface area, making it able to absorb and hold more contaminants that would otherwise poison water and soil.

They also conduct experiments using large cylinders, or "columns" of biochar, to see the effect the substance has on the chemical condition of the soil around it over time.

Biochar is also a special tool in that it both protects the environment, and serves as a way to reuse waste on a large scale. Rajapaksha and her team normally just make garbage into biochar, especially because Sri Lanka has problems with waste management and a prevalence of dumping sites. So biochar can be a productive way to both dispose of trash and keep water clean. But there are other options as well, which can help preserve the environment from a completely different angle: removing invasive species.

"To prepare this biochar, we use different materials," she said. "For a few studies, we used invasive plant materials—we remove them from the environment because they are troublesome, then convert them into biochar."

PROBLEM OF QUANTUM MEASUREMENT

M. Asghar FIAS

Abstract: This write-up attempts to elucidate the role of the classical act of measurement behind the decoherence and collapse of the superposed state of the Schrodinger's linear equation.

In Quantum Mechanics represented by Schrodinger's linear equation, the wavefunction evolves deterministically as a linear superposition of its different eigen-states of a quantum particle - the observable. As an example, if ψ_1 and Ψ_2……ψ_N are the eigen-states of this quantum particle, the sum-state:

$$\psi = 1/(N)^{1/2}.\ (\psi_1 + \psi_2 \ldots\ldots \psi_N), \qquad (1)$$

is also its state. Here the different eigen-functions have the same weight, but they could have different weights.

During its evolution as a superimposed state, if it is subjected to a measurement, it always signals the detection of the particle in *only one state of the classical world* resulting from its collapse and decay according to the Born probability rule. This apparently surprising result has been called the "problem of quantum measurement". Over last more than 90 years, various attempts have been made to understand the origin of this problem:

1. Copenhagen Interpretation

Initiated by Bohr and Heisenberg **(1)** this has been and remains the most prominent one. Here one keeps separate the classical macro-world of the observer from the quantal micro-world, and the solution to the problem is that *"something irreversible*" happens to the evolving wavefunction leading to the decay of its quantal coherence, which imparts it the classical behavior of observation or measurement. However, it is not clear as to what this something is and which is in contradiction with the basic linearity of the Schrodinger Equation.

2. Many-worlds interpretation **(2)**

Here one assumes that the only wavefunction is the superposition of entire universe which never collapses. Moreover, the act of measurement is just an interaction between the quantic entities consisting of the observer and the detector and all of this ought to form a single entity. This many-worlds interpretation is often used for the elucidation of different problems in Physics, but always without any verifiable sign for its existence.

3. De Broglie-Bohm pilot-wave theory-based interpretation **(3)**

Here the system consists of the wavefunction and the trajectory of positions of the particle. The wavefunction generates the velocity field of the particles and ensures that the probability distribution for the particle remains consistent with the orthodox quantum mechanics. However, the system needs an external classical interaction to neutralize its quantal correlation leading to the collapse of the superposed wavefunction.

4. Objective-collapse Models

There have been attempts to introduce non-linearity in the Schrodinger linear equation to disturb its linearity and hence, its quantal quality, but this operation does not deal per se with the measurement problem.

Or to increase the mass of the particle hoping to push the system into the classical domain. However, here, during the last few years, quantal correlation has been found for systems with heavier and heavier macroscopic masses **(4)**, thus, blurring the boundary between the classical and quantal worlds**.**

5. Decoherence and its decisive role in the collapse of superposed wavefunction

Coherence as concept was introduced in 1970 by H. D. Zeh **(5).** The interaction of a quantal system with an external classical environment tends to destroy the quantal coherence of the superposed state and forces the system into the classical domain. We know at present very well that the functional quality of quantum computers depends critically on the control of this destructive decoherence. Clearly, this ought to be the case for the problem of quantum measurement, where an external act of measurement of classical in nature, should destroy the quantal coherence of the superposed wavefunction leading to its collapse and forcing the particle into the classical world.

In this context, one has to know that historically most of these interpretations were introduced before the introduction and validation of the decoherence concept.

Conclusion: This document underlines that the classical act of measurement is the source of decoherence and collapse according to the Born probability rule, of the superposed wavefunction of the Schrodinger's linear equation.

I am grateful to Jean-Marc Richard for his feedback.

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DISCOVER NATURE'S POWERFUL CLOCKS

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There is much that we can learn from the mind of a simple fruit fly, and research on the tiny creatures has already facilitated progress in our understanding of the biological, internal clocks that govern so much of our lives, said Michael Rosbash, a keynote speaker for the TWAS 16th General Conference on 21 November.

Michael Rosbash is a neuroscientist and chronobiologist at Brandeis University in the United States, and in 2017 was among the winners of the Nobel Prize in Physiology or Medicine for discoveries of molecular mechanisms that control circadian rhythms. Circadian rhythms are the ways that biological organisms align their lives with 24-hour cycles from day to night, governing important processes such as sleep.

The word "circadian" comes from the Latin phrasing, "circa dies", which means "about a day." The rotation of the Earth is such a powerful environmental force that circadian rhythms have risen independently in evolution multiple times, in bacteria, in plants, and again in animals. This is because of the evolutionary advantage it provides, or, as Rosbash put it: "The early bird gets the worm, and the early worm also avoids getting eaten by the bird." These biological clocks also help govern the internal coherency of a creature's body, keeping processes separate that can't happen simultaneously.

"The big picture concept is that circadian rhythms are solved in the fly, and it turned out to be the same in mammals," said Rosbash. "The concept that has not been solved is why do we sleep, and what is the function of sleep. If that problem can be solved in fruit flies, maybe that will also turn out to be insightful for human sleep."

"And so that means other human health problems will be similarly impacted by research in basic science," said Rosbash. "The point is you never know what is going to emerge from basic science research and how it's going to impact human health."

Basic science, he said in his keynote lecture, is driven by two factors: curiosity and doubt. He said people are familiar with curiosity, but doubt can be more elusive. And what it means to doubt, is that people shouldn't believe something to be true simply because of history, tradition or authority. The real key, he explained, is the evidence; this is why he teaches his students that, when someone offers up a fact, they should always ask what the evidence is, and how they arrived at that conclusion.

"Scientists are no better than any other group of people. They're not more ethical, and not more honest," said Rosbash. "But arguably, our ecosystem—publications, vigorous debate—probably keeps science more honest than other areas of the modern world we inhabit."

