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THE ECOLOGICAL FOOTPRINT OF JORDAN

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1. Introduction

a. The Ecological Foot Print (EFP) measures human demand on the biosphere, including biotic and abiotic components (the natural capital). It is how much of nature it takes to sustain a given population or economy. It reflects consumption and production processes as it impacts the planet.
Knowing the ecological footprint helps understand how the variable factors affecting consumption and population can impact the biosphere. As such it can educate policies and institutions to improve sustainability and well-being and help direct public investment to conserve or /and restore nature.
EFP is measured by the unit: global hectares (gha) which is the amount of biologically productive land with productivity equal to the world average. The global hectares are comparable and standardized with world average productivity.

b. The ecological footprint has a demand side and a supply side.
- The demand side measures the ecological assets a population consumes through production and consumption. The amount of assets consumed is affected by the population (N) consumption/capita which is approximated by GDP/capita (Y) and by the ability to absorb or

neutralize the emissions and waste (through technology) which is measured by the annual increase in technology ($\propto$).

Mathematically:

The Demand = $\frac{N \times Y}{\propto}$

- The supply side of the ecological footprint = G(s) which is the regenerative rate of natural resources which in turn is a function of the biosphere stock (s). It is the biocapacity of nature which could be measured also by the amount of biologically productive land and sea area available to provide resources and absorb waste.

c. If a given population's ecological footprint exceeds its biocapacity (regenerative rate), that population has an ecological deficit. Which translates into excessive demand by the population for natural resources that exceeds its intrinsic supply which can lead to depletion and high emissions of carbon into the biosphere.

This condition creates Impact Inequality $\frac{N \times Y}{\propto} > G_{(S)}$

If the demand equals the biocapacity (G) we have Impact Equality.

If the biocapacity is more than the ecological footprint we have ecological reserve. Then having a footprint smaller or at least equal to the biocapacity is necessary for sustainable development.

2. Situation Analysis (Jordan)

a. Jordan occupies 1.3 million hectares of productive land and water. 97000 ha is forest land. 230000 ha is crop land. 743000 ha are grazing land and 211000 ha support the country's infrastructure. 62000 ha of continental shelf and in land water to support fisheries.

b. Factors that affect ecological footprint in Jordan:

1. The population increased by 165% (from 2181000 to 5787000) during the period 1980-2008. This figure doesn't account for the surge of Syrian refugees after 2011.
2. Human development Index has jumped 29% during the same period (1980-2008).
3. GDP/capita had increased during the period 1980-2008 by 30% (from $1932 to $2510).

c. Thus:

1. Jordan's ecological footprint /capita had increased 22% from 1.75 gha (global hectar) to 2.13 gha during the period 1980-2008.
2. Biocapacity/capita dropped down by -34% from 0.36 gha to 0.24 gha during the period 1980-2008.
3. The deficit/capita has increased by 6% from 0.88-0.93 gha.

d. Currently Jordan's ecological footprint per capita (2021) is 2.1 whereas its biocapacity per capita is 0.2 with a deficit of -1.89.

e. The above figures indicate that Jordan needs more biologically productive area (land mainly) that equals 0.9 of its available productive area to maintain sustainable development.

f. Jordan needs to invest heavily in sustainable food production, adopt policies and institutions to help increase productivity while protecting our natural resources (i.e. sustainable agriculture, renewable energy), and instill social norms that respect nature.

3. Ecological footprint/capita and biocapacity/capita vary greatly between countries

a. EFP/capita and biocapacity /capita for some countries

Country	EFP/ capita	Biocapacity/ capita	Deficit/ capita
China	3.71	0.92	-2.79
USA	8.04	3.45	-4.59
Qatar	10.8	1.24	-9.56
Kuwait	8.13	0.55	-7.58
Egypt	2.15	0.56	-1.59
Saudi Arabia	5.61	0.5	-5.12
Turkey	3.38	1.5	-1.81

b. The world average ecological footprint is 2.75 global hectares per capita. The average biocapacity for the world is 1.63 global hectares. This means a global deficit of 1.1 global hectare/capita.

4. Although Jordan's Ecological footprint is high relative to its biocapacity, it fairs well compared to neighboring or regional or even international countries. Its contribution to the world's CO_2 emission is negligible as compared to other countries. That emission does not warrant intervention although the government is committed to curbing CO_2 emissions by 14% in response to COP 21 of which 1.5% uses its own public money. The remaining 12.5% is contingent upon available support from donor agencies.

CO_2 emissions metrics for some countries including Jordan

Country	CO_2 emission/ capita in tons	Annual CO_2 emission	*Consumption-based adjusted for trade	Production-based CO_2 emission	Share of global CO_2 emission are emitted
Jordan	2.50 tons (2020)	25.74 million tons (2019)	34.11 million ton (2019)	25.49 million ton (2019)	0.07 % (2018)
China	7.32 tons (2019)	10.49 billion tons (2019)	9.44 billion ton (2019)	10.67 billion ton (2020)	30.65 % (2020)
USA	15.97 tons (2019)	4.71 billion tons (2020)	5.63 billion ton (2019)	5.26 billion ton (2019)	13.54% (2020)
Qatar	37.02 tons (2020)	106.65 million tons (2020)	76.70 million ton (2019)	106.65 million ton (2020)	0.31% (2019)
Kuwait	20.83 tons (2020)	88.94 million tons (2020)	96.65 million ton (2019)	88.94 million tons (2020)	0.26% (2020)
Egypt	2.09 tons (2020)	213.46 million tons (2020)	226.89 million ton (2019)	213.46 million tons (2020)	0.61% (2020)
Saudi Arabia	17.97 tons (2020)	625.51 million tons (2020)	645.4 million ton (2019)	625.51 million ton (2020)	1.8% (2020)
Turkey	4.66 tons (2020)	392.79 million tons (2020)	399.34 million ton (2019)	392.97 million tons (2020)	1.13% (2020)

** If a country imports goods, the CO_2 emissions needed to produce such goods are added to its domestic emissions. Consumption-based exported goods are then subtracted from the domestic emissions.*

WATER, ENERGY AND FOOD SECURITY NEXUS: THE SUSTAINABILITY TRIANGLE

Adnan Badran[1], Elias Baydoun[2] and Sohail Murad[3]

The importance of climate change and its impact on society in general is clear from the proceedings of the 21st Conference of the Parties of the UNFCCC (United Nations Framework Convention on Climate Change) in Paris and adopted by consensus on 12 December 2015[4]. The aim of the convention was as follows[5]:

(a) Holding the increase in the global average temperature to well below 2 °C above preindustrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above preindustrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.
(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.
(c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Countries furthermore aim to reach "global peaking of greenhouse gas emissions as soon as possible".

