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BIODIVERSITY IN AN EVER CHANGING WORLD

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INTRODUCTION

Nature is made of biotic and abiotic components. The interaction within and between these components support multiple functional ecosystems. Smooth unidirectional flow of energy through balanced coexistence of its biotic components and the cycle of material confer stability and resiliency on Mother Nature.

The intrinsic balance is assured by natural laws that prevent dominance of a particular species allowing diverse organisms (biodiversity) to coexist in diverse communities which in turn form diverse ecosystems. Biodiversity is a tool to maintain healthy and productive nature. Healthy nature is essential for humanity as it provides food, feed, energy, medicine genetic resources, a variety of materials, sustains air quality, and minimizes the effect of natural catastrophes and extreme climate.

Pollination, a determinant factor for production in 75% of food crops worldwide including vegetables and fruits, is another service rendered by nature.

In addition, 60% of carbon emissions which amount to 5-6 gigaton of carbon/year are sequestered in ecosystems (marine and terrestrial). Vibrant nature also with its healthy ecosystems constitutes non-material aesthetic aspect that improves the quality of life. Ecosystem with its functional biodiversity is a key element in the efforts towards achieving sustainable development goals.

As the UN decade of biodiversity (2011-2020) comes to an end, the global progress towards achieving

biodiversity targets fall below satisfactory, the unprecedented decline rate in biodiversity exerted negative impact on people and planet pushing 1 million species to the verge of extinction.

According to Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) the rate of species extinction is at least tens to hundreds times higher than it has been historically. This trend was not limited to wild life but also it extends to local domesticated plants and animals where local varieties and breeds are disappearing. Since SDGs are intertwined and integrated, loss of biodiversity in ecosystems was estimated to hinder progress in 80% of targets related to poverty, health, water, climate, oceans, land and cities (SDGs 1, 2, 3, 6, 11, 13, 14 and 15). The biodiversity loss also affects negatively the ability of local communities to manage and conserve life and domesticated biodiversity. Thus loss of diversity presents a serious challenge to the world food security. The situation is exacerbated by promotion of commercial seeds and animal stock that are bred for high production at the expense of local ones leading to more uniformity and less diversity, undermining resilience of agricultural systems and increasing vulnerability to pests and climate change. Interaction with and use of available resources provided by varying biodiversity in different ecosystems also contributed to cultural and indigenous knowledge diversity (biocultural diversity).

I. Diversity Change (Factors Affecting Biodiversity)

1- Change in the Land Use:

It is estimated that 75% of land surface (including 85% of wet land) had been changed by man activity and 66% of ocean area is exposed to pollution and acidification. Land use change also affects surface fresh water ecosystems by pollution. The impact was more prominent in over extracted and exploited water bodies or aquifers, leading to increase salinity. This activity comes with more encroachment to wild life habitat and deforestation. This is important knowing that deforestation and encroachment to wild life will reduce the capacity of ecosystems to sequester carbon and expose humans to new diseases (COVID-19).

Expansion of agricultural areas was significant factor in land use change to feed ever growing population of the planet. Almost 1/3 of terrestrial land surface is under cropping or allocated for animal husbandry purposes.

Urban development span over vast areas which doubled since 1992. This expansion requires a network of infrastructure which has come at the expense or jeopardize wild life and forests.

2- Agriculture:

Agricultural ecosystems are not natural. They are stable only by continuous energy input (pest control, supplemental irrigation and fertilization etc.) Agricultural activities have resulted in 60% loss in vertebrate biodiversity and shared 25% of greenhouse gas emission and utilized 70% of fresh water. Historically man was part of the ecosystem when he used to be hunter and fruit gatherer as way of life. But with time as population grew he practiced agriculture. Early agricultural ecosystems were not exerting tangible pressure on other natural ecosystem. However, with advent of technology and the green revolution during the last century, impact of agriculture on natural ecosystem was inevitable and significant. The demand on food and energy created by 7.7 billion people in the world is being reflected in over exploitation of ecosystems at alarming rate. Agricultural ecosystems pose a significant intervention in natural processes and often come with undesirable outcome.

a) Monoculture:

Planting high yielding crops, demanding a lot of nutrients, over vast areas facilitates the spread of pest-causing disease epidemics or insect outbreaks that necessitates intensive fertilization and frequent applications of pesticides; this could play havoc on beneficial organisms, leaks into aquifer and permeates the food chain causing pollution and accumulation of toxic and hazardous material across the trophic pyramid.

b) Uniformity:

Planting genetically uniform crops may cause eruption of otherwise unfamiliar pathogens as it had been recorded, for the eruption of new race of the fungus (*Helminthosporium maydis*) on the F1 corn hybrid variety with a genetic trait that confers male sterility (TCM). The disease caused estimated monetary losses of US\$1 billion in 1970 (worth of 7 billion today).

c) Introducing Intentionally or Accidentally an Alien Species to A New Habitat:

The ecological consequence of introduced species may disrupt the invaded ecosystems. Gypsy moth (*Lymantria sp*) which had been introduced to USA caused severe defoliation of many forest trees. Another example is the introduction of potato to Europe from Southern America. The crop in Ireland in 1845 succumbed under severe infection by late blight disease caused by (*Phytophthora infestans*). The disease devastated the crop causing wide spread famine with catastrophic 1 million deaths.

3- Trafficking of Wild Life:

Illegal trade to make profit gain from direct exploitation of organisms (or their parts) pushed some species to dire situation of near extinction especially when their original habitats are not able to replenish their stock to counteract human greed.

4- Climate Change:

Climate change has a direct and indirect impact on the health of ecosystems and biodiversity. Global warming, as an indicator of climate change, has been elevated by 1°C by 2017 relative to preindustrial level with average increase of 0.2°C per decade. In the last 50 years planet earth experienced extreme weather episodes, fire, drought and heat spills. The sea level had risen between 12 – 21 cm since 1990, at the rate of 5 mm/year over the past 20 years. The impact of the changes was manifested in changing species distribution, phenology, population dynamics and community structure.

Climate change is projected to be more intense in the next decades on biodiversity and ecosystem function debilitating its ability to provide vital services to human kind. If warming stays on course and reaches 2°C average increase, 5% of species will face risk of extinction that will rise to 16% at 4.3°C warming.

Therefore, it is of paramount importance to curb the trend of global warming and to keep it at bay well below 2°C. This could be done by mitigation practices, management of activities that release CO₂ to the atmosphere and by increasing the capacity of ecosystem to fix CO₂.

II. Other Issues Related to Biodiversity

Germplasm Collection (Biopiracy) and Intellectual Property Rights

Developing countries in Africa, Asia and South America are home for more than 90% of the earth biological diversity. People of these countries for centuries interacted with and nurtured this biodiversity developing their traditional knowledge in a characteristic bioculture.

The western countries (developed) embarked on germplasm collections of medicinal, domesticated and feral species from their indigenous habitat in developing countries starting from the last century and continued today. The collection campaigns were undertaken without consent or compensation of local people whose bioculture (material and traditional knowledge) had been exploited to benefit others. The collected germplasm is used in the pharmaceutical industry or plant breeding programs. About 7000 medical compounds had been derived from plants are being used in western medicine contributing about US\$30 billion/year in their economy according to a

study commissioned by the United Nations Development Program. Companies like Merck&Co had patented material collected from 9 countries. The materials were used to make testosterone, antibiotic, antifungal agents, and medicine for manic depression. Pfizer deposited and patented 30 American type culture fungi and bacterial accessions collected from at least 15 countries. Bristol Myers Squibb deposited 38 accessions coming from 15 countries with one patent claim for each accession.

80% of plant-based medical compounds used in the western world are similar or related to ethnic use of source plant in developing countries. The plant-based medicines currently constitute a quarter to third of total medical compounds in use.

Until 1970 plant genetic resources collection had been done under the implicit justification that biodiversity is a common heritage of human kind. This notion was emphasized by the International Undertaking on Plant Genetic Resources Agreement which was approved by FAO 1983. Under this treaty germ plasm in foreign countries are considered as public domain and are not properties of individual, group or state.

The fluxes of biodiversity from North to South precipitate a widespread inequality in terms of the exchange as elegantly illustrated by Fowlers and Mooney 1990 (figure 1).

The common heritage concept had been perpetuated and used also in developing gene banks (for cultivated and some wild plants) which took legal status by UNESCO Convention for Protection of the World Cultural and Natural Heritage in 1979, by the Moon Treaty and in 1982 in the Law of the Sea Convention.