He also emphasised the importance of internationalism, pointing out that global threats such as pandemics and climate change do not respect national borders, and so science must stress across borders, too.

Illustrating this point, he detailed some recent research by a Chinese postdoctoral student in his lab, Dylan Ma, whose work is helping illustrate the rich diversity of timekeeping brain cells in the fruit fly's brain. He said he has had 15 Chinese PhD students and postdoctoral researchers in his lab over the course of his career and he believes he owes them a great deal.

"(Internationalism) is important beyond science," he said. "We learn from other cultures in human ways."

The circadian rhythms of fruitflies can reveal much about the biological clocks of humans, too. [Photo: Egor Kamelev/Pexels].

PROPHETIC MEDICINE- A MESSAGE PAR EXCELLENCE[1]

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The Traditions (*Sunnah)* of the Prophet Muhammad (peace be upon him) are rich in advice and instructions on such matters as hygiene, sanitation, and treatment of disease through the use of medication. Referred to as *Al-Tibb Al-Nabawi* (prophetic medicine) by Muslims the world over, about 50 prophetic traditions on specific ailments and their remedies have been grouped together under the chapter referred to as *Kitab-al-Tibb* (the book of medicine) in the well-known collections of *Hadith* (Prophetic Sayings) by Bukhari, Muslim, Abu Dawud, At-Tirmidhi and many others.

Also, more than 300 traditions on aspects of hygiene, cleanliness, habit of eating and drinking, etc. find mention in these same collections under different heads of Kitab al-Mardha, Kitab al-Asharuba, Kitab al-'Atama, Kitab al-libas, Kitab al-Janaiz, Kitab al-Salam, Kitab al-Masaqaat, Kitab al-Adab. All these traditions, which number about 400, constitute what is referred to as Prophetic Medicine, and can be found together in the classic books of Ibn al-Qayyim Aljouzia (8th century Hijrah), Abu Nu`aim (5th century Hijrah), Abu Abdullah al-Dhahbi (8th century Hijrah), and Abu Bakr ibn al-Sani (4th century Hijrah). Most of these original Arabic treatises have been translated into English and other languages.

Islamic Foundations of Well-Being

The Prophet Muhammad laid down the foundation for a social order in which every member of society was advised to maintain a healthy life, physically, psychologically, and spiritually. No aspect of life was to be disregarded.

As a matter of fact, there are several such sayings in which the Prophet laid great stress on medicine and discouraged seeking help through amulets, relics, and charms. For instance, the Prophet once said, "There is a remedy for every malady and when the remedy is applied to the disease, it is cured." This and several such hadiths have been described in Bukhari, Muslim, Tirmidhi and Abu Dawud.

Once the Prophet was asked by one of his companions, "Is there any good in medicine?" To this, he emphatically replied, "Yes." As a result, Islamic teachings make it the duty of every society or group of people to conduct research and discover the remedy for diseases that afflict human beings. The concept of incurable diseases is thus alien to Islam.

Changing Age-Old Attitudes

There were several occasions when the Prophet visited the sick, and after enquiring about the ailments advised to take the medicine prescribed from experienced physicians. On several occasions he advised the sick to approach Harith bin Kalda, a well-known Jewish physician of *Thaqif* (a place near Madinah, Saudi Arabia where the Prophet resided at the time). On one particular occasion the Prophet visited Sa`d ibn Abi Waqqas who had suffered a heart attack. When the Prophet placed his hand on the chest of Sa`d he felt great relief, but the Prophet cautioned him and said, "You've had a heart attack and therefore should consult Harith Bin Kalda, who is the expert physician." It is these and many other similar occasions that greatly changed the attitude of the Arabs towards diseases. Arabs, during the pre-Islamic period, depended mainly on invoking supernatural aid or different deities for the treatment of disease.

Hopelessness, despondency, dejection and frustration on account of serious disease and pain are against the spirit and tenets of Islamic medical ethics.

The Prophet Muhammad, realizing the consequences of infectious epidemics, advised his companions that, "When you hear about a break of plague in any area, do not enter there and when it has broken in a land where you are, then do not run way from it (and thus spread it elsewhere)." On the basis of this hadith, Muslims considered precaution and vigilance against infectious epidemics as the command of God.

The Prophet also opposed charms and incantations as a form of remedy for diseases. On some occasions, however, when physical remedy (medicine) was not available, he allowed, mainly for psychological reasons, the recitation of an incantation that has definite meaning. He also declared the victims of epidemics such as cholera and the plague as martyrs. This was a great consolation for those who suffered from it and realized the fatal consequences.

The Prophet always cautioned physicians to take extreme care in treating their patients and warned those not well-versed in the skill of medicine not to attempt treating the ill lest they might be held responsible for any complications. Quackery is, therefore, forbidden in Islamic medical ethics.

The Prophet Muhammad advised his followers to always care for their health, and whenever they were ill, whether seriously or otherwise, consoled them and told them not to feel that they were victims of the wrath of Allah. "Disease," he said, "is not the wrath of

[1] *Source: Medicinal Plants in the Traditions of Prophet Muhammad (10th Ed. 2019) by Dr. M.I.H. Farooqi. Lucknow India Email: mihfarooqi@gmail.com*

Allah, because Prophets also suffered great pains, much greater than ordinary people." Imagine what a solace these sayings would have provided to the followers of Islam.

Hope as Medicine

There are many Prophetic hadiths in Bukhari, Muslim and others that show that people were accustomed to go to the Prophet regularly and tell him about their ailments. He would advise them to resort to medicine first and then pray to God to get rid of the disease. On several occasions he would himself suggest certain medicines. For instance, in case of loss of appetite he frequently advised his followers to take *Talbina*, a preparation made from barley (Hindi, Jau). For constipation he used to recommend the use of Senna (*Senna alexandrina*; Hindi Sanai Makki). He was also in favor of regular use of honey (Hindi, *Shahed*) for keeping fit. Similarly, for different ailments he would advise the use of Olives (*Olea Europaea*; Hindi, Zaitun), Black cumin (*Nigela sativa; Hindi, Kalonji)*), Chicory (*Cichorium entybus*; Hinidi, Kasni), Fenugreek (*Trigonella foenum-graecum*), Ginger (*Zingiber officinale*; Hindi, Adrak, Sonth), Marjoram (*Origanum vulgare*: Hindi, Marzanjosh), Saffron (*Crocus sativus*; Hindi, Kesar, Zafaran), Vinegar (Hindi, Sirka) etc. Hadiths on these medicines and others show the concern of the Prophet for the welfare and good health of his followers. For even apparently small matters like drinking water, eating food, and keeping clean and tidy, he also gave advice. He is noted to have said, "Cleanliness is half of faith."