While **climate change** is a problem that will challenge all countries, countries in the Middle East are especially vulnerable, because they are in a weak position to politically and economically cope with the expected damage to the environment and the economic well-being of the region. This is primarily because many governments in the region are dysfunctional and are unlikely to undertake the long-term planning and complicated policies needed to cope with a changing world climate. Climate change has also resulted in major political upheavals in the area. In Syria, for example the 5 year drought that began in 2006 resulted in drastically impoverishing farmers which led to their movement to urban areas, where no government support services were provided. This exodus led to unrest, social discontent and tearing down the entire social and political fabric of the country – the consequences of this unrest are being felt all over the world, especially in neighboring countries and Europe. While climate change alone is not clearly responsible for the entire problem in for example, Syria –it would be equally wrong to discount the role of climate change completely.

Most of the countries in the Middle East are essentially **arid** and receive very little rainfall (250 – 450 mm annually), and the expected drop from such limited amounts can be especially disastrous to domestic, agricultural, industrial and diversity.

Another problem facing countries in the region is **the rise of sea level** resulting from polar ice melts, for example, it is estimated that up to 30% of coastal areas could be submerged under water over the course of 21st Century in Middle East regions such as the Nile Delta for example, the food basket of Egypt, where sea level expected to rise by half meter by 2025. The fertile Nile Delta provides around a third of the crops for Egypt's population of 100 million "As a result, over half a million inhabitants may be displaced and approximately 70,000 jobs could be lost". Other estimates include serious threats to Alexandria, Egypt of 4.1 million people and 40% of the country's industry. In addition, the Middle East is unlike other regions very susceptible to climate change in countries in Asian, and North American countries, from where it imports almost half its food supplies. If food production in these areas is threatened, it could have additional impact on the Middle East.

According to the latest Inter-Government Panel on Climate Change (IPCC)[6], **higher temperatures** (1-3 C) are a likely outcome of climate change in the MENA region and reduced precipitation will result in an addition of 80–100 million people in water-stressed areas. This will result in a decrease in agricultural yields, in rain-fed areas, coastal flooding, heat waves, and lower air quality, all further lowering the quality of life in the region.

There are however, some encouraging signs. There continues to be **increased awareness** among decision makers in the Middle East region on the possible disastrous consequences of climate change, which likely is caused by the global increase in such awareness especially among the more enlightened leaders of the region. The awareness is also a result of more frequent

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droughts in the region and the worsening water supply shortage.

I. The consequences of climate change on the **water, energy and food triangle was published in comprehensive book (Springer.Nature 2017)** that first describes the problem and then also provides possible solutions. The book is divided into **three sections** (although as is often in science, the sections overlap). **The first section** is concerned with **water**. Water sustains life, environment and development. Water crises in term of quantity and quality is man-made disaster linked to the degradation of the life-support ecosystem. The section on water includes chapters on the politics of water, the concept of virtual water, as well as water treatment and conservation strategies that are particularly applicable to Middle Eastern countries and are relevant for efficient agriculture. By 2050, it is estimated that half of the people on our planet will be living in water scarcity. Sustainable management of an integrated approach of water, land, and people for a sound ecosystem, is needed. 60% of renewable water resources in Arab countries originate from sources outside the region. Shared management of downstream with upstream riparian countries is imperative. The total Arab water resources is 371.8 billion m3 distributed as follows; 41% Mashreq Arab States, 23.4% Maghreb Arab States, 31% Nile Arab States, 4.6% Arab Peninsula (Gulf States).

Already one third of the world population is living in water-scarce or water-short areas. Climate change will accelerate the figure to one-half, there are 13 Arab countries among world's most water scarce nations, and 8 Arab countries water availability is less than 200 m3\capita\year, less than half UN-designated water-severe country (UN severe water scarcity below 500 m3/capita/year).

The Arab region houses 5% of world population and occupies 10% of Earth space, with only 1% only of world water resources. This is why Arab region shares 50% of world desalination capacity, and is expected to double. Agriculture consumes 80% of available water resources, as compared to 70% of world average. The industrial sector consumes 7% and domestic use 6%.

It is a crisis of water management, fragmented institutions, inadequate policies and legal systems, lack of political will, and widening gap between science and policy making at the national, regional and global levels. 12% of the world's population uses 85% of its fresh water. And water supply resources are being stretched to their limits. By 2050 an additional 3 billion people will be born mostly in countries already suffering from water shortage.

II. The second section is concerned with **energy**. Energy according to the IPCC-Nov 2014 report, the world's electricity must be produced from zero carbon sources by 2050; otherwise, our planet faces irreversible damage. The report says renewables have to grow from 30% share of the power sector to 80% and all fossil fuel generation without carbon capture and storage (CCS) have to be phased out by 2100. Strategies to harvest it from abundant solar sources suited to the Middle East, as it is situated in the desert sunbelt where sun is available over 90% of the year over vast areas in most countries of the region, as well as steps that can be undertaken for its efficient use as well as conservation. It includes producing hydrocarbon fuels from lingo-cellulose (agricultural waste is one such example). This is especially suited for many already oil-producing countries in the area that are already oil producing since it eliminates the need for new infrastructure that would be needed for ethanol-based fuels for example. **Two chapters focus** on two important alternate energy sources that are especially important for the Middle East, viz. **solar energy** and **wind energy**.