Included in these treaties are several legal elements that insure the availability of genetic resources free of national sovereignty or private property claims in an exclusive use for peaceful purposes by all states. The gene banks are administered and owned by Consultative Group for International Agricultural Research (CGIAR) and located in its centers such as CIMMYT, IRR, ICARDA and others. These centers disseminate seeds (mainly of cultivated crops) samples free of charge to any individual, center or government in the spirit of common heritage.

This development however, reduced dependency of developed countries on the genetic resources from the developing countries.

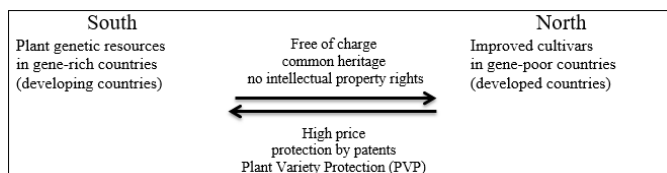


Figure 1. Flux of biodiversity between South and North

Plant cultivars developed in the west specially in America are protected under intellectual property rights through the scheme of Plant Variety Protection if they are developed by classical breeding. This protection is enforceable only in USA. Under this scheme farmers can harvest seeds from the protected variety and use them if they wish for planting in the succeeding seasons. To broaden the geographical domain of the protection, the patent must be observed in other countries. This necessitates that other countries should develop their Intellectual Property Rights (IPR) legislation and willing to enforce it. This is why developed countries exert tremendous pressure on developing countries to establish their intellectual property right legislation.

As part of the pressure developed countries drafted a Trade Related Aspects of Intellectual Rights. In response to the pressure, the developing countries agreed to develop IPR law but they exempted plants, animals, and essential biological processes from the list of patentable subject matters. It is astonishingly enough that they gave their consent to include microorganisms and non-biological microbiological processes in the patentable list.

The agreement was formulated in Convention on Biological Diversity (CBD). The convention was opened for signature in 1992 at UN conference on Environment and Development (The Rio Earth Summit). 168 countries signed the agreement. The convention became binding international law. USA refused to sign the convention because application of some articles related of IPR stipulate compulsory licensing of using genetic resources that originated in the developing countries.

Article 15 of CBD stipulates that individual states have sovereignty over genetic resources where collections and use of these resources requires prior consent. This agreement further recognized the contribution of local knowledge. It promotes conservation of biodiversity and regulates use of its genetic resources fairly and equitably between developing and developed countries. A spin-off CBD is the Cartagena Protocol which deals with handling, transfer and release of transgenic plants (biosafety to the CBD). Another treaty which is negotiated within CBD framework is the Nagoya Protocol which regulates access to genetic resources and fair and equitable sharing of benefits arising from utilization.

With the advent of molecular biology, scientists were able to sequence DNA, cloning vectors and isolation and characterization of genes. This capability allows breeders to transform plants with foreign genes that can confer desirable traits on the transformed plant.

The developing countries resorted to the World Trade Organization (WTO) in the framework of GATS to enact Trade Related Aspects of Intellectual Property Rights Agreement (TRIPS) in 1995. TRIPS seeks to apply IPR on plants and animals in contrast with CBD which emphasize sovereignty over plants and animals and consider them as goods.

III. Shared Natural Resources and International Conflicts

Transboundary ground water, river basin, seas, shared management of natural resources present challenging obstacles. There should be governance structures and management system capable of addressing the complexity of multiple interests of concerned parties. Shared natural resources that are subject to actions by one party would have effect far beyond its national jurisdiction. Here comes the role of environmental diplomacy. So it is imperative to put forward an agreed management scheme for the shared resources as a tool to diffuse and manage any emerging conflict. Unconsented intervention in biotic and specially abiotic component of shared natural resources may have negative impact beyond the national borders. This may generate friction and conflict that jeopardize peace and stability.

IV. Nexus Assessment

Biodiversity, water, food and health are intricately connected as mirrored in the Sustainable Development Goals related to food, water, health and climate change. These goals are inseparable and are emphasized by United Nations actions in three Agreements; Convention on Biological Diversity, Framework Convention on Climate Change and United Nations Convention to Combat Desertification. The linkages fall in 3 categories; synergy, co-benefit and trade-off. While biodiversity contributes to food production and health by providing clean and safe water, the food production processes impacted biodiversity, water, climate change and health. Moreover our ability to produce food, supply clean water and enjoy healthy lives is detrimentally affected by loss of biodiversity and climate change. These relationships present a challenge to strike balance among economic, social and environmental issues with the aim of maintaining Sustainable Development Goals.

SCIENCE POTENTIAL FOR SUSTAINABLE WATER POLICY AND CLIMATE CHANGE

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Water sustains life, the environment and development. Human rights to water, as water is becoming a commodity threatens the poor. Global water crisis in term of quantity and quality is man-made disaster

linked to environmental imbalance and degradation of life-support ecosystem. It is a crisis of water management, fragmented institutions, inadequate policies and legal systems, political will, widening gap between science and policy making at the national, regional and global levels. Already one third of world population is living in water-scarce or water-short areas. Climate change will accelerate the figure to one half. 12% of World's population uses 85% of its fresh water. Water supply resources are being stretched to their limits. By 2050 additional 3 billion people will be born mostly in countries already suffering from water shortage

With the advent of climate change, most of water stressed areas particularly in arid and semi arid zones (Middle East and MENA regions) will face rainfall decline of 20% and temperatures rise 2-3⁰ C. that would result of large losses of water resources, basic food, basic needs, and increased poverty.

Water science is a “must” in developing a unique water management scheme. It contributes to well defined policy for efficiency, sound strategy and sustainable plan of action. There is unlimited potential what science can do on our planet, where salt water comprises 97.5% of planet waters, and fresh water of 2.5%: 70% tied in polar caps, and of what is left to humanity only 30% in rivers, lakes and ground waters. Fundamental change in water policies and engaging science to develop a unique water management scheme is imperative. Currently, water policies are divorced from sound science. Demands should be managed by new culture of efficiency, cutting losses, protecting water from overuse and pollution.

At the global level; nanoscience in seeds-clouding, in nano-membrane, for efficient diffusion technology for harvesting fresh water from oceans and seas, coupled with nanosolar cells for utilizing efficiently sun-energy. The amount of sun energy falls on one square meter on the desert of the MENA region, equals to one barrel of oil (BTUs) annually. Arab region with 5% of world population produces 50% of desalinated water of the world. Generation of electricity is linked with water desalination utilizing fossil-fuel, in the Gulf region.

At the regional level; managing shared water resources whether rivers, or ground water aquifers, should be placed on the agenda of countries of water basins, bilateral or multilateral agreements should lead to stronger economic and political ties among countries of shared water-basins, leading to peace rather to conflicts. Of all renewable water resources in Arab countries, two thirds originate from sources outside the region.

At the national level; science can contribute in acquiring knowledge via remote sensing to identify new ground water basins and develop policy for their wise-use and sustainable management.

Water governance should have stakeholders participation. Information is hardly shared between “policy makers” and authorities or between “government” and “nongovernmental sector” effective institution-strengthening and legal framework to expand public-private partnership needed.

Agriculture accounts for 83% of water use in Arab region against world average of 70%. Irrigation efficiency remains at 35%. Science can contribute in developing new local crop tolerant to aridity and salinity condition. (stressed physiology crops) Rain-harvest system is recommended. More efficient science-based agricultural practices and techniques in conserving water under i.e. plasticultures. Other policy reforms for new political economy of water acquiring water “virtually” through imports of crops from water-rich countries, while allocating scarce water resources to low-water consuming, high value adding crops that

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DIGITAL TRANSFORMATION IN HIGHER EDUCATION; EMERGING CHALLENGES AND FUTURE OPPORTUNITIES

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Background

The COVID-19 pandemic imposes strict restrictions on human contacts and movements in society, such as social distancing constraints, setting a minimum of a 2-meter diameter circular self-isolation zone for individuals in a group of people setting; coupled with the 'anonymizing' masks. Such space restrictions drastically reduce the feasibility/possibility of organizing educational meetings and lecturing in small lecture halls. Even in relatively large attendance-capacity amphitheatres, the likelihood of a full-house is mostly reduced. Moreover, the draconian restrictions applied to the different modes of transport make students' and faculty's movement somewhat problematic from their specific educational institutions. Moreover, sanitizing surfaces and maintaining personal hygiene has become the usual practice in all environments where human beings are present to keep the virus at bay.

Since the beginning of 2020, and with a relatively great speed, the COVID-19 pandemic has revealed shortcomings in the national policy systems and various related sectors, including science, technology, and innovation (STI) and higher education globally. It has also highlighted some successes in other sectors such as the information and communications technology (ICT) sector, whether in terms of smart applications or, on a broader level, providing the endless array of virtual educational channels to facilitate distance education, among other aspects.