Some of the hadiths on Black cumin (*Nigela sativa* Linn.-Hindi Kalonji), Senna *(Senna alexandrina syn., Cassia angustifolia)*, and Watercress **(*Nasturtium officinale; Hindi Jarjir*)** are very thought provoking. For instance, the Prophet is reported to have said that, "Black cumin is a remedy for every disease except death." The Prophet expressed similar views on the efficacy of Senna and Cress. The style and language of these hadiths are a clear indication of the fact that the Prophet placed great stress on medicines. These hadiths also put emphasis on confidence building of the ill towards their diseases and agonies suffered. Very rational advice was given that none should be disheartened by the intensity and duration of the disease because remedies have been provided by nature. They were also advised not to be afraid of impending death.

Once during the time of the Prophet, a person committed suicide as he could not bear the agony of his disease. The Prophet condemned the act and refused to participate in the last rites. Thus, hopelessness, despondency, dejection and frustration on account of serious disease and pain are against the spirit and tenets of Islamic medical ethics, as shown by the tradition of the Prophet.

Charms and amulets were shunned by Islam

There are several authentic hadiths, according to which people were said to come to the Prophet for spiritual remedies for their illnesses and that of their kith and kin. The Prophet, of course, prayed for them, but only after suggesting remedies in the form of medicines. Often, he would advise the patients to consult the best physician in the area. On one occasion a lady came to the Prophet with her child who was bleeding because of a throat infection. He admonished her and advised her to treat the disease by using the extract of Costus (*Sassuria costus*; Hindi, Kuth) and Pseudo-saffron (*Flemingia grahhmiana*; Hindi Warus). Similarly, once his wife complained of an abscess on her finger. The Prophet suggested an application of Sweetflag (*Acorus calamus*) on the fingers and then asked her to pray to Allah for recovery. There was also an occasion when a scorpion bit the Prophet himself. He immediately asked for hot water to which salt was added. The hot solution was poured on his bitten fingers while he recited Qur'anic verses.

These occasions and Prophetic hadiths led Muslims to believe in the rationale of using medicine rather than resorting to charms and incantations. On several occasions he exhorted them not to depend on supernatural methods of healing. He is also reported to have said, "charm is nothing but a work of Satan."

Although the Prophet, on one hand, gave suitable advice to his followers on earthly affairs when such situations were brought to his attention, on the other hand he tried his best to create confidence in them so that they could act according to their own experience and opinions. Once, while withdrawing his advice given earlier on the cross pollination of date palm he said, "Whenever I command you to do something related to religion, do obey. And if I command you something about earthly matters, act on your own also (experience)."

Putting Prophetic Medicine into Proper Perspective

In recent years, several books on Prophetic Medicine have been published, particularly in India and Pakistan, which do not project the true essence of the Prophet's message. For instance, the author of a recently published book entitled Tibbe Nabwi Aur Jadid Science (Prophetic Medicine and Modern Science), claims that Prophetic treatment of heart attack by eating seven dates, as was suggested to Sa`d ibn Abi Waqqas, should still be preferred over modern by-pass surgery for the disease, provided people have faith in the treatment of the Prophet. The learned author failed to understand that the Prophet, while suggesting to Sa`d to take dates as temporary relief, also advised him to consult the expert physician Harith bin Kalda for treatment. There are several errors in the botanical identification of the drugs mentioned by the Prophet.

In most of the said books, Bihi (Hadith, Safarjal), Luban (Hadith, Laban), Kundar (Hadith, Kundar), Oud (Hadith, Oud alhindi), Warus (Hadith, Varus) and Camphor (Hadith, Kafur) etc. have been identified with botanical names that are completely incorrect.

As a matter of fact, it is not desirable to consider the Prophet's traditions on medicine as similar to the prescription of a physician. In this connection, the opinion of Ibn Khaldun (14th century AD) is highly relevant and realistic. He says, "The Prophet's mission was to make known to us the prescription of the Divine Law and not to instruct us in medicine of the common practice of ordinary life" (Muqqaddima). In his opinion, even very authentic hadiths cannot be taken as a mere medicinal prescription, which is the duty of an experienced physician. He says, however, that "with sincere faith, one may derive from them [hadiths] great advantage though this forms no part of medicine as it is properly called." To emphasize his point of view, Ibn Khaldun refers to occasions when the Prophet tried to create confidence in his followers by advising them to take their own judgments in worldly affairs.

Prophetic medicine can be called a new turn in the history of medicine, and according to Ibn Al-Qayyim, "Physical treatment is the Sunnah of the Prophet. Prophetic medicine is an understanding for those people who consider the disease as a divine predestination and treat it as a sin. Prophetic medicine is the name of the order that the Messenger of Allah, peace be upon him, gave to humans to find new ways in the field of medicine.

Prophetic medicine is a message par excellence. It is an advice to keep a healthy body and soul and to have faith in both physical and spiritual treatment. It is a command to us to strive hard to find newer medicines and newer remedies. It is a warning to those who consider diseases as the will of God for which no remedy is needed. It is an admonition for us to keep away from so-called spiritual treatment based on superstitions like sorcery, amulets, and charms.

What Non- Muslim Western Scholars of Eminence say about Prophetic Medicine and status of Medicine before Islam

Western historians accept the truth and feel that the sayings of the Holy Prophet benefited humanity by reviving medical science in Europe. The so called Arab Medicine partially based on forgotten Greek medicine and the works of Muslim physicians like "Al Qanun"(Canon) and "Al-Hawi" (Continents), Avicenna (Abi Sina) and Rhazes (Zakaria Razi) respectively, had been taught in European medical universities for more than six hundred years.

In the opinion of Douglas Guthrie (A History of Medicine, 1945), great advances in medicine made by Muslims during the Middle Ages were mainly due to the impact of the traditions of the Prophet Muhammad. Guthrie writes, "Had not the Prophet Muhammad himself said, 'O Servant of God, use medicine, because God hath not created a pain without a remedy for it"'? Guthrie failed to quote the source of this important prophetic saying, but it is obvious that he was referring to the famous hadith from *Tirmidhi* (one of the six most important collections of prophetic traditions).