Morocco an advanced country in utilizing renewable energy, sun & wind, in their energy mix. The Desert–Tech Solar project is aiming to export electricity by feeding it to the grid of Europe from North Africa MENA region. Jordan although is moving slowly because of its governmental beaurecracy and insufficient grid capacity to accommodate renewables, has achieved 10 – 20% renewable in the energy mix in 2020. Emirates and Saudi Arabia have ambitious plans, in advancing renewables to reduce dependence on fossil fuel energy. Experts say that renewables have to grow to 80% share of the power sector by 2050.

Two final chapter focus on energy conservation strategies. **The first focusses** on the use pf phase change materials (PCM) for both energy storage during non-peak and peak hours and other simple steps that can be taken to reduce energy usage. **The second describes** NetZero energy building that can either be designed or retrofitted to make them more efficient during renovations.

Finally, to demonstrate the close connection between water and energy, a chapter is included on strategies to minimize energy use for water treatment technologies. **This chapter serves** as **the link between the sections on water and energy. This chapter then leads to the last chapter on Food.**

III. This last section of the book addresses issues related **to food**. Include are chapters on **food safety and security** as they pertain to specific conditions in the Middle East. Because of the abundance of sea water in many Middle Eastern countries, **one chapter focuses on agriculture** based on saline (brackish water). In addition, **there are chapters on the diminishing arable land in the Middle East** and how erosion can be minimized or reversed. There is also **a chapter on the impact of food losses and waste on food security** since losses constitute over 35% of food produced in the region. **Finally, a chapter is** included which discusses **the technologies available for agriculture in water-challenged regions**, especially those areas dependent largely on rain water for agriculture.

With climate change and managing scarce resources of water, food & water are inextricably linked. Therefore, food security for self-sufficiency could be achieved through right policies and improved agricultural and irrigation technologies with high yield cultivars suitable for semi-arid zones. Conservation of water through protected agricultural innovative practices to bring down the high use of water of 87% to world average of 70%.

IV. There is no doubt that the Climate change and Water - Energy - Food security Nexus in the Arab Middle East, is becoming more complex due to rapid population growth and growing demands by industrial and agricultural developments. Therefore, science becomes crucial in providing the basis for sound governance and a holistic approach enlightened policy linked to energy and water management for sound food security.

ENERGY AND ITS SUSTAINABLE AVAILABILITY

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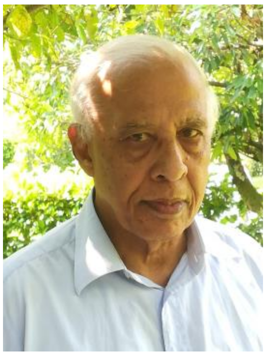

Abstract: This write-up takes up the existential need of energy sustainability. In this context, it treats the different components of the energy matrix consisting of fossil fuels of coal, petrol natural gas; the solar radiation energy exploited through windmills, photo-voltaic, hydraulic, biomass systems; and the nuclear energy. The present deepening climate problem caused by the critical accumulation (413.3 ppm) of the greenhouse gas CO2 gas in the atmosphere strongly recommends that one has to stop totally the exploitation of these fossil fuels that actually produced in 2020 around 83% of the total energy in the world and are the major source of this gas and have dumped more than 42 billion tons of it in the atmosphere last year. The low carbon intermittent, and non-intermittent but modulable solar-energy and the modulable nuclear energy systems are the only available choice. These electric systems are expected to operate together in a controllable manner to ensure the stability of the distribution system. However, a large part of the world, where the nuclear power cannot be set up due to its technical complexity and basic high cost, one may have to operate with the solar energy in its different forms along with the storing means via appropriate batteries and/or through the production of storable hydrogen and/or by other means such as the gravity-based hydraulic or vertical-moving rock systems.

1. Introduction

Life itself is a process which is out-of-thermodynamic-equilibrium, and it is maintained in this non-equilibrium state through energy. Without energy there cannot be any life. Hence, for sustainable life, there is an absolute need of sustainable energy. Moreover, in daily life one employs different tools and systems to use this energy: different industrial means to produce the necessary products, different types of transport for personal and group mobility along with the transport of goods of all sorts, in the domain of agriculture, in daily household tasks.

As to the macro-energy sources on the Earth, they are the *organic fossil fuels* (hydrocarbons) consisting of coal, petrol, and gas. The coal is the most abundant source, and it is quite evenly distributed on the surface of the Earth. These fossil fuels produced in 2020 around 83% (**Table 1**) of the total energy in the world. The other macro-source is the *material source* consisting of Uranium

Coal	27.2 %
Petrol	31.2 %
Natural gas	24.7 %
Nuclear	4.3 %
Hydraulic renewable	6.9%
Other renewables	5.7 %

Table 1: Total primary energy consumption in the world in 2020 (Wikipedia)

Isotopes that produce energy through the *fission reaction* in specially designed nuclear reactors. Then, there is the solar energy from the Sun that amounts to a power of 1.367 kW/m^2 on the surface of the Earth. The solar energy is produced through the *nuclear-fusion reaction* in the Sun. Since the origin of the organic fossil fuels is also the solar energy*, all the macro-energy sources on the Earth are of nuclear origin.*

a. Windmills

About 47% of this radiation energy via the Earth's absorption and re-emission as infra-red radiation, ends up in heating the atmosphere leading to wind exploited by the windmills to convert this wind energy into electric energy. The cumulative capacity of installed wind power in 2020 was 743 GW and it is increasing more than 30% every year with more and more powerful on-shore and off-shore wind-machines with a conversion capacity reaching 15 MW.

b. Photovoltaic system

The photo-voltaic systems are mostly based on silicon-based detectors which directly converts the incident solar radiation into electric current. However, as the average conversion efficiency this silicon-based system is just around 15 %, and an intense effort is being made to find other systems with a higher conversion value. Currently, a silicon /perovskite tandem has a reached a remarkable conversion efficiency of 29.15%. The solar PV capacity reached 638 GW in 2019 and is also strongly increasing every year.