The inability of agencies responsible for the management of the current crisis to predict the speed and comprehensiveness of the epidemic's spread and the best practices to limit the extent of its spread – among other things - and indeed the predicted fallout of the pandemic on aspects of life in our post-COVID world, may require a speedy transformation of the

can generate foreign exchange. Food security may be achieved through well-balanced trade policies.

Waste-water generated by domestic and industrial sectors in the Arab region is 10 Km³/year, of which 5.7 Km³ undergoes treatment of the volume of the waste water that is treated, only one third is reused. Waste water treatment plants currently handle waste loads that exceed their capacity limits.

The untapped potential of waste water requires appropriate policy interventions. It should be augmented in the national water management strategy for water reuse policies. Dissemination of best scientific practices, cost recovery, professional training and public awareness.

Water leakage and theft rates in the distribution network of fresh water averages are estimated to be, 13% in Europe, 15% in USA, 25% in Turkey and 35% in the Arab region.

UN & UNESCO classify rich-water countries, those who secure 8000 m³ per capita per year. World average estimated at 6.000 m³ per capita per year. An allocation below 1000 m³ is considered a water-scarce country, and an allocation of below 500 m³ per capita per year represents severe water scarcity. 13 Arab countries are among world's 19 most water-scarce nations, and per capita water availability in 8 countries is below 200 m³, less than half of UN-designated water-severe scarcity country. Climate change endangers biodiversity and food security of those countries.

Science in water stressed areas is more important than ever in finding solutions to water scarcity, where enlightened policy can rest. Barriers to the use of science in policy making, exist particularly, in the Arab region where political decision-makers do not value the impact of science on development and management of resources.

The Arab economical summit of Arab head states held in Kuwait 2009, declared that priority of science R&D in the Arab region should concentrate on three areas: **water, energy, food security**, but no Arab state had seriously incorporated it in the policy-making **needs**, and they continue to have it as slogan without **deeds**.

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national research and higher education ecosystems. The mobilization of the science, technology, and innovation sector, in part, by leveraging the tools of ICTs, addresses such a multitude of problems.

We attempt to discuss some of the policy issues related to the digital transformation in research and higher education in the light of the COVID-19 crises, as highlighted in the webinar organized by the COMSTECH Inter-Islamic Network of Virtual Universities (CINVU) on 29 October 2019. First of all, Dr Najafi, the dean of CINVU, stated that this virtual university is the only active international academic organization in the field of science and technology in all OIC (Organization of Islamic Cooperation) member states and is honored to hold its first global webinar presenting prestigious scientists, intellectuals, professors, students and experts in the field of innovative sciences and technologies. The webinar on "Digital Transformation in Higher Education; Emerging Challenges and Future Opportunities" is an essential step towards innovative education, research, and management of the virtual universities in the Islamic world to provide the necessary platform to achieve educational equality in the Islamic countries and other countries with great Islamic potential. He mentioned that the need to appreciate the worthwhile contribution of this network's active members and the Islamic world's scientists, especially the Islamic-World Academy of Sciences (IAS), is felt. This network will make any effort to support and strengthen any needed educational program, including short-term and long-term virtual courses for the world universities, especially those in the Islamic countries. Meanwhile, CINVU welcomes all active scientists, including the Islamic world, to conduct virtual teaching in any required field of science at the higher education level. The positive feedback of scientists with the hope for growth and richness of science and technology in the Islamic countries is welcomed.

In the webinar, Prof. Muhammad Asghar addressed the 'Performance of Higher Education Institutions under and aftermath of COVID-19 Pandemic Crisis,' while Dr Moneef Zou'bi presented a talk on the 'Digital Transformation in Research and Higher Education; Lessons Learnt from the COVID-19 Pandemic.' Moreover, Prof. Mohammad Abdollahi talked about digitalization's pros, while Prof. Shekoufeh Nikfar summarized the cons of digitalization. Also, Mr Soroush Ahmadi made a presentation on 'Digital Transformation in Higher Education Institutions Roadmap and Summary of the Panel.' At the same time, Prof. Mohammad Abdollahi and Prof. Shekoufeh Nikfar moderated an interactive discussion session with almost 120 participants. They ultimately presented a concise summary of the ideas presented in the webinar.



Summary of Discussions made by the Lecturers

Humans can face this highly abnormal and unprecedented situation – owing to the Coronavirus pandemic - through the use of up-to-date digital means of information gathering and transmission, essentially through tele-lecturing and tele-conferencing e-platforms while ensuring that on the receiving end are expected to receive such lectures and talks in their 'personal places,' and have the appropriate means of visual and vocal reception via laptops, tablets or smartphones with the possibility of visual and vocal exchanges during the talks and lectures. The advantage of these digital tele-means is that the people concerned can be anywhere near or far from the institutions offering higher education programs. Moreover, people's absence or reduced movement from one place to another might help reduce the overall carbon footprint and combat climate change. This is important because it is highly probable that the climate dynamics and global warming might drive the entire planet to uncontrollable global tipping points. However, such digital tele-means cannot substitute practical training in laboratories where students have to physically present with their supervisors.

Additionally, the long-term use of such digital tele-means and the absence of in-person communications could seriously hamper science's progress and damage social links and human relations in society at large, as city dwellers cannot survive without a lively social life. Face-to-face discussions and exchanges build mutual trust and lead to new ideas, topics, and effective collaborations in the sciences among individuals with different backgrounds. However, if we suppose that the COVID-19 pandemic persists for a long time, then, in that case, these digital tele-means of communications may become the norm not only in higher education but in other branches of education, i.e., schools and colleges, and ultimately in all domains of communication and interactions in society. Hence, there might be a danger that society would transform into an ensemble of quasi-digital robotic tools. One

has already seen this tendency of digital robotization through the uninterrupted use of smartphones or other mobile means in many public places such as the pavements and streets, causing traffic incidents and accidents.

Moreover, there are tangible signs of the damaging psychological effects of so-called “digital addiction”. The reason is that, genetically, an individual is a social entity that needs physical and social contacts for its mental well-being, as proclaimed ages back as being one of the basic tenets of Confucianism. Hence, it is the duty of all who have a responsibility in the society at different levels and for various tasks such as education and social interaction and cohesion, to ensure that despite these powerful digital information tools, the cities, the villages, the hamlets should remain alive and lively, i.e., not become virtual social entities for citizens on the path of a healthy and sustainable overall development.

In the next sections, the significant challenges that higher education institutions face in digital transformation are discussed. These include insufficient internet bandwidth, ‘digital divide,’ defined as the gap in the access to technology across countries and between income brackets within countries, and digital literacy issues, e.g., lack of training for academic staff. Another major challenge is how to attract multi-stakeholder engagement. Multiple stakeholders’ collaboration should be established to smoothly and comprehensively implement digital transformation. These stakeholders are from the private sector, e.g., ICT companies, internet service providers, software developers, etc., and the governmental sector, e.g., governmental funding programs and policymakers in ministries of education, academia, learners, and the general public. Furthermore, there should be mechanisms to ensure the quality of distance-learning programs and assessments, which should be foreseen in different accreditation criteria.

To sum up the meeting, a sample roadmap of academic institutions as an example of implementing digital transformation was discussed. This roadmap consisted of the following domains:

1. Digital infrastructure, such as bandwidth and connectivity, learning management systems, etc.
2. Policy issues, such as ICT policy, developing learner-centered credit systems, data protection, etc.
3. Training programs for academic personnel
4. Sufficient monitoring and evaluation.

Subsequently, the discussion concluded with a list of pros and cons that can be applied to the current state with the least adverse outcomes. It was noted that current challenges could be classified into four categories, namely (1) technological challenges, (2) individual challenges, (3) cultural challenges, and (4)

course challenges; all might vary from one country to another due to different cultures, context, and readiness. The pros, cons, and effective solutions for existing issues are listed below:

Pros

- 1- Good time to reconfigure digital skills
- 2- Providing access to learning for those who are geographically remote from the instructors
- 3- Time-saving
- 4- The flexibility of classes: students have on-demand access to educational content in any location, time, or situation they wish
- 5- Improved interaction with instructors and classmates: depending on the student, this might also be the opposite and be regarded as a disadvantage.
- 6- Providing more comfortable and more effective access to a wider variety and greater quantity of materials and information
- 7- Providing more manageable and faster-updated versions and distribution of the educational content in comparison to the printed references;
- 8- Limited social contact and social distancing (during COVID-19 pandemic) may lead to saving money and energy, and a decrease in the use of public transport is one noted advantage of online learning;
- 9- Better learning achievement: this may not always be true. For instance, most students are not motivated to self-study and might need force or encouragement. Therefore, of course, e-learning is not beneficial to these groups of learners.
- 10- Students interested in more learning can go online and search engines.
- 11- Students can work with each other through online sources
- 12- Digital learning can be cost-effective compared to face-to-face learning. This is because they may reduce the cost of teaching, physical space for teaching, printing and paper costs, traveling, etc.