Illness was considered divinely ordained and treating it was unnecessary, a mindset prevalent in the Roman Empire. It is said that a massive malaria epidemic killed a large population of the Roman Empire. Millions of people were paralyzed mentally and physically. The structure of the empire began to collapse, but no physical method was adopted to control the situation. Because doing so was considered against God.

It is important to note that during the 7th century and earlier in all areas of Africa and Asia where the Romans or Byzantines ruled, there was a strong hatred of medicine and the use of medicine for a disease was considered inappropriate from a religious point of view. Controlling the disease or getting rid of it was not the job of the physicians, but it was the duty of priests, magicians or religious leaders living in places of worship. Some European historians have written that for several hundred years after the fall of the Roman Empire, the Church interpreted Greek medical knowledge as heathen and called it atheism and allowed only spiritual treatment for the treatment of diseases.

In terms of treatment, the condition of Europe was worse than the condition of Persia, Iraq, Syria and Egypt. There was no other way to get rid of the disease except magic and sorcery, the vices of ignorance, bigotry, cruelty, magic, sorcery and amulets were common. (Donald Campbell, Arabian Medicine, 1926). According to Campbell, the main reason for the aversion to knowledge in Europe was the role of the Church. So, he writes that: The Christian Church helped further degrade the intellectual level (environment) of Europe. After mentioning the environment of ignorance in Europe, Campbell compares Christianity and Islam in terms of medicine in these words: "During the days when the Christian world was going through a dark period, the scholars of Islam started showing amazing activity in the science of medicine".

George Sarton's views echo Campbell's sentiments. He writes that: Before Islam, medicine meant magic and not real medicine. Well known de Boer writes: Muslims cleansed science from obsolete beliefs.

SUSTAINABLE AGRICULTURE THROUGH IMPROVED RHIZOSPHERIC PLANT-BACTERIAL INTERACTIONS

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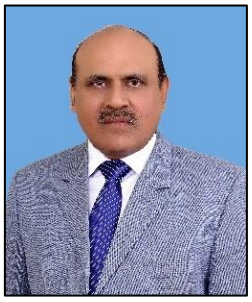

The rhizosphere is a hotspot zone that forms diverse rhizosphere microbiomes. It influences plant root secretions and comprises nutrient-rich soil that facilitates rhizospheric messages, signaling, and plant-microbe interactions. Plants secrete various compounds (sugars, amino acids, organic acids, flavonoids, proteins, and fatty acids) as root exudates which act as signals to attract beneficial rhizobacteria and/or hold off phytopathogens. These exudate molecules act as chemoattractants and rhizospheric messengers between plant roots and rhizobacteria. Plant-bacteria have a symbiotic association in which both organisms mutually benefit from each other. The plant nurtures rhizobacteria by providing nutrients, vital energy, and shelter in root exudates. Rhizobacteria impact the capacity to produce plant growth-promoting metabolites and have a beneficial role in nutrient uptake, growth and yield promotion, as well as mitigation of abiotic and biotic stresses.

Plant roots and bacteria communication through root-to-root and root-to-microbe is interdependent for the exchange of nutrients. During plant-microbe interactions, the exudation of antimicrobial metabolites, *viz.* extracellular proteins from roots, is involved in plant growth promotion through the suppression of microbial pathogens. Rhizobacteria may respond to soil rhizosphere nutrients by secreting multiple compounds with double-sword effects, as some compounds suppress phytopathogens, while others promote plant growth (Figure 1). Exudate compounds promote bacterial biofilm formation, which conglomerates the bacterial cell's attachment with the root surface through extracellular polymeric materials. For example, exopolysaccharides from bacterial biofilm are involved in modulating plant transcriptional responses and monitoring transmembrane receptor kinase gene *EPR3* expression triggering Nod factors, including root nodule symbiosis and lipochitooligosaccharides. These Nod factors ensure bacterial colonization through NFR1-NFR5 receptors, which causes root hair curling and symbiotic association signaling accompanied by *EPR3*-dependent exopolysaccharides. Some exopolysaccharides are involved in developing indeterminate nodules, while others are involved in pathogenic interaction by blocking xylem vessels and causing water-soaked lesions. Root exudates allow the plants to choose well-adapted diverse microbiomes. That is why rhizospheric soil is 10-100-fold more abundant with microorganisms than bulk soil.

Rhizospheric plant-bacterial interactions have dynamic importance in sustainable agriculture due to plant growth promotion and reduction in agrochemical dependency. Rhizobacteria are promising tools to promote macronutrient and micronutrient availability, uptake, translocation, and recycling through fixing atmospheric nitrogen (N_2) and mineral solubilization (Figure 1). Under nitrogen-limiting conditions, bacteria from the *Rhizobiaceae* family are involved in symbiotic association with the leguminous plants to form N_2-fixing root nodules induced by nodulin genes. Symbiotic N_2-fixation by *Rhizobium* is catalyzed by metalloenzyme nitrogenase complex containing dinitrogenase and ATP-dependent electron-donating iron proteins and dinitrogenase reductase. The majority of N_2-fixing genes involved in symbiosis are plasmid-borne *nif* and *fix* genes that encode nitrogenase components and other regulatory proteins. Leguminous plant assimilates fix ammonium from nodules into amino acid through glutamine synthetase and glutamate synthetase. Phosphoenol pyruvate carboxylase is linked with nitrogen and carbon metabolisms in the nodules. Rhizobacteria also increase the availability of plant essential minerals through their power to solubilize insoluble minerals. Bacteria solubilize insoluble minerals mainly by producing mineral-dissolving acidifying compounds, including the production of hydroxyl ions, organic acids, siderophores, protons, and various enzymatic activities. Most of the bacteria involved in mineral solubilization produce different organic acids, *viz.* acetic acid, 2-ketogluconic acid, butyric acid, citric acid, fumaric acid, formic acid, gluconic acid, malic acid, lactic acid, oxalic acid, propionic acid, succinic acid, tartaric acid and valeric acid. These mineral solubilizing compounds are involved in chelation, acidolysis, enzymolysis, capsule absorption, and extracellular polysaccharides complexation with minerals that convert into plant-available forms of minerals. Under limited iron conditions, bacteria produce iron-chelating agents called siderophores, which improve iron availability to plants. A high concentration of siderophores is produced by microbial activity in the rhizosphere that has a fundamental role in the bioavailability of iron to bacteria that ensure their colonization in the rhizosphere and are involved in the biocontrol of the phytopathogens.