However, both the windmill and the photovoltaic sources being *intermitten*t in nature, are available for only around 25% of the time and they need stable back-up means to ensure the normal functioning and stability of the distribution system.

c. Hydraulic systems

In these systems the gain in the gravitational energy due to the free-fall of water from a higher point, is used to run the appropriate turbines coupled to the electric current producing generators. Although the hydraulic energy is renewable, it is not intermittent like the other renewables. The world hydraulic capacity is 1330 GW. This represents about 17% of the total electricity in the world, while the windmills and the photo-voltaic represent respectively 9.5% and 8.1%.

d. Biomass

At present, the world solar biomass energy capacity is around 140 GW. This energy is renewable but again not intermittent and its use is widespread on the globe.

2. Climate crisis and the choice of energy sources

Since the start of the industrial period from around 1850, the atmosphere temperature has gone by more than 1.1 °C caused principally due to the increase in the presence the greenhouse CO2 green gas that has reached 413.3 ppm recently. The half-life of this gas in the atmosphere is around 120 years and the world is adding more than 42 billion tons of it every year. The 2015 Paris Agreement on climate postulates that to keep the climate dynamics under control, the average temperature increase should be well below 2°C preferably only 1.5°C compared to the preindustrial averages by the end of the 21st century. However, with the present concentration of CO2 and the fast-increasing concentration in methane CH4 (half-life of 10.5 years), the IPCC scientists warn of global temperature increase of around 2.7 - 3.1°C by the end of this century. This critical situation will lead to crossing the *"tipping point"* where the climate dynamics becomes uncontrollable and devastating for the overall matrix of life.

Under these existentially demanding conditions, one has to choose the energy sources with low CO2 contribution, to keep the climatic situation under control. **Table2**, presents the CO2 content per kWh for different energy sources:

Coal-fired power plant	820 g CO_2 /kWh
Gas-powered power plant	490 g CO_2 /kWh
Petrol	264 g CO_2 /kWh
Solar photovoltaic energy	27 g CO_2 /kWh
Solar wind energy	11 g CO_2 /kWh
Nuclear energy	12 g CO_2 /kWh
Solar Hydraulic energy	Without CO_2
Solar biomass energy	Neutral in CO_2

Table 2. CO_2 content per kWh for different energy Sources: www.energuide.be

If one stops the utilization of the fossil fuels of coal, petrol, and natural gas, one has to live with the different types of solar energies and the nuclear energy. Here, the stable and modulable nuclear, hydraulic and biomass energies have to take care of the intermittence of the wind and photovoltaic energies to ensure the normal functioning and stability of the energy distribution system.

Since the nuclear energy density is about million times higher than that from the fossil fuels, a high technical savoir-fair is required for installation and operation of nuclear reactors implying this energy may not be available everywhere in the world; in such places one has to operate without nuclear energy using the external storing means such as batteries and the production of hydrogen, when required to ensure the stability of the distribution system. Moreover, one expects that in future more than 97 % of the total available energy will be in the form of electricity.

3. Conclusion: Sustainable availability of energy

The solar radiation has been here since 4.5 billion years, and it is expected to go on for another 10 billion years ensuring that the solar energy in different forms continues to be sustainably available. In the case of nuclear energy, the development of the new generation of nuclear reactors including the breeding fast reactors that produce more fissile material than they consume, should also ensure its long-term sustainable availability. Moreover, under these conditions, an economic use of energy amounting to about 20% to 30% may be required for the general well-being of the society.

NOTE: IMPACT OF COVID-19 MUTATION RATES ON TRANSMISSION OF THE VIRUS

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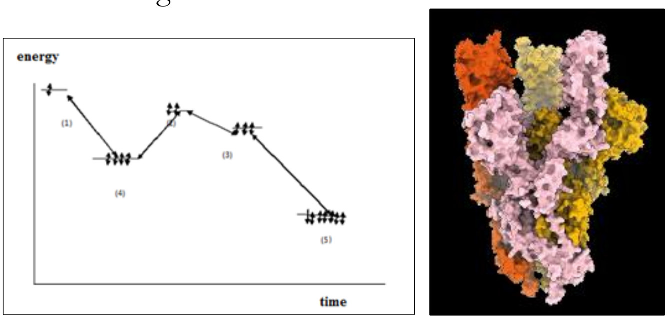
Since the beginning of the Covid-19 pandemic, new knowledge has been accumulated dealing with the structures of the virus as well as its activity. Remarkably, one may get the impression that, such a new evidence can be easily understood on the basis of the formerly reported model, in which the virus is viewed as a single macromolecule, the properties of which, may be described in terms of a molecular dynamic picture [1]. Consequently, the chemical, thermodynamic and kinetic, behavior of the virus macromolecule may be accepted. The interchange of the virus molecule from one structure to the other i.e. mutation is affiliated then with its transition from one energy level to the other. The elucidation of the virus structure enables the discussion of its mutative properties on the chemical and physical basis Figure 1. Interestingly is that the viral activity and structure for some mutations have been determined both clinically and through laboratory experiments. Till now, the majority of mutation studies published, discussed the structural changes of the protein (polypeptide) shell of the virus macromolecule [2]. Of special interest are changes in the spike protein, a segment that is responsible for the penetration of the viral molecule into the living cell of the host.



(a) (b)

Figure 1: Scheme, a- of virtual energy levels of a molecular system undergoing successive reactions, b-global structure of Covid-19 virus [2].

Chemically perceived, the mutation process is the result of C-C or C-N bond cleavage and/or recombination reactions taking place in the virus molecule. These reactions must proceed through thermodynamic transition states according to Eyring's theory. It is important to realize that the bond cleavage and recombination reactions show different values for the kinetic variables such as activation energy or molecular concentration, which determine the reaction rates. It is worth noting, that in the case of Covid-19 macromolecules the reaction rates depend on the environment surrounding them, too. Figure 2 shows a scheme of some discovered mutations of Covid-19 virus [3].