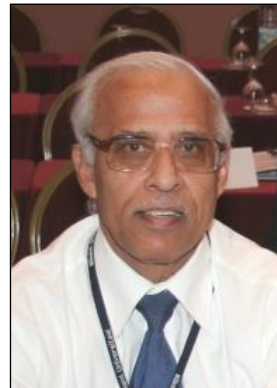
Cons

- 1- The availability of essential infrastructures and efficient institutional readiness
- 2- Lack of access to the internet, with digital inequity, still increasing in some countries
- 3- Parental attitudes and misconception related to spending time around digital devices may create some problems for students: although in some families the computer is part of the learning activity, in others, it is seen as a mere source of entertainment
- 4- The need for teacher training programs or reluctance and avoidance of educators to engage in new technologies and applications because of their limited knowledge or lacking proper training and experience in these fields

BIG BANG EXPLOSION AND ITS ENTROPY

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Abstract: This write up is an attempt to deal with the lowest possible value of entropy of the universe at the instant of Big Bang explosion and the decohering effect of gravity leading to temperature and entropy of the nascent universe.

- 5- Digital devices contribute to developing the capacity to use different forms of understanding
- 6- Low quality of teaching
- 7- Low interaction with instructors
- 8- Insufficient financial capacity of students
- 9- Lack of commitment to distance learning courses by students
- 10- A significant challenge is acquiring adequate clinical medical skills
- 11- In some cases, faculty members face difficulty in recording lectures from home and have to visit their institute to record the speech physically
- 12- Challenge of the students with a shorter attention span
- 13- Teachers deficits in training and online assessment
- 14- Female workers should do household jobs together
- 15- Online classes may be uncomfortable or not crucial in some student's opinion
- 16- Lack of security and privacy concerns
- 17- Lack of effort and support by faculty members in the use of e-learning
- 18- Technical issues, especially during summative exams
- 19- Increase in exposure time to electronic devices, i.e., cell phones, tablets, and computers; all of which may put the students at a higher risk of health problems, especially vision and hearing problems
- 20- The issue of cheating: students can copy and paste each other's work into their assignments
- 21- Lack of in-person interactions and possible progression of depression, anxiety, and so on.

Conclusion of Webinar on Practical Solutions for Current Challenges

- 1- Many strategies have been recommended to improve the quality of online teaching and enhance student engagement. These include providing clear directions at the start of the sessions, interacting with the students instead of just talking, giving breaks, blending both synchronous and asynchronous teaching methods, introducing gamification, and encouraging participation by using polls, breakout rooms, and whiteboards during the sessions.
- 2- Institutes with established IT and education departments that are successfully managing e-learning before the COVID-19 pandemic should share their expertise and guide new personnel. There is also a need to research to formally document the experiences and challenges being faced by the students and faculties in this pandemic.
- 3- There are many examples from the world universities about successful digital education and e-learning programs.
- 4- The e-learning success depends on the students' willingness and acceptance to use such techniques.

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1. Entropy

There is a state function called entropy S that for an isothermal and cyclic process is conserved through the Clausius relation derived from the Carnot reversible cycle:

$$S = \oint_C \delta Q/T = 0 \quad (1)$$

where δQ is the differential change in heat of the system and T is its absolute temperature. The heat is thermodynamical quantity that represents the system's thermal energy, which is not available for mechanical work, but is used up as its internal excitation energy.

The equation (1) is used to define the differential of entropy:

$$dS = \delta Q/T \quad (2)$$

According the second law of thermodynamics, the entropy of an *isolated* system always increases irreversibly over time as

$$dS = \delta Q/T > 0 \quad (3)$$

and it reaches its maximum value, as the system reaches its thermodynamical equilibrium. For the reversible case, the entropy of the system always remains constant and does not change:

$$dS = \delta Q/T = 0 \quad (4)$$

The statistical analysis of the phenomenon of entropy leads to the Boltzmann classic relation:

$$S = Q/T = k_B \ln \Omega \quad (5)$$

where Ω is the ensemble of the excited microstates of the system caused by its intrinsic heating, and k_B , the Boltzmann's constant.

2. Arrow of time and the entropy of the universe

Since the entropy of an isolated thermodynamical system always increases *over time*, it signifies that the direction of “flow” of time in thermodynamics is from the past towards the future. This phenomenon is called arrow of time. As one moves towards the past, the system’s entropy should decrease and at a certain moment of time, it should go to zero and, then, according to (4), its ensemble of microstates should reduce to only one microstate. This unique situation corresponds to the zero point of the Kelvin’s absolute temperature scale.

The universe seems to be an isolated thermodynamical system, and there are good signs of this through the high entropy of black holes (1), created under the influence of gravity, that its overall entropy is increasing over time. The age of the universe from the zero-point defined by the Big Bang (BB) explosion to the present epoch is determined to be 13.787 billion years (2). As one moves towards the past, this entropy should decrease, but the fundamental question for cosmology is: what was the universe’s entropy at the instant of BB explosion? It could be zero implying that the universe was born in just *one coherent quantal state*. This is quite probable, if the nascent pulse of radiation from the BB explosion was *completely correlated quantum-mechanically*. However, here, the ultimate one *microstate* of the system with entropy $S=0$ as foreseen by the relation (5) is replaced by a *macro-quantal state* containing all the possible microstates of the future universe. This is not surprising, because the production of this type of quantum-mechanically correlated radiation is observed often in different types of experimental work.

It is highly likely that the BB-explosion radiation pulse was caused by the excitation of *quantum vacuum* at time zero. However, the question is as to which type of quantum field was excited leading to this radiation. It may be reasonable to assume that at time zero, the correlated radiation pulse as a macro-quantal state with entropy $S=0$ resulted from the EM-field excitation out of quantum vacuum, because the massive particles needed for switching on the strong and weak interactions are created later in time. However, the cosmological work suggests that the nascent universe had a temperature of around 10^{15} K just a tiny fraction of second after the explosion implying a higher temperature at the moment of explosion. How did this come about? The solution seems to be in the presence and effect of gravitational field. As the radiation pulse has energy, thus, effective mass, the moment it was produced from quantum vacuum, the decohering gravitational interaction came into play. This gravity-

caused decoherence introduced randomness in the structure of radiation and converted a part of its energy into internal energy as heat that led to the increase in temperature and entropy of the nascent universe.

Penrose (3,4) has suggested a possible solution to this expected low entropy of the Big Bang explosion in terms of *gravitational entropy*. Here, the gravitational field is expected to have its maximum value at the moment of BB explosion and entropy $S=0$; this corresponds to the macro-quantal state for the radiation discussed above. As time passes, the gravitational field is expected to be distributed more and more in its degrees of freedom leading to an increase in entropy of the universe as required by the second law of thermodynamics with its arrow of time.

For both the “radiation entropy” treated here and for the Penrose’s gravitational entropy, the Big Bang explosion has to correspond to minimum entropy: $S=0$. However, unlike the gravitational entropy case, the radiation entropy can create temperature right after the BB event as discussed above. However, as the 2.73° K CMB radiation intensity distribution corresponds to black body radiation with a high precision, indicating that the matter in the universe is in thermodynamical equilibrium. This result indicates that the radiation entropy has already reached its maximum value some time back and the continuing increase in its value is due to the gravitational entropy in accordance with the second law of thermodynamics and arrow of time.

3. Conclusions

It is reasonable to assume that the BB-explosion produced a pulse of EM-radiation from quantum vacuum which was completely correlated quantum-mechanically leading to a coherent quantal state of zero entropy. However, right at the beginning this correlated radiation was subjected to the decohering gravitational field resulting in temperature and entropy of the nascent universe.

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PRECISE METHOD BASED ON MIX PRIMERS DESIGNED FOR DETECTING HALAL MEAT PRODUCTS

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Today, mixing in meat products, especially processed products, is considered one of the most important problems of some production units in the food industry. Various aspects such as sources, price, religious factors, production systems, and safety affect the consumer's acceptance of meat. Therefore, the meat type test is critical, and its identification leads to confidence in consumers and the factories that use animal protein sources in their products. In recent decades, new biotechnology techniques have allowed for health control and preventing fraud by producers in foods, and in some ways, it encourages quality control and consumer health.