Rhizobacteria are involved in plant growth promotion by synthesizing auxin (indole-3-acetic acid; IAA), which interferes with plant developmental processes (Figure 1). More than 80% of rhizobacteria associated with various crops are known to synthesize auxin as a secondary metabolite. IAA affects gene expression in various bacteria by acting as a signaling molecule and playing a crucial role in plant-microbe interactions. Bacterial-induced IAA alters the auxin pool in plants and regulates physiological processes by promoting root surface area and length as well as greater uptake of nutrients in plants. Rhizobacteria produce IAA using the precursor tryptophan and an amino acid tryptophan, while anthranilate (a tryptophan precursor) reduces IAA production. Node chorismite encodes *trp* genes that initiate the tryptophan biosynthesis through phosphoenolpyruvate and erythrose 4-phosphate in the shikimate pathway. Further, tryptophan is converted into IAA via five different pathways, including (i) indole-3-pyruvic acid and indole-3-acetic aldehyde, (ii) indole-3-acetic aldehyde, (iii) indole-3-acetamide, (iv) indole-3-acetonitrile, and (v) tryptophan-independent pathway. Bacteria-induced IAA has been involved in cell division, the formation of vascular bundles, and nodule formation. Rhizobacteria even alleviate the environmental stresses by producing the enzyme 1-aminocyclopropane-1-carboxylate (ACC) deaminase, which reduces the production of ethylene levels and facilitates plant growth and development. They convert ethylene precursor ACC into 2-oxobutanoate and NH_3, and mitigate various biotic and abiotic stresses. The targeted application of beneficial bacteria and their cocktail formulations to combat nutrient deficiencies as well as abiotic and biotic stresses is gaining ground and becoming an intriguing research topic. It is viable to modify the bacterial community structure to induce systemic resistance against phytopathogens and acquire essential nutrients through the external application of specific beneficial bacteria at a massive scale. In this regard, advancing microbiome-driven cropping systems could be the next agricultural revolution for more sustainable crop production. Advances in the next-generation sequencing platform, gene editing technologies, metagenomics, and bioinformatics allow us to disentangle the intricate webs of interactions between plants and core microbiomes to effectively deploy the bacteria to improve crop nutrient uptake and resistance to environmental stresses. Moreover, multi-omics techniques such as CRISPR will enhance nutrient uptake and crop production to achieve zero-hunger for an ever-increasing human population. The CRISPR technique has revolutionized genome editing in bacteria and other organisms, including plants and animals. Further, fluorescent-protein-based methods are being employed to estimate the efficacy of genome editing through CRISPR-technique. Future research endeavors will definitely leverage synthetic biological technologies to utilize the full benefits of plant microbiome interactions to enhance crop production under both normal and stressful environments.

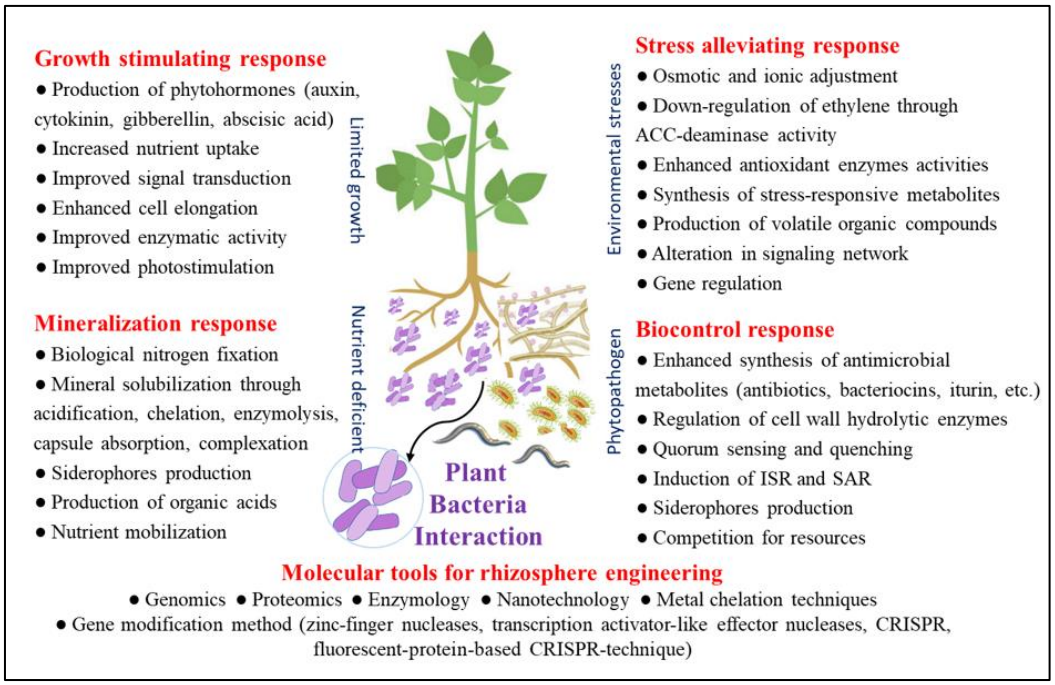

Figure1: *Infographics showing various responses of plant-bacteria interactions under nutrient deficient, abiotic, and biotic stress conditions, and modern molecular tools that could be applied to improve rhizosphere engineering during plant-bacteria interaction.*

PRESENT SITUATION OF THE WEAK EQUIVALENT PRINCIPLE

M. Asghar FIAS

Abstract: This contribution discusses the relevance of the Weak Equivalence Principle (WEP) in the context of Einstein's General Theory of Relativity (GTR), and the various experimental techniques used over time to test it with a higher and higher precision reaching 10^{-15} in terms of the Eôtvös parameter η, which is, at present, the best result on its validity.

Introduction: Newton's second law of motion states that the acceleration **a** of an object depends on the net force **F** acting upon the mass **M** of the object as:

$$\mathbf{F = M\ a} \qquad \mathbf{(1).}$$

This mass M represents the inertial mass $M = M_I$ of the object and $\mathbf{F = F_I}$, the inertial force
The gravitational force $\mathbf{F_G}$ acting on a gravitational mass $\mathbf{M_G}$ is:

$$\mathbf{F_G = M_0\ M_G\ /\ r^2} \qquad \mathbf{(2),}$$

where $\mathbf{M_0}$ is the spherical mass of the source of gravitational field acting on the spherical mass $\mathbf{M_G}$ and **r**, the distance between their centers.