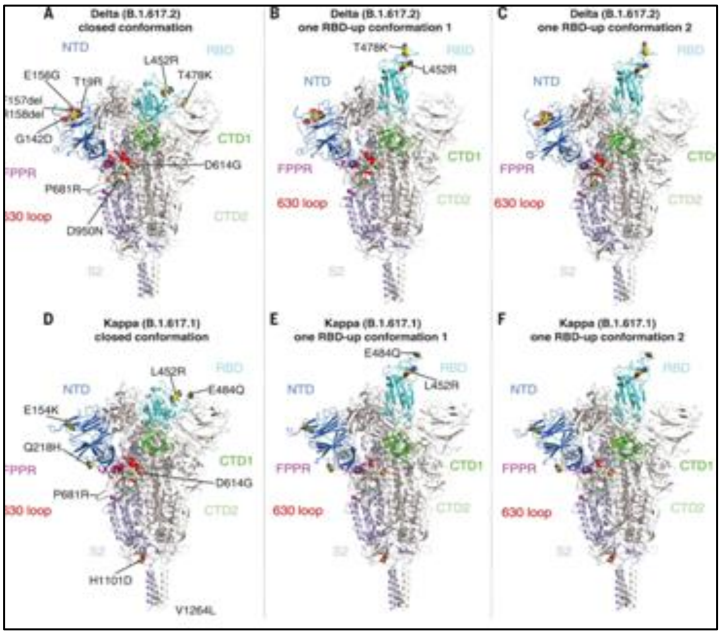


Figure 2: Scheme of some discovered mutations of Covid-19 virus. [3]

It is reported that different variants of Covid-19 exhibit diverse pathogenic as well as transmission properties among human groups. Recent reports showed that the viral transmission increases on going to higher variants. Thus, Covid-19 variants Alpha, Beta, Gamma, Delta and Omicron as well as the original Wuhan virus exhibit different transmissions as well as different mutations number belonging to each of them [4]. An example is detected on reviewing the number of mutations that were reported for the Delta mutation as compared with those of the Omicron, [5], which is exhibited in figure (3). It is understood that, the Omicron variant includes 50 experimentally discovered mutations; while the number of the reported mutations for the Delta is 9. On the other hand, the stated transmission for Omicron variants is about 50 times as high as that of Delta variant [6].

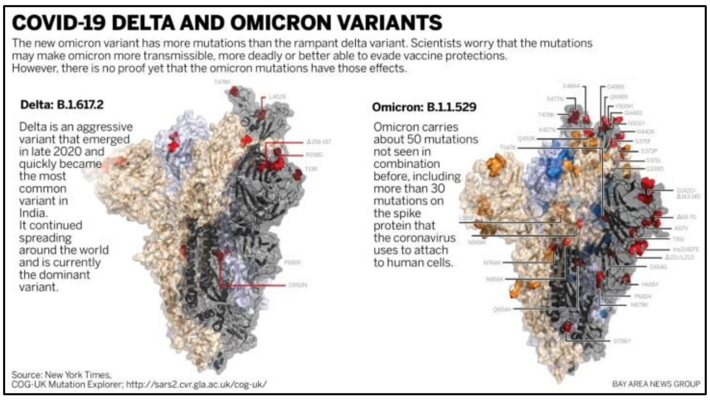
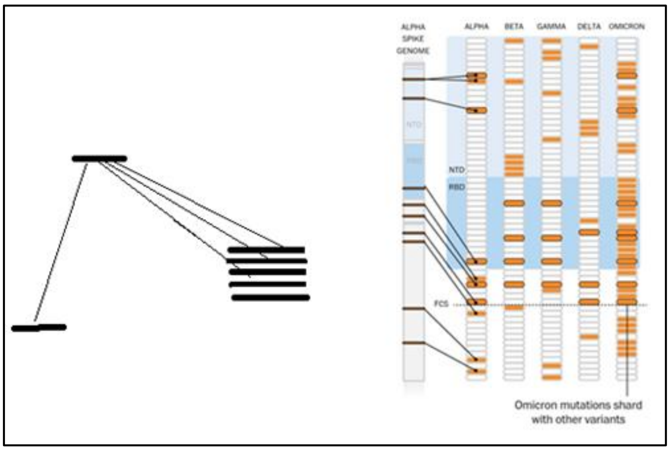


Figure 3: Covid-19 Delta and Omicron variants. [5]



Scheme A Scheme B

Figure 4: Scheme A; different total energy values of an interacting molecule ordered in a term diagram; Scheme B, mutations of the five variants of Covid-19 ordered in column representation. [6]

Increase in the viral transmissions noticed on going from the wild Covid-19 virus to the Alpha variant (50% increase). Beta is about 50% more transmissible than the wild Covid-19 too. Gamma variant possess 12 mutations with a transmission 2 times greater than Beta and Delta. And Delta variant with10 mutations is 60% more transmissible than Alpha or Beta variants, Figure 4.

This phenomenon of transmission related to the number of Covid-19 variants may be understood in terms of the previously reported molecular dynamic picture of the chemical bonding applied to the virus molecule [1]. The chemical bonding of the Covid-19 macromolecule conforms with a Force Field (Kraftfeld) that is described in terms of coordinates and momenta of all the atoms in the macromolecule. Different forms of the macromolecule, i.e. different variants or mutations are related then to different total energy values, which might be ordered in a term diagram, (Scheme A).