The genetic methods are highly accurate and quick among the new biological methods used to identify the content of processed meats used. The aim of the present study was to develop a specific PCR method for the identification of Halal meat products and animal species-specific detection. In this method, after extraction of DNA from ten types of meat tissue, using the novel primers designed for the cytochrome b gene, the PCR reaction is performed to amplify the desired gene, this way it is possible to understand the content of mixed meat.

Polymerase chain reaction (PCR) was used to identify meat products, and different primers were designed from the mitochondrial sequence that produced different lengths of cytochrome b gene in each species. The polymerase chain reaction was performed individually or on a mixture of primers, allowing the simultaneous detection of three types of meats.

Due to the speed, simplicity, sensitivity, and special feature of this method is the possibility of simultaneous detection of three types of meat, this method has a high potential in identifying Halal meat.

Keywords: Polymerase chain reaction (PCR), Cytochrome b, Mitochondrion sequences, Halal meats detection



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POLICY AND LEGAL LANDSCAPE ALONG WITH ISSUES PERTAINING TO TRADITIONAL KNOWLEDGE OF PLANT GENETIC RESOURCES

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Traditional knowledge (TK) is a living body of knowledge that is developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity. Examples of TK are agricultural, environmental or medicinal knowledge or knowledge

associated with genetic resources. There is a key issue in the use of plant genetic resources in agricultural research and development (R&D) that implicates intellectual property rights (IPRs) and public-private partnerships. This issue concerns the management of intellectual assets that are held not by scientists, but by within specific geographic areas of the world, and often, by indigenous peoples. These assets are referred to as ‘traditional knowledge’. For many years, traditional knowledge has been perceived as information freely available for use in the public domain and therefore, it is not considered for protection under any intellectual property rights laws. However, traditional knowledge was deemed to be recognized under other customary laws. Traditional knowledge and indigenous people were significant in the improvements of farmers’ varieties (landraces) and the development of new plant varieties in developing countries. Traditional knowledge and indigenous communities often play important role in conserving in situ biological diversity.

The lack of recognition afforded to traditional knowledge and the more direct misappropriation, unfair acquisition, and inequitable benefit sharing of biological resources are referred to as biopiracy. The concept is defined as “illegally accessing and using genetic resources and related traditional knowledge, either through direct appropriation or indirectly through the use of intellectual property, especially patents.” In a few words, it is the exploitation of indigenous knowledge for commercial gain without compensation to indigenous people themselves.

Genetic resources are genetic material of plant, animal, microbial or other origin containing functional units of heredity that has actual or potential value as defined in the Convention on Biological Diversity (CBD). The CBD was adopted in 1992 at the Rio Earth Summit and entered into force in 1993. The objective of the convention as in Article 1 is “the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.” This is to enable developing countries to benefit from genetic resources which are embedded within traditional knowledge. It is required, for instance, to obtain informed consent to access such resources and share benefits of the biodiversity with the community and country of origin. To some extent, establishment of appropriate regulations by the CBD to prevent biopiracy have been unsuccessful. As Biodiversity Experts and Consultants, Ruiz & Vernooy (2012, p.3) noted that “existing laws and mechanisms, such as IPRs (are) unable to protect indigenous and traditional knowledge and are inadequate when it comes to collaboratively developed innovations.”

The global policy-related literature draws attention to the notion of access and benefit sharing (ABS) for access to genetic resources and use of traditional knowledge produced or reproduced by indigenous people and communities. Most of the CBD provisions describe and focus on access to and use of genetic resources and benefits arising from them. For example, CBD recognizes “the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices, relevant to the conservation of biological diversity and the sustainable use of its components.”

There are 196 member states of the CBD that signed and ratified the Convention. The U.S. is not a member of the CBD. An explicit relationship and developing a linkage between the CBD and the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) has yet to develop by the TRIPS Agreement and in a different manner of Article 27(3)(b). TRIPS Agreement (1994) provides, “Members may also exclude from patentability . . . plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement.” (Article 27(3)(b) of the

TRIPS Agreement). The approaches of the WTO and the CBD are quite different, the Agreement on TRIPS asserts IPR on life form such as plants, while the CBD asserts national sovereignty and thus by implication the right to prohibit IPR on life forms. The CBD promotes equitably shared benefits from use of biological resources and protection of traditional knowledge; TRIPS promotes the private appropriation of benefits and has no mechanism for acknowledging the role of traditional knowledge in the industrial use of genetic resources.

Key issues for agriculture and agri-biotechnology emerge from the CBD in relation to traditional knowledge, as well as biosafety. The CBD recognizes the traditional knowledge of indigenous and local communities. The IP Professor and Expert, Peter Yu (2009a, p. 534) noted, “the traditional knowledge debate to date has been particularly intense, and the international community has yet to reach a consensus on how to protect indigenous materials.” This situation is the result of the limited understanding of the complexities involved in defining the scope of protection and classifying materials defined as “indigenous” as well as the likelihood of opening up a much larger range of issues related to indigenous peoples and minority rights. It is also found that national and international laws do not necessarily meet the expectations of indigenous people with respect to regulating the protection and exploiting of biological resources. Biosafety is also an issue implicated in the CBD.

The Conference of the Parties to the CBD adopted in 2000 a supplementary agreement known as the Cartagena Protocol on Biosafety which came into force in 2003. The Protocol seeks, “To protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. It establishes an advanced informed agreement procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory.” The Cartagena Protocol also established the “Biosafety Clearing House” which assists countries in the implementation of the Protocol by facilitating the exchange of information on living modified organisms and developing or strengthening capacity building in biosafety. Initiatives include such activities as cooperation on scientific and technical training in the proper and safe management of biotechnology.

Similarly, the International Treaty of Plant Genetic Resources for Food and Agriculture (ITPGRFA) was adopted in 2001 and came into effect in 2004. This

new treaty sought to promote “the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the CBD, for sustainable agriculture and food security” (Article 1.1). The treaty also “recognizes the sovereign rights of states over their own plant genetic resources for food and agriculture, including the authority to determine access to those resources” (Article 10.1). The treaty further requires member states “to establish a multilateral system, which is efficient, effective, and transparent” (Article 10.2). This treaty is a multilateral system that recognizes the contribution of farmers and indigenous people to agricultural biodiversity. The multilateral system involves 64 major crops and forages as part of the global commons. The treaty also provides other strategies such as information-exchange, access to technology and capacity building. It encourages national governments to “develop and maintain appropriate policy and legal measure that promote the sustainable use of plant genetic resources for food and agriculture” (Article 6.1). As well the Treaty recognizes plant breeders’ rights and therefore, plant breeders can claim rights that do not limit access. Patents, however, cannot be claimed as specified in Article 12.3.d “Recipients shall not claim intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the multilateral system.” The treaty also affirms farmers’ rights “to save, use, exchange and sell farm-saved seed and other propagating material, and to participate in decision-making regarding, and in the fair and equitable sharing of the benefits arising from, the use of plant genetic resources for food and agriculture.”

It is also important in discussions of traditional knowledge and IP management to clarify that ITPGRFA is the only treaty that resulted in an operational, multilateral access and benefit sharing system. Therefore, ITPGRFA regulates conservation and sustainable use of plant genetic resources for food and agriculture, including access and benefit sharing through the multilateral system, and a second agreement known as the Nagoya Protocol regulates access to genetic resources and derivatives and the use of traditional knowledge of indigenous people. It is noted, that to date, the subject of traditional knowledge of genetic resources has not been addressed in the UPOV Convention. However, new plant varieties that are developed by indigenous people with traditional knowledge and meet the requirements of the UPOV, would be granted protection.

The exchange of seeds for breeding, research, and training was facilitated by the ITPGRFA. As a result of the implementation of the system, a legal proceeding known as a material transfer agreement (MTA) was created and put into practice. MTAs contain obligations that limits the further use of genetic materials received through a transfer from one scientist or institution to another. A MTA represents a binding legal agreement that varies from country to country and is ruled by the principle of contract law. Specific legal principles must be taken into consideration when a MTA is formed, interpreted, performed, and terminated. A MTA contains certain elements such as the parties to the agreement, the object of the contract, and rights and obligations of the provider and the recipient. MTAs also contain the following statements: introductory provisions of the legal status of the provider and user of genetic resources, access and benefit-sharing provisions, and legal provisions. MTAs are now established practice used by industrial organizations, universities and non-profit organizations for the transfer of genetic materials.