As both the inertial and gravitational forces act only on the mass **M** of the object, the *weak equivalence principle* (WEP) which as the basic postulate of the Einstein's general theory of gravity (GTR) claims that the inertial and the gravitational masses of a body should be the same and equal. Moreover, the validity of the WEP signifies that the gravitational acceleration is independent of the gravitational mass of the object under study.

1. Some valuable relations.

a. Active gravitational M_0^{act}, passive gravitational mass M_1^{pass} and inertial mass m^{iner}

By the definition, the gravitational force on M_1^{pass} due to the gravitational field of M_0^{act} is:

$$\mathbf{F_1 = (M_0^{act}\ M_1^{pass})\ /r^2.}$$

Similarly, the force on a second of object of mass M_2^{pass} due to the gravitational field of M_0^{act} is:

$$\mathbf{F_2 = (M_0^{act}\ M_2^{pass})\ /r^2.}$$

The inertial mass m^{iner} results from Newton's law of motion:

$$\mathbf{F = m^{iner}\ a,}$$

where a is the acceleration of the inertial mass m^{iner} due to the force F.
If M_1^{pass} and M_2^{pass} are at the same distance from M_0^{act}, they fall at the same rate, because their gravitational accelerations do not depend on the gravitational mass of the object:

$$\mathbf{a_1 = F_1\ /\ m_1^{iner} = a_2 = F_2\ /\ m_2^{iner}.}$$

hence: $\mathbf{M_0^{act}\ M_1^{pass}/\ r^2\ m_1^{iner} = M_0^{act}\ M_2^{pass}\ /r^2\ m_2^{iner},}$
leading to:

$$\mathbf{M_1^{pss}\ /m_1^{iner} = M_2^{pass}\ /m_2^{iner}} \qquad \mathbf{(3).}$$

Mass must be proportional to the inertial mass of all objects. Moreover, each pair of gravitational M^{pass} and inertial m^{iner} in (3) represents the same object.
Furthermore, by Newton's third law of motion:

$$\mathbf{F_1 = M_0^{act}\ M_1^{pass}}$$

must be equal and opposite to:

$$\mathbf{F_1 = M_1^{act}\ M_0^{pass}}$$

leading to:

$$\mathbf{M_0^{act}\ /\ M_0^{pass} = M_1^{act}\ /\ M_1^{pass}.} \qquad \mathbf{(4).}$$

The relation (4) signifies that the passive gravitational mass must be proportional to the active gravitational mass of all objects.

2. Eötvös dimensionless parameter η

The dimensionless parameter η is defined as the difference of the ratios of passive gravitational and inertial masses divided by their average value for two sets of masses "1" and "2":

$$\boldsymbol{\eta}\ \mathbf{(1,2) = \{(m_g\ /m_{iner})_1 - (m_g\ /\ m_{iner}\ )_2\}\ /\ \{(m_g\ /m_{iner})_1 + (m_g\ /\ m_{iner}\ )_2\}} \qquad \mathbf{(5)}$$

The validity of the WEP implies that that the gravitational and inertial masses of an object should be equal in magnitude, and the value the parameter $\boldsymbol{\eta}$ **(1,2)** would be zero. If this is not the case, the parameter $\boldsymbol{\eta}$ **(1,2)** will have a finite value indicating the violation of this principle.

3. Different experimental tests of the equivalence principle

a. Eötvös torsion balance (1).

The Eötvös torsion balance consists of a rigid rod of negligible mass with two masses m_1 and m_2 of the same or of different materials, attached to its both ends. It is attached to a highly flexible fiber which is suspended in such a way that in mechanical equilibrium, the bar's position remains horizontal and that of the fiber vertical (Fig.1a). A mirror is attached to the rod to monitor more precisely via its reflected light, its rotation with a telescope. The torsion balance is subjected to the Earth's gravitational field through its horizontal component (Fig.1b) and the outwards oriented horizontal centrifugal force due to the rotation of the Earth:

$$\mathbf{F = (m\ v^2)\ /\ r^2} \qquad \mathbf{(6),}$$

where v is the velocity of the rotating Earth, r, the radius of the circle for the **latitude** of the Earth, where the torsion balance is installed.

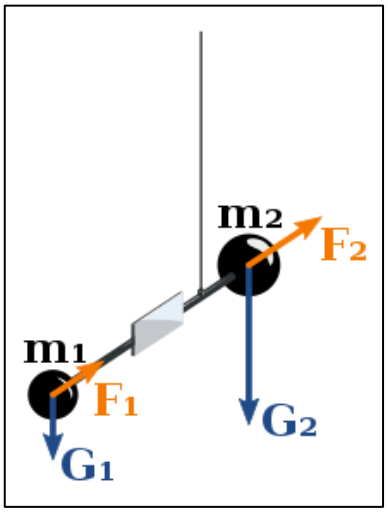

***Fig.1a**, the layout of the Eötvös torsion balance (Courtesy Wikipedia).*

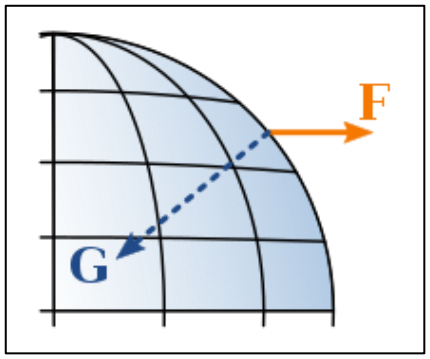

***Fig. 1b**, Direction of the centrifugal force in relation to gravity on the surface of Earth (Courtesy Wikipedia).*

If the WEP holds, the gravitational mas and inertial mass of an object are expected to be the same, and the ratio of the gravitational forces G_1 and G_2 on the gravitational masses is the same as the ratio of the inertial forces F_1 and F_2: $(F_1 / F_2) = (m_1 / m_2)$ (Fig.1a.), and these forces will be parallel to each other and will not produce any torque in the balance. However, if these ratios are not the same, then, the inertial force and the gravitational force are not coupling to the same masses of test bodies. In this case, the ratios of the components of one vector to those of the other vector are not the same and these forces are not parallel to each other producing an angle between them which will result in a torque on the torsion bar leading to its rotation along with its attached mirror.