The thermodynamically stable Force Field of each variant might be perturbed (disturbed) through interaction with an effective factor, such as collision with a different massive partner or an enzymatic interaction. Obviously, such perturbation should lead to an increase in the total energy of the macromolecule up to a level where the C-C or C-N bond cleavage becomes probable, passing through a so called **reaction transition state**. According to the observed formation of multiple mutations for each new variant, the required activation energies for the formation of all mutations of a variant are apparently comparable with each other. Consequently, transition from one variant to the other is not limited to the formation of a single mutation form but rather to a number of such mutations. The transition from one variant to the other is represented by a set of competitive chemical reactions, which yield the number of mutations. Revising the number of the so formed Covid-19 mutations, (Scheme B), as well as the detected transmission values, ***one may conclude that the rate of transmission of each variant is obviously depending on the number of mutations formed for each variant i.e. the greater the number of mutations the higher the transmissibility of the virus.***

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NOTE: CLIMATE DISORDER AND THE WEATHER IN THE NORTHERN HEMISPHERE

M. Asghar FIAS

The Jet stream is a channel of fast-moving air that circles the northern hemisphere. It travels from east to west at an altitude of around 10 km. The different airlines exploit the Jet-corridor winds during their east to west flights. Moreover, these winds drive large scale weather systems around the globe. These jet-stream winds though travel at the same altitude, they can shift into wave-like patterns known as the Rossby pressure traverse waves that oscillate from high-pressure in the north to low-pressure in the south and back again. During this operation, the warm air fills the peaks of the waves, while the cold polar air drops into the troughs. Normally, these Rossby waves continue to move with the Jet stream from east to west, shifting the high-and low-pressure weather systems with them. However, due to the present increasing climate disorder, they can stall (get blocked) for days or weeks causing heatwaves, drought and floods as the regions of hot and cold air hover over the same regions. This stalling of the Rossby waves is considered to be the cause of the 2013 European floods, the 2012 China floods, the 2010 Russian heatwave, the 2011 Pakistan floods, the 2018 heatwave in North America, Western Europe and Caucasus along with the heavy rain and flash floods in South-east Europe and Japan.
The frequency of these "weather events" risks to increase as the climate disorder intensifies.

BLACK HOLE INFORMATION PARADOX AND ITS POSSIBLE SOLUTION

M. Asghar FIAS

Abstract: This document investigates the genesis of the black hole information paradox and its possible solution based on a new configuration in the black hole itself.

In Einstein's classical General Theory of Relativity (GTR), for a black hole, the escape velocity from a region inside its event horizon is greater than the velocity of light implying that material objects from outside can fall into black hole and increase its mass, but nothing can come out from its inside However, when in the seventies Stephen Hawking (1) analyzed the black hole semi-classically by treating the matter in and around the black hole quantum mechanically, but describing the gravity through the use of Einstein's classical theory and found that the black hole has a temperature called Hawking temperature:

T= hbar k/2π = hbar c3/ 8 π k G M, **(1)**

where hbar is the reduced Planck constant h/2π; k, the Boltzmann constant; G, the Newton's gravitational constant; and M, the mass of the black hole.

The temperature causes the black hole to emit/ evaporate random radiation (Hawking radiation) due to a random quantum process at the edge of the black hole leading to a decrease in its mass M, and at the end of the emission process, the whole of this mass is used up as radiation. As the edge-based random radiation is supposed to carry no information from the inside of the black hole, all the information inside the black hole concerning this mass is lost. However, there is a problem, because the quantum mechanical wavefunction ψ of the Schrodinger equation representing the black hole, is subject to the unitary principle: during the time evolution of the wavefunction, the sum of the all the possible probabilities of the wavefunction representing the different outcomes, must be preserved, and no information of the system represented by the wavefunction is ever lost. This contradictory situation has been called the information paradox of black hole. The fact that structured objects/matter can enter the black hole from outside, but it evaporates only structureless, random radiation, violates the basic principle of symmetry of time, because the formation and evaporation processes are irreversible. If the time reversibility holds, the information inside the black hole must come out of it. This requirement suggests that the Hawking radiation is not random but is emitted carrying this information to ensure the validity of the quantum principle of unitarity. In this context, Don N. Page (2) proposed the phenomenon of "quantum of entanglement" between the radiation and its place of emission in the black hole and expressed the amount of quantum entanglement in terms of "E**ntanglement Entropy (EE)**". At the beginning, the EE must be zero as no radiation has been emitted and at the end of the emission process, when there is no longer a black hole and if the information escapes from the black hole, the EE should be zero too. Initially as the radiation emission starts, the EE rises with time, but then this trend has to reverse and the EE stops rising and starts dropping, and it should be zero again at the end point, when the whole of the black hole mass has evaporated. Therefore, over time, the EE must follow a curve shaped like the inverted V-called the Page curve. Moreover, this reversal seems to occur roughly halfway through the process called the "Page Time", where the black hole is still of substantial size.

The curve of radiation entropy Srad as calculated by Hawking, starts to rise and continues to rise till the evaporation of the total mass of the black hole, and thereafter this remains constant. This leads to the loss of information in the black hole. However, if information is preserved and escapes from the black hole, the Srad must follow the EE curve as a function of time subject to the constraint:

Srad ≤ SBH, **(2)**

where SBH is the Bekenstein - Hawking entropy:

SBH = k c3 A /4 G hbar, **(3)**

where A is the event horizon area, k, the Boltzmann constant; c, the velocity of light; G, the Newton gravitational constant; hbar, the reduced Planck constant h/2π. Since the mass, hence, the area A of the black decreases as a function of time due to radiation, the SBH decreases also with time.

In fact, the SBH represents the total information inside the black hole. Since at the end of the emission process, when there is no more a black hole, as both SBH and EE go over to zero, the information must have escaped from the black hole represented by the initial value of SBH. Hence, if information does get out of the black hole, the entanglement entropy has to follow the Page curve.

During the last few years, a lot of theoretical effort has been devoted to calculating the Page curve (2). The most recent work (3) claims the solution of the problem is based on a new configuration in the black hole itself resulting from the Anti-de Sitter space (AdS) / Conformal Field Theories (CFT) duality. Here, the AdS deals with the theories of quantum gravity and the CFT treats the quantum field theories of different interactions. This scenario can also be expressed in terms of the Holographic duality which states that the entropy of a mass (say, in three dimensions) is proportional to its surface area (in two dimensions) and not its volume. This work claims that key to relating the two sides of this duality is the presence of a quantum extremal surface. This quantum extremal surface relates a geometric concept of area to a quantum entanglement and thus, to the EE.