In summary, inventions based on, or derived from genetic resources could be patented by third parties, raising questions as to the relationship between the patent system and the conservation and sustainable use of biodiversity and the equitable sharing of benefits. A traditional remedy could be appropriated by a pharmaceutical company and the resulting invention patented by that company. An indigenous folk song could be adapted and copyrighted, without any acknowledgement of the indigenous community which created the song and without sharing any of the benefits arising from the exploitation of the song with the community. Therefore, it is possible to argue that the protection of indigenous and traditional knowledge does not exist in most of the legislation associated IPRs, particularly at a national level and specifically, in countries such as USA and Canada. There are provisions at the global level within the international regime governing access to genetic resources and benefit sharing under the CBD and the protection of traditional knowledge under WIPO's sui generis systems that protect local natural and genetic resources. The ITPGRFA is important because it represents a multilateral system that facilitates access for agricultural crops and recognizes farmers' rights. The legal recognition of farmers' varieties is important for food security and implementation of farmers' rights at the national level. Plant breeders can not prosper unless farmers do. Many believe that strong breeders' rights could increase genetic diversity and food security. Furthermore, such recognition may exert positive influence on the development of policies and

strategies to promote sustainable agriculture and the conservation of plant genetic resources for food and agriculture at the international level.

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NOTE: COAL AS FUEL IN THE ENERGY MATRIX

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1. Coal is the biggest recoverable reserve of energy of more than 1000 billion tons in the Earth with a rather even distribution on its surface.

2. Coal is the biggest source of Co₂ in the domain of different fossil fuels including natural gas and petrol

3. The climatic constraint limiting the mean increase in the atmospheric temperature to 2°C by the end of 20th century, needs that the atmospheric concentration of Co₂ does not go beyond 450 ppm from its present value of 413 ppm.

To achieve this target, one has to have the Carbon Capture and Storage (CCS) process in operation and available at the earliest possible time, for a general and binding use everywhere in the domain of the coal-based thermal power generation, because it is totally unrealistic to stop now or in future, the use of a good amount of abundant and relatively cheap coal for power generation and other needs in large parts of the world. However, the capture and storage of coal produced Co₂ is going to be a highly complex and rather costly task.

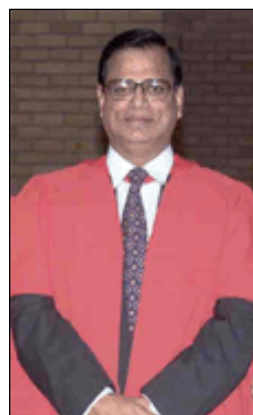
In addition to the CCS for coal, one has to minimize the use of petrol and natural gas through higher thermal efficiency and the overall economy in the use of energy along with the development and integration of different types of renewable energies (wind, PV, biomass, hydro, geothermal and sea-tide) in the stable energy-producing sources.

4. There are quite a few CCS-based projects under construction or programmed in USA and other countries, and even one Saskpower 110 MWe totally carbon-purged, coal-fired thermal power station has already been in operation in Canada since some time. However, it seems that in this domain, China's action is going to be the determining factor for the world, because China, as in the field of renewable energies, has already mastered and dominates the construction and operation of ultra-supercritical thermal power stations with a thermal efficiency higher than 50%. As China has already started to work on the CCS process, one expects a good progress in this domain in the next few years added to the ultra-supercritical thermal power stations with the economically acceptable added overcost per unit of energy produced.

5. In the worst scenario of failure to achieve the needed limit on the production of Co₂, but still keeping the 2°C limit by the end of 20th century, it has been claimed that one has to leave underground and unburnt 80 % of coal, 50 % of gas and 30 % petrol. If this is going to be the situation in the future, one has to learn to live really economically with the energy from the renewables everywhere with a corresponding storage capacity along with the nuclear power in quite a few places otherwise the atmospheric Co₂ concentration could go beyond 1000 ppm resulting in an average increase in temperature of 4°C or more that could trigger life endangering highly non-linear tipping-points phenomena.

BIOPROSPECTING FOR NOVEL MEDICINES FROM INDIGENOUS BIOTA, AND PRODUCTION OF AFFORDABLE BIOSIMILAR MEDICINES IN THE ISLAMIC WORLD

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There are undoubtedly many areas of high priority research that need to be carried out in the Islamic world to address common challenges such as Food Security, Health Equity, Renewable and Green Energy, Climate Change, and Protection of Environment and Biodiversity. They are all equally important for all Islamic countries irrespective

of economic status, and need to be championed by experts from the Islamic world's own scientific community. All these big challenges would benefit from adequate and coordinated funding, multidisciplinary and multi-institutional research collaboration across the Islamic world, and pooling and sharing of resources and ideas. In the process they also provide opportunities to improve the quality of higher education, build and strengthen postgraduate research, and establish partnerships with relevant industries for product and process development, and for job and wealth creation.

To initiate a useful dialogue, two examples are presented here of biopharmaceutical research that could be carried out in, and benefit, the entire Islamic world. These research initiatives could involve the participation of scientists from many different Islamic countries, including those from scientifically-lagging ones, and could also provide excellent opportunities for multi-institutional, multidisciplinary and multinational collaborations, and for advancing postgraduate and postdoctoral research throughout the Islamic world.

Health Equity through ready availability of affordable and effective medicines is one of the major requirements for the entire Islamic world. The demand for low cost and effective medicines in developing countries has till now been largely met through **generic** medicines, which are less expensive but highly effective replicas of small molecule drugs.

Substantial amounts of generic medicines are sourced from developing countries including some in the Islamic world. However, the pipeline of new small-molecule drugs, from which generic medicines are copied, have almost dried up as multinational drug companies have turned their attention largely to highly effective new biological therapeutics to meet emerging health challenges.

This provides an opportunity for Islamic countries, including the low-income ones, to get involved in the discovery and development of new medicines based on their own existing resources and strengths, and by the judicious use of patent exemptions afforded by the *World Trade Organisation* (WTO) to *Least Developed Countries* (LDCs). There are two areas of pharmaceutical research that have huge potential for success through multinational and multidisciplinary collaborations between academic and industrial research groups in different parts of the Islamic world. Such collaborations, involving research groups in different Islamic countries, would be greatly aided by uniform *Intellectual Property* (IP) and regulatory guidelines. For detailed description of the two highly promising therapeutic research areas please see link (<https://youtu.be/8gqfgwr9iDE>) to a recent COMSTECH webinar “*Opportunities in the Islamic world for the production of novel natural product-based therapeutics, and affordable Biosimilar Medicines*”. The main points covered in the webinar are summarised below:

(i) **Novel Medicines from Indigenous Biota:**

One very promising area of drug discovery and development where Islamic countries, irrespective of economic and developmental status, can productively collaborate, is through “**rational**” **bioprospecting of the Biota**. Most Islamic countries are endowed with diverse hotspots of unique flora and fauna, and rich traditional medicine systems. Ethno-pharmacologists and medicinal chemists in Islamic countries, and in the developing world, have been very prolific in publishing scholarly research articles on medicinal plants and their putative active principles, but relatively little of this has translated into scientifically-verified safe and efficacious modern drugs. Natural products-based drug research would be greatly enriched by additional involvement of biomolecular scientists, involved in studying the molecular basis of disease pathogenesis, who could help to identify precise disease-specific molecular targets, and develop target-based bioassays, for drug development.

Secondary metabolites of plants, antibiotics, and toxins and venoms of many organisms, have very

unique molecular structures and often very specific biological functions. Many of these have been the source of well-known modern medicines, and many others could have specific medicinal properties that still remain to be discovered. The usual practice in natural product-based drug research has been to isolate all secondary metabolites from medicinal plants, determine their structures and publish them. Only after that attempts might be made to determine their possible biological or therapeutic properties using commercially available bioassays that are not necessarily disease-specific. Using this approach, the chances of discovering a novel drug candidate are very remote, and the Intellectual Property (IP) would have been compromised because of prior publication.

A more rational approach, with a much higher chance of **identifying novel lead compounds**, would be to screen libraries of indigenous flora and fauna (as extracts or isolated chemical compounds) with simple **disease-specific** and **molecular target-based bioassays**. As an example, a simple bioassay could be developed based on the very specific binding of the Covid-19 spike protein to the ACE receptor on the human cell, and this assay could be used to identify molecules in the Biota that prevent or disrupt the specific interaction/binding of the viral and human proteins. This could be the first step in the discovery and development of possible new drugs that prevent Covid-19 infection and its entry into human cells.