The relation between the torque T and the resulting angle of rotation θ of the balance includes the Eötvös dimensionless parameter η:

$$\mathbf{T = \eta\, k\, \theta} \qquad \mathbf{(7),}$$

where k is a constant depending on the properties of the balance. The first torsion balance-based work of Eötvös **(1)** showed the WEP violation parameter η is compatible with zero at a level of 2×10^{-9}. As Table 1 shows that over time, the precision of the torsion balance-based work has been improved by many orders of magnitude to $\eta = 5\times 10^{-14}$ in 1999.

b. Pendulum.

For a pendulum the restoring force is proportional to the force of gravity and the sine of the angle between the position of the pendulum and the vertical. The inertial force depends just on the inertial mass m_i of the pendulum bob. This leads to the equation of motion of a pendulum:

$$\mathbf{m_i\, l\, d\theta^2/dt^2 = -\, m_g\, g\, \sin\theta} \qquad \mathbf{(8),}$$

where the m_i is the inertial mass and the m_g, the gravitational mass of the suspended bob. For small deflections, where $\sin\theta \sim \theta$, the solution for the period T is:

$$\mathbf{T = 2\pi\, (m_i\, l\, /\, m_g\, g)^{1/2} = T_0\, (m_i\, /\, m_g)^{1/2}} \qquad \mathbf{(9).}$$

with $\mathbf{T_0 = 2\pi\, (l/g)^{1/2}}$. **(10).**

If the WEP holds, $m_i = m_g$, and the expression (9) for the period T reduces to the familiar with the period T_0 (10).

If there is non-equivalence, one expects this to show up, when comparing different materials such as lead and silver as pendulum bobs. If they have different ratios for m_i / m_g, then, the identically constructed pendulum with either lead or silver bob would have a different period T.

Following Newton, set up two pendulums side by side with bobs of lead and silver and let them go at the same time. Observe whether they stay "in sync" or whether one is swinging faster than the other.

It was found that the WEP holds, because their periods and hence, the ratio m_i /m_g were different from one only at a level of 10^{-3} **(2).** Here, again the precision has improved by orders of magnitude over time to 3×10^{-6} (Table 1).

c. Tests of WEP through free fall.

In the case of free fall of two different bodies "1" and "2" at the same distance from the source of gravity, the dimensionless parameter η is defined as:

$$\mathbf{\eta = 2\, (a_1 - a_2)\, /a_1 + a_2} \qquad \mathbf{(11),}$$

where the a_1 and a_2 are their respective gravitational accelerations. The sensitivity of the WEP test is determined by the precision of the differential acceleration measured divided by their average value, hence, the value of the parameter η. As Table 1 shows, over time different types of "drop towers" under different conditions have been used to determine the η parameter through "free fall" of pairs of objects of different materials and the value of η has been tightened from a "small" 1500 years back to 10^{-10} in 1987. The study of "free fall" of a pair of Titanium and Platinum alloys and a pair of Platinum in space in the MICROSCOPE satellite mission **(3)** has led to η (Ti, Pt) = 10^{-15} hoping to push it to 10^{-17}, more and more compatible with zero that sharpens the validity of the WEP.

d. Lunar laser ranging test of the WEP with Earth and Moon.

The lunar laser ranging system consists of preparing with an Earth based system, a laser pulse optimized in shape and intensity and sending it to the Moon, where it is reflected back to the Earth by an appropriately designed and efficient retroreflector placed on the Moon's surface. This measurement provides the accurate distance between the Earth and the Moon.

If the WEP holds, then, the inertial and gravitational masses are the same and the Earth and the Moon would have the same acceleration towards the Sun despite their different masses. In this case the Moon's orbit will remain *stable* and the Eötvös parameter η in relation (5) will be zero. However, if the WEP were to be violated, this would result in an inequality of the inertial and gravitational masses which would lead to slightly different accelerations of the Earth and the Moon towards the Sun thereby *distorting the lunar orbit*. This distortion of the Moon's orbit will result in fluctuations in the Moon and Earth distance resulting in a change in the value of the Eôtvös parameter η in relation (5). The work of Shapiro et al. **(4)** led to $\eta = 10^{-12}$ (Table 1), and this value has been improved to 10^{-13} by James G. Williams et al. **(5).**

Table 1
Different techniques used over time to test the WEP (Courtesy Wikipedia)

	Investigator	parameter η	Method
500?	Philoponus[14]	"small"	Drop tower
1585	Stevin[15]	5×10^{-2}	Drop tower
1590?	Galileo[16]	2×10^{-2}	Pendulum, drop tower
1686	Newton[17]	10^{-3}	Pendulum
1832	Bessel[18]	2×10^{-5}	Pendulum
1908 (1922)	Eötvös[19]	2×10^{-9}	Torsion balance
1910	Southerns[20]	5×10^{-6}	Pendulum
1918	Zeeman[21]	3×10^{-8}	Torsion balance
1923	Potter[22]	3×10^{-6}	Pendulum
1935	Renner[23]	2×10^{-9}	Torsion balance
1964	Dicke, Roll, Krotkov[10]	$3x10^{-11}$	Torsion balance
1972	Braginsky, Panov[24]	10^{-12}	Torsion balance
1976	Shapiro, et al.[25]	10^{-12}	Lunar laser ranging
1981	Keiser, Faller[26]	4×10^{-11}	Fluid support
1987	Niebauer, et al.[27]	10^{-10}	Drop tower
1989	Stubbs, et al.[28]	10^{-11}	Torsion balance
1990	Adelberger, Eric G.; et al.[29]	10^{-12}	Torsion balance
1999	Baessler, et al.[30][31]	$5x10^{-14}$	Torsion balance
2017	MICROSCOPE[32][33]	10^{-15}	Earth orbit

Conclusions: This document treats the case of the weak equivalence principle (WEP) and the different experimental techniques used over time to test its validity with a higher and higher precision reaching 10^{15} in terms of the Eötvös dimensionless parameter η, which, at present, is the best result for its validity.