The black hole radiation is due to the presence of entangled pairs of particles created through quantum fluctuations at its outer edge. One of these particles ends in the black hole and the other is emitted as the entangled radiation contributing to the EE. When the quantum extremal surface is outside the event horizon and only the black hole is the inside space, the EE = Srad rises as a function of time reaching its maximum value at t = Page Time, where its value is equal to the corresponding value of SSBH at this time: Srad = S BH. At this inflexion point, suddenly the quantum extremal surface appears inside the event horizon of the black hole which may be due to an unknown change of phase in the system. The presence of the quantum extremal surface inside the black hole converts it into something like a shell and everything inside this surface is no longer part of the black hole and thus, the innermost particles no longer contribute to the EE causing a decrease in its value as a function of time and finally dropping to zero, when the black hole's total mass is used up as radiation. This rise and then fall of EE as a function of time, simulates the Page curve and confirms that information indeed escapes from the black hole (4). However, the reason for this quantum extremal surface's sudden appearance inside the event horizon has to be analyzed more thoroughly and understood.

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2. "Time Dependance of Hawking radiation Entropy", Don N. Page, arXiv:1301.4995v3] 9Aug.2013

3. "The entropy of bulk quantum fields and entanglement wedge of an 9evaporating black hole", Ahmed Almheiri et al. arXiv:1905.08762v3[hep-th] 4Nov.2019

4. "The most famous paradox in physics nears its end", Quanta Magazine, Oct. 30.2020

Miscellaneous News

Mustafa Prize Laureates become IAS Honorary Fellows

During its last General Assembly meeting, the Islamic World Academy of Sciences (IAS) decided to award the Mustafa Prize Laureates the Honorary Fellowship of the IAS. This decision was made in appreciation of the efforts and achievements they have made in various fields.

The membership of the IAS is now made up of 20 Honorary Fellows and 103 Founding and Elected Fellows including Noble Prize laureates and eminent scientists of distinction who have achieved the highest academic honors in their countries and internationally.

Honorary Fellows of the Islamic World Academy of Sciences

1. *Dr. Mohammad **Abdolahad**, The 2019 Mustafa Prize Laureate, Iran.*
2. *Mr. Fouad **Alghanim**, President, Alghanim Group, Kuwait.*
3. *Prof. Hossein **Baharvand,** The 2019 Mustafa Prize Laureate, Iran.*
4. *Prof. Sami Erol **Gelenbe,** The 2017 Mustafa Prize Laureate, Turkey.*
5. *Prof. M. Zahid **Hasan**, The 2021 Mustafa Prize Laureate, Bangladesh.*
6. *Prof. Ekmeleddin **Ihsanoglu,** Former OIC Secretary General, Turkey.*
7. *Prof. Umran S. **Inan,** The 2019 Mustafa Prize Laureate, Turkey.*
8. *Prof. Ali **Khademhosseini,** The 2019 Mustafa Prize Laureate, Iran.*
9. *Tun Pehin Sri Haji Dr. Abdul Taib **Mahmud**, the Governor of Sarawak (Yang di-Pertua Negeri), Malaysia.*
10. *Dr. Adnan M. **Mjalli**, Chairman, MIG, USA.*
11. *His Excellency Dato' Seri Dr. Mahathir **Mohamad**, Former Prime Minister of Malaysia.*
12. *Prof. Ferid **Murad**, 1998 Nobel Laureate (Medicine), USA.*
13. *His Excellency Nursultan **Nazarbayev**, Former President of the Republic of Kazakhstan.*
14. *Prof. Ugur **Sahin,** The 2019 Mustafa Prize Laureate, Turkey.*
15. *Prof. Mohamed El-**Sayegh**, The 2021 Mustafa Prize Laureate, Lebanon.*
16. *His Excellency Mr. Mintimer **Shaimiev**, Former President of the Republic of Tatarstan/ Russian Federation.*
17. *Prof. M. Amin **Shokrollahi**, The 2017 Mustafa Prize Laureate, Iran.*
18. *Prof. Yahya **Tayalati**, The 2021 Mustafa Prize Laureate, Morocco.*
19. *His Excellency Sheikh Hamad Bin Jassim Bin Jabr Al **Thani**, Former Prime Minister of Qatar, Qatar.*
20. *Prof. Cumrun **Vafa,** The 2021 Mustafa Prize Laureate, Iran.*

IAS – PAS Series of Webinars on Climate Change

The Islamic World Academy of Sciences (IAS) in collaboration with the Pakistan Academy of Sciences (PAS) held a series of webinars on Climate Change.

Session 1 hosted **Prof. Dr. Khan Bahadar Marwat**, PhD (Botany/Taxonomy, Pakistan), PhD (Weed Science, UIUC, USA) Dr. Marwat served the University of Agriculture, Peshawar as a teacher and retired as Meritorious Professor (1977-2013). During this period, he served as Lecturer, Assistant, Associate and Full Professor and then conferred with the status of Meritorious Professor in 2004. He remained Chairperson, Dean, and ultimately Vice-Chancellor of the same university. After his retirement, he was given a task to establish a new public sector University, SBB University, Sheringal, (2013-2017). He represented Pakistan in conferences, Seminars in 26 countries.

Dr. Marwat presented a talk entitled **Climate Change and Plants Biodiversity.**

Watch the webinar on IAS YouTube Channel:
https://www.youtube.com/user/TheIASworld/videos

Session 2 hosted **Prof. Dr. Zabta Khan Shinwari**, UNESCO Laureate, Fellow IAS & PAS and Prof. Emeritus, Quaid-i-Azam University, Islamabad, Pakistan. Dr. Shinwari got his Ph.D. from Kyoto University (Japan) followed by several Post Doc. Fellowships in Japan. He served WWF-Pakistan, COMSTECH before his appointment as Vice-Chancellor of Kohat University of Science & Technology. One of his major achievements is to extend higher education facilities to the neglected communities of Pakistan, especially to females. He also established the University of Science & Technology, Bannu. He is the founder of KUST Institute of Medical Sciences (KIMS). Dr. Shinwari also served private sector as CEO of Qarshi Research International and Vice-Chancellor, PD Qarshi University-Lahore. He is a Fellow & former Secretary General of the Pakistan Academy of Sciences and Islamic World Academy of Sciences (IAS). He was awarded by the President of Pakistan twice (Tamgha-e-Imtiaz) in 2011 and Sitara-e-Imtiaz in 2018 for his services in Higher education. He also got the Best University Teacher Award from Higher Education Commission. Distinguished Scientists Award by Chinese Academy of Sciences, 2019-2020.

Dr. Shinwari talked about **Ethics: Ensuring Food Security in the Era of Climate Change.**

Watch the webinar on IAS YouTube Channel:
https://www.youtube.com/user/TheIASworld/videos

Session 3 hosted Prof. Dr. Shahid Mansoor, **Director and Principal,** National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad. His presentation was entitled: **Climate Change and Sustainable Agriculture.**

Agriculture is the key for food and nutritional security. The increase in population and climate change scenario pose a dual challenge in the developing world. The climate change is resulting in extreme temperatures, change in rain pattern that is disturbing cropping pattern and sustainability. Fortunately, progress in our understanding of genome of crops and livestock as well as microbes is providing new opportunities for tackling these challenges. Although the opinion is divided about genetically-engineered crops but the use of genome editing in enhancing yield, quality and nutritional value is accepted by both developed and developing world. The lecture will cover the concept of climate smart agriculture by adopting technologies which decrease environmental footprint of agriculture and enhance efficiency in use of inputs such as water, chemical fertilizers and pesticides. Examples of use of genomic selection and genome editing in enhancing genetic gain in crops and livestock will discussed. Finally a road-map for food security in OIC member states will be presented for sustainable agriculture.

Watch the webinar on IAS YouTube Channel:
https://www.youtube.com/user/TheIASworld/videos

SESSION 4

Prof. Dr. Shaukat Hameed Khan

How Green is Renewable Energy

Saturday: 16 April 2022

11:00 Amman, Jordan

Register in advance:

https://us06web.zoom.us/meeting/register/tZ0kceChpz0rE9SxyFXv8YAcrflCC--Jc1Aa

SESSION 5

Prof. Dr. Zulfiqar A. Bhutta

Climate Change and Nutrition in Pakistan, on the downstream effects and solutions

Saturday: 7 May 2022

Time will be determined in due time

Register in advance:

https://us06web.zoom.us/meeting/register/tZEqcO2tqzwoGdYhs5sRaj0WMgKAVgRQbkCu

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THE MUSTAFA(pbuh) AWARD TO PROF. DR MUHAMMAD IQBAL CHOUDHARY OF THE INTERNATIONAL CENTER FOR CHEMICAL AND BIOLOGICAL SCIENCES (ICCBS)

Established in 2012 by Iran, the prestigious science and technology prize is granted biennially to the top researchers and scientists from the Organization of Islamic Cooperation (OIC) member states. The Mustafa Prize is regarded as the Nobel Prize of the Muslim world. The 2021 Mustafa(pbuh) prize from Islamic countries in bio-organic chemistry was presented to Prof. Dr Muhammad Iqbal Choudhary in recognition of his outstanding achievements and contributions in the field of "*Discovery of fascinating molecules with therapeutic applications*".

Prof. Choudhary is a professor of bioorganic and natural product chemistry, and since 2002, has served as the Director of the International Center for Chemical and Biological Sciences (ICCBS) that has been called the developing world's finest research center of chemical and biomedical sciences. His efforts have been instrumental in setting up several research institutes both domestically and abroad.

One of the most notable contributions of Prof. Choudhary is to lead the transformation of H. E. J. Research Institute of Chemistry into the International Center for Chemical and Biological Sciences (ICCBS), a UNESCO Center.

Prof. Choudhary got his Ph.D. in organic chemistry from H. E. J. Research Institute of Chemistry located at Karachi University, Pakistan, and post-doctoral studies from top US universities. He is now one of the most prolific authors of quality publications and among the world leaders in the field of natural product chemistry. He has tremendously affected the field with his research, like his mentor Prof. Dr. Atta-ur-Rahman *FRS*. A natural product is one that is produced by plants, animals, and microorganisms; metabolites such as carbohydrates, proteins, lipids, and nucleic acids.

Natural products chemistry aims to know the products that evolved in living organisms under various tensions during many million years. These chemists try to extract this ancient wisdom of nature and exploit it for the benefit of man. Many of these chemicals have been demonstrated to have medicinal properties by Dr. Choudhary and other natural products chemists.

Prof. Choudhary has tested many medicinal plants for their effectiveness. "As a chemist, he has been truly fascinated by the immense chemical diversity present in plants". With the modern tools of science, combined with traditional knowledge of their uses, medicinal plants can serve as a sustainable and rich source of new drugs against prevailing and emerging diseases.

Medicinal plants have been the basis of traditional medicines since antiquity, and in the contemporary era they have played a central role as sources of new drugs, says Prof. Choudhary.

Prof. Choudhary's research interest has been centered on finding the biological activities of natural and synthetic compounds. His team's research projects are focused on metabolic and neurological disorders. "We aim to find solutions to the unsolved and prevailing health challenges," he says. They have successfully employed a deep understanding of chemical principles and biological processes in discovering a large number of fascinating molecules with potential therapeutic applications. The quality of their research is internationally recognized and has also attracted the attention of leading pharmaceutical industries.

Prof. Choudhary's team has worked on many medicinal plants used in traditional medicines, and isolated several bioactive lead compounds or potential drugs. For example, they used pygmy groundcherry (*Physalis minima*) against Leishmaniasis