Both the development of highly specific bioassays and the discovery of novel lead molecules could lead to new and valuable IP that could encourage the involvement of pharmaceutical companies in funding developmental research and in commercialisation of research outcomes. Contemporary chemical and molecular technologies, available in some research centres in more advanced Islamic countries (such as the *International Centre for Chemical and Biological Sciences* (ICCBS, University of Karachi), could be used in the optimisation of the novel lead molecules into candidate drugs (new IP). Potential drug industry partners, attracted by the series of new IP generated, could be encouraged to collaborate with academic colleagues in carrying out preclinical animal studies and human clinical trials, and help with the regulatory process and commercialisation.

(ii) **Production of Affordable Biosimilar Medicines for the Islamic World:**

Another highly promising area is the development of affordable new high-tech biopharmaceuticals by

taking advantage of patent concessions accorded to LDCs by the WTO. Because of increase in human mobility and environmental degradation with consequent changes in disease patterns, multinational drug companies have largely turned their attention to a new class of very efficacious protein-based pharmaceuticals (**Biologics**). The earlier Biologics were human enzymes, hormones, growth factors and cytokines produced by recombinant DNA technologies. Cheaper versions of earlier (out of patent) biologics, termed **Biosimilars**, have been produced in some developing countries, including a few in the Islamic world, from molecular clones sourced from the *International Centre for Genetic Engineering and Biotechnology* (ICGEB, Trieste).

The **new age Biologics** are monoclonal antibody (Mab)-type molecules. This new generation of life-saving drugs are extremely expensive (at least \$50 thousand/patient/pa) and simply beyond the means of most people and poorer countries of the developing and Islamic world. There is, therefore, a huge demand for the production of cheaper Biosimilars of these wonder drugs through reverse-engineering and recombinant DNA technology. As most Mab-type Biologics are currently under patent protection, countries that are the main producers of Biosimilars (such as Korea and China) cannot legally copy originating Biologics till the patents have expired. Luckily LDCs are exempt from patent restrictions till 2032, and are free to legally copy and produce any drug on the market irrespective of their patent status. However, the competitive advantage would be lost if the initiative did not get off the ground urgently.

Besides exemption from patent restrictions, affordability of new Biosimilars produced in the Islamic world will be contingent upon the development of seed molecular clones in a technology competent LDC. At least one country in the Islamic world that fits the bill, Bangladesh, has already developed the technological capacity to produce molecular clones of these new Biosimilars, and their large-scale production under GMP conditions. Moreover, Bangladesh has a very well-established pharmaceutical industry that manufactures and exports high quality, and inexpensive, generic medicines to over 130 developed and developing countries including 19 LDCs mostly in Sub-Saharan Africa. However, any LDC that is chosen would need access to cutting-edge technologies available in technologically more advanced Islamic countries, and also require support in carrying out preclinical animal studies and human

clinical trials, and in obtaining regulatory approval in OIC-member countries.

Scientists involved in high-impact multinational collaborative research of the type described here, including those in low-income Islamic countries, would greatly benefit from the establishment of “*Centres of Excellence*” (national technology hub) in each country, and access to strategically located “*Regional Core Facilities*” (high-end technology platforms and special facilities) that can’t be replicated in each individual country, and that are critical for the scientific advancement of lesser developed countries. Such Regional Core Facilities could be hosted by economically stronger Islamic countries that also have the supporting infrastructure.

While patent restrictions could be avoided, and competitive advantage gained, by producing Biosimilars in suitably competent LDCs, their commercialisation, marketing and affordability in the Islamic world would be greatly impeded unless the cost and time required for gaining regulatory approval are minimised. The stringent and obligatory preclinical animal studies and human clinical trials are very expensive, and unless their costs are substantially reduced, without compromising their safety and efficacy, new life saving drugs developed and produced in any Islamic country will not become affordable and readily available to the common man in the Islamic world.

Though US FDA and EU EMA regulations could provide some useful guidelines, medicine regulatory authorities in Islamic countries should take an independent stand to support development and manufacture of new biopharmaceuticals in the Islamic World by helping to reduce the cost and complexity of the regulatory process. Serious consideration should be given to the establishment of an *OIC-wide Medicines Regulatory Authority* (OIC MRA), with similar jurisdiction as the EU EMA, whose job would be to develop, monitor and implement uniform policy and regulatory guidelines to support and protect the special interests of the pharmaceutical sector throughout the Islamic world. OIC and COMSTECH should also seriously consider establishing strategically located and internationally credible *Contract Research Organisations* (CRO) that would conduct, at competitive rates, preclinical and clinical trials of candidate drugs developed and manufactured in OIC-member countries.

High-impact multinational and development-focused research of the type described above cannot

succeed without adequate and coordinated funding spearheaded by the OIC. COMSTECH and IAS, backed by governments of OIC-member countries, and with the support of the *Islamic Development Bank* (IsDB) and other development partners, should aim to set up a Trust or Foundation to adequately fund and coordinate multidisciplinary and multi-institutional research in common areas of highest priority within the OIC region. These research and development initiatives could be supported through an *OIC-IsDB Collaborative Research Program* that would require applicants to forge multidisciplinary and multi-institutional collaborations between research and development teams from academia, research institutions, regional technology and resource centres, and industry from within the OIC-member countries. Additional Private sector and industry funding for in-house developmental research, and research in academia and public research centres, should be encouraged through tax concessions and other suitable incentives.

IAS as the premier Science Academy in the Islamic world has to take the lead in convincing the OIC, and governments of OIC-member countries, to adopt and implement the above scientific capacity building initiatives to support not only the drug discovery and development research described here for drug discovery and development, but also other high priority research that aim to address the many common challenges facing the Islamic world.



MISCELLANEOUS NEWS

CONFERENCE ON BIODIVERSITY

**Under the Patronage of
His Royal Highness
Prince El-Hassan bin Talal
Founding Patron of the Islamic World
Academy of Sciences (IAS)**

Conference on Biodiversity

Organized by:
Islamic World Academy of Sciences (IAS) and
Organization of Islamic Cooperation (OIC) Ministerial
Standing Committee on Scientific and Technological
Cooperation (COMSTECH)

1 April 2021

Please register in advance for this conference:

<https://zoom.us/join/zoom/register/tjAKd-6ppjotGNV/G988I9mBjDjJbe0o8PC1f>

CONFERENCE PROGRAM

Thursday 1 April 2021

10:30-10:35	Welcome note by Prof. Abdullah Al-Musa, President, National Center for Research and Development (NCRD), Director General, Islamic World Academy of Sciences (IAS), Jordan.
10:35-10:45	Welcome note by Prof. Muhammad Iqbal Choudhary, Coordinator General COMSTECH, Director ICCBS/ Distinguished National Professor, International Center for Chemical and Biological Sciences, University of Karachi, Pakistan.
10:45-11:30	Address of HRH Prince El-Hassan bin Talal, Founding Patron of the Islamic World Academy of Sciences (IAS), Jordan.
11:30-11:40	Break
11:40-12:10	What are Farmers' Rights under the International Treaty on Plant Genetic Resources for Food and Agriculture <i>Mary Jane Ramos de la Cruz</i> , Technical Officer, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Food and Agriculture Organization of the United Nations (FAO), Italy.
12:10-12:40	Biodiversity under Changing Climate <i>Syed Mahmood Nasir</i> , Former Inspector General of Forests and Focal Point CBD/Nagoya Protocol/ Cartagena Protocol, Pakistan.
12:40-13:10	Sustainable Food Systems, Agricultural Heritage and Biodiversity Nexus <i>Parviz Koohafkan</i> , President World Agricultural Heritage Foundation, Italy.
13:10-13:40	Threats and Challenges of Biodiversity Conservation in West Asia Region <i>Hany Al-Shaer</i> , Regional Director, IUCN (International Union for Conservation of Nature) Regional Office for West Asia (ROWA), Egypt.
13:40-14:10	Biodiversity Loss, Emerging Infectious Diseases Frontier Technologies and Impact <i>Zabta Shinwari</i> FIAS, Prof. Emeritus, Quaid-i-Azam University, Islamabad-Pakistan.
14:10-14:40	Biodiversity and Intellectual Property Rights <i>Bushra Mirza</i> , Vice Chancellor, Lahore College for Women University, Lahore, Pakistan.
14:40-15:10	Mitigation and Conservation Measures of Fragile Ecosystems in Morocco <i>Omar Assobhei</i> , Resident Member at the Hassan II Academy of Science and Technology, Morocco.

Schedule is in Amman, Jordan Time (+3GMT)

WEBINAR ON NANOTECHNOLOGY



THE ISLAMIC WORLD ACADEMY OF SCIENCES (IAS)
invites you to a series of webinars on
Nanotechnology

SESSION 1
NANOTECHNOLOGY INNOVATIONS IN HEALTH CARE, FROM LAB TO CONSUMER



Dr. Munir Nayfeh
Department of Physics
University of Illinois at Urbana-Champaign, USA

Saturday 8 May 2021 3 pm (Amman)

SESSION 2
NANOSCIENCES & NANOTECHNOLOGIES: PLATFORMS TOWARD SDGS' ATTAINMENT

Dr. Malik Maaza
UNESCO UNISA Africa Chair in
Nanoscience & Nanotechnology, South Africa



Saturday 5 June 2021 11 am (Amman)

SESSION 3
NANOTECHNOLOGY: THE WORLD OF WONDER AND THE EMERGING OPPORTUNITIES



Dr. Alaaldin Alkilany
Associate Professor, Pharmaceutical Nanotechnology
Pharmacy School, University of Jordan (JU), Jordan
Director of Accreditation and Quality Assurance Center at JU

Saturday 3 July 2021 11 am (Amman)

SESSION 4
SUBJECT TO BE DETERMINED

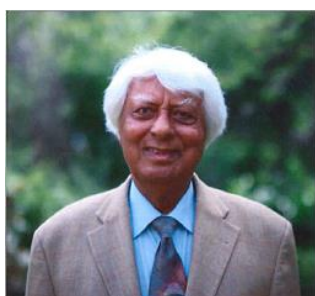


Dr. Yuliang Zhao
Deputy Director
General, National Center for Nanoscience and Technology of China

Saturday 7 August 2021 11 am (Amman)

The IAS will hold a series of webinars on Nanotechnology starting May 2021. The links will be sent out in due course.

PROFESSOR QAIM CO-ORGANIZES A REGIONAL ADVANCED E-LEARNING COURSE IN SOUTH KOREA



Prof. Dr. Dr. h. c. mult. Syed M. Qaim of the Forschungszentrum Juelich and the University of Cologne, Germany, who is also a Fellow of the Islamic World Academy of

Sciences, co-organized a Regional Advanced E-Learning Course sponsored by the International Atomic Energy Agency (IAEA), the World Council on Isotopes (WCI) and the Korean Atomic Energy Research Institute (KAERI), at Seoul, Korea, from 2 to 18 December 2020.

As Chair of the Education and Training Committee of WCI, he welcomed the participants, gave a series of lectures and also acted as a Tutor. The course was devoted to Medical Radioisotopes and it was attended by about 20 participants from 15 Asian countries, including Jordan, Pakistan, Bangladesh, Malaysia and Indonesia. The resonance to the course by attendees was very positive.

COMSTECH

International Workshop on Nanomedicine Development and Challenges

Realizing the significance of Nanomedicine for wider public health and health sciences in the OIC states in scenario of COVID-19 and beyond, COMSTECH is arranging a workshop during March 15-17, 2021. In this workshop a systematic approach will be followed to introduce and elaborate on nanomedicine design, development, characterization, and the associated challenges thereof. In addition, the potential role of nanotechnology for the timely diagnosis of COVID-19 and other diseases will also be highlighted.

KEYNOTE/INVITED SPEAKERS

 <small>Vincent Rotello UMass, Amherst, USA</small>	 <small>Wolfgang Parak Hamburg University, Germany</small>	 <small>Francesco Stellacci EPFL, Switzerland</small>	 <small>Rashed Bashir UIUC, USA</small>	 <small>Charlotte Hauser KAUST, Saudi Arabia</small>
 <small>Mathias Brust Univ Liverpool, UK</small>	 <small>Antonios Kanaras Univ. Southampton, UK</small>	 <small>Neus Felz Fraunhofer, Germany</small>	 <small>M. B. Abdul Rahman Univ. Putra, Malaysia</small>	 <small>M. Nawaz Tahir KFUPM, Saudi Arabia</small>
 <small>N. M. Butt (S.I.) Preston University Islamabad</small>	 <small>Inshad Hussain LUMS, (Focal Person Technical) hussain@lums.edu.pk</small>	 <small>M. Raza Shah ICCBS, Univ. of Karachi</small>	 <small>M. Najam ul Haq BZU, Multan</small>	 <small>Muhammad Yousaf CUJ, Lahore</small>

Registration Deadline: January 15, 2021

Participation: Virtual & In-person

DATE: MARCH 15-17, 2021

VENUE: COMSTECH, Islamabad



For Details: <http://www.comstech.org/nanomedicine-development/> | Ms. Khadija Muzamir, Email: khadija@comstech.org

Dr. N. M. Butt, Vice President, IAS participated in the COMSTECH International Workshop on “Nanomedicine - Development and Challenges”.

The workshop was inaugurated on March 15, 2021 At the COMSTECH Auditorium, Islamabad where 15 scientists from UK, USA, Germany, France, Switzerland, Saudi Arabia, Malaysia and Pakistan presented at the workshop.

More than 100 academic and research institutions from Pakistan and other OIC member states and from across the world participated both physically and virtually in the event.

The workshop consisted of four technical thematic sessions. The themes of the sessions were functional materials for disease sensing and treatment, functional nanoparticles for biomedical applications, nanotechnology for diagnostics and clinical applications and nano-antimicrobials.

It was concluded by the speakers that nanotechnology offers new prospects of developing affordable, quick and scalable solutions in diagnoses and treatment of COVID-19 and other diseases and manufacturing of personal protective equipment.

Source: <https://www.technologytimes.pk/2021/03/17/comstech-international-workshop-on-nanomedicine-concludes/>

Comment by M. Asghar on:

**REINFORCING CONNECTIONS:
INTERACTION, CO-OPERATION AND
RESILIENCE, HRH El Hassan bin Talal**
*Published in LAS Newsletter Volume 29, Number 44
(January - April 2021)*

El Hassan brings out wisely and powerfully the need for “reinforcing connections” for global harmony that should allow humanity to be able to live in peace and security free of destructive conflicts. However, there is a perpetual and powerful local and non-local sway of “geopolitics” where every side/entity has to act fundamentally for its self-interests to ensure that one is and remains in the category of the “biologically fittest” to succeed and survive in the savannah - the world. When there is balance-of-interests amongst different sides, there is “peace” and the moment this balance is disturbed for one reason or another, there is often conflict and destruction of conquest and defeat. This has been going on all the time among the homo sapiens in spite of all the earthly and unearthly ethical structures set up to deal with such situations.

Comment by M. Asghar on:

THE MORAL IMPERATIVE OF MONEY
Mohamed H. Hassan & Daniel Schaffer
*Published in LAS Newsletter Volume 29, Number 44
(January - April 2021)*

While discussing the scientific development across the world, the authors cite that China, USA and Europe as a whole account for 2/3 of the annual global USA\$2 trillion investment in research and development. This is interesting, but it is a linear-scale view of the reality. It may more revealing if one considers a logarithmic view that will bring up the situation of the countries that have little or no scientific investment and try to understand its reasons such as the structure of the society or lack of it or the society that is just surviving at the existential threshold for different causes, hence, has no possibility of any scientific investment.

For a society to move up towards a scientific threshold, it has to start with the minimal technical tasks such as the construction of kitchen utensils for others; such tasks help it to evolve and evolve very fast towards a creative scientific R&D threshold. This is what happened in South Korea in less than two generations, and even in China, at present the undisputed industrial workshop of the world, in little more than one generation, and more than a century back in Japan. Moreover, the number of peered scientific publications quite often does not reflect the scientific R&D level of a society that is still unable technically to construct even simple tools such as a screw-driver or a sewing needle and lives on acquiring the industrial set ups along with the “keys” for their operation.

IAS NEWSLETTER

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*The LAS welcomes the submission of short articles for
publication in the Newsletter (publication however is at the
LAS discretion)*

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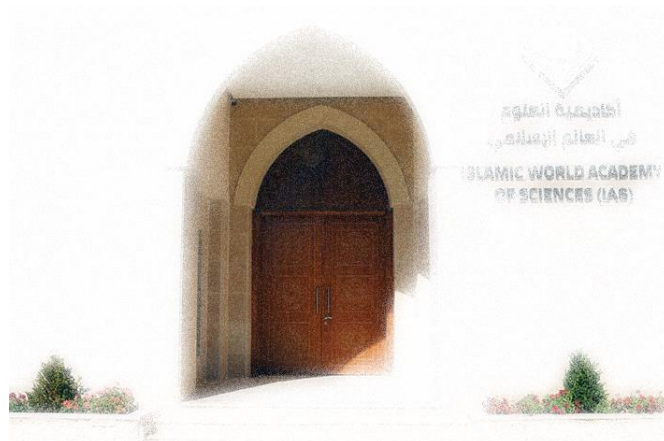
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Najwa Daghestani