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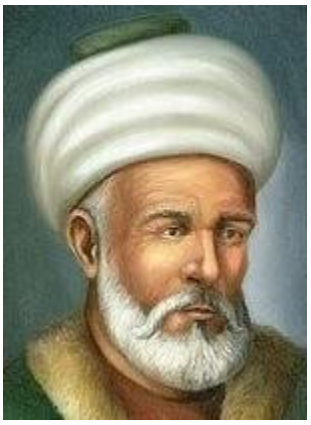
ABUL AL-NASR AL-FARABI (870-950 AD)

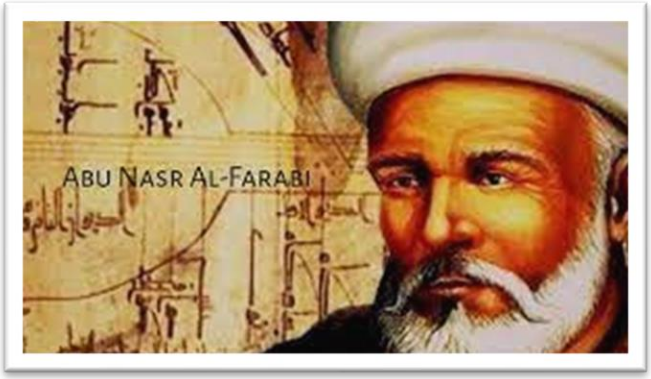


Abu Nasr Mohammad Ibn al-Farakh al-Farabi was born in a small village Wasij, near Farab in Turkistan in 259 A.H. (870 A.D.). His parents were originally of Persian descent, but his ancestors had migrated to Turkistan. Known as al-Phrarabius in Europe, Farabi was the son of a general. He completed his earlier education at Farab and Bukhara but, later on, he went to Baghdad for higher studies, where he studied and worked for a long time viz., from 901 A.D. to 942 A.D. During this period, he acquired mastery over several languages as well as various branches of knowledge and technology. He lived through the reign of six Abbasid Caliphs. As a philosopher and scientist, he acquired great proficiency in various branches of learning and is reported to have been an expert in different languages.

Farabi travelled to many distant lands and studied for some time in Damascus and Egypt, but repeatedly came back to Baghdad, until he visited Saif al-Daula's court in Halab (Allepo). He became one of the constant companions of the King, and it was here at Halab that his fame spread far and wide. During his early years he was a *Qadi* (Judge), but later on, the took up teaching as his profession. During the course of his career, he had suffered great hardships and at one time was the caretaker of a garden. He died a bachelor in Damascus in 339 A.H./950 A.D. at the age of eighty.

Farabi contributed considerably to science, philosophy, logic, sociology, medicine, mathematics and music. His major contributions seem to be in philosophy, logic and sociology and, of course, stands out as an Encyclopedist. As a philosopher, he may be classed as a Neoplatonist who tried to synthesize Platonism and Aristotelism with theology and he wrote such rich commentaries on Aristotle's physics, meteorology, logic, etc., in addition to a large number of books on several other subjects embodying his original contribution, that he came to be known as the 'Second Teacher' (*al-Mou'allim al-Thani*) Aristotle being the First. One of the important contributions of Farabi was to make the study of logic easier by dividing it into two categories viz., *Takhayyul* (idea) and *Thubut* (proof).

In sociology, he wrote several books out of which *Ara Ahl al-Madina al-Fadila* became famous. His books on psychology and metaphysics were largely based on his own work. He also wrote a book on music, captioned *Kitab al-Musiqa*. He was a great expert in the art and science of music and invented several musical instruments, besides contributing to the knowledge of musical notes. It has been reported that he could play his instrument so well as to make people laugh or weep at will. In physics, he demonstrated the existence of a void.



Although many of his books have been lost, 117 are known, out of which 43 are on logic, 11 on metaphysics, 7 on ethics, 7 on political science, 17 on music, medicine and sociology, while 11 are commentaries. Some of his more famous books include the book *Fusus al-Hikam*, which remained a text book of philosophy for several centuries at various centres of learning and is still taught at some of the institutions in the East. The book *Kitab lhsa al 'Ulum* discusses classification and fundamental principles of science in a unique and useful manner. The book *Ara Ahl al-Madina al-Fadila* 'The Model City' is a significant early contribution to sociology and political science.

> An art, which has an aim to achieve the beauty, is called a philosophy or in the absolute sense it is named wisdom.
>
> Al-Farabi

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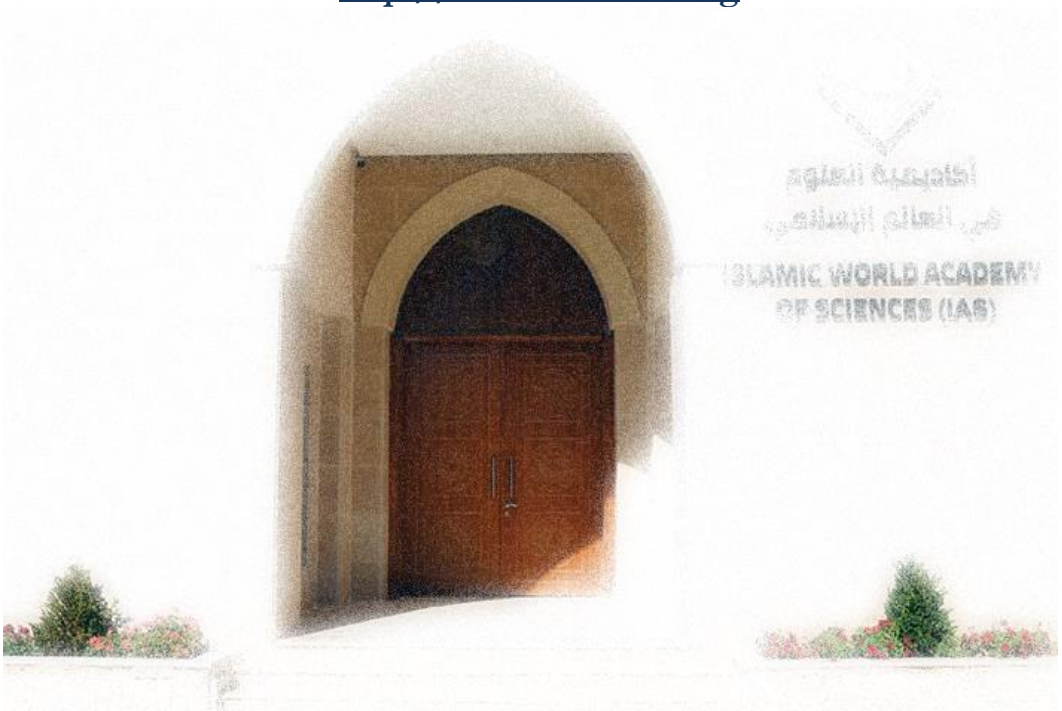

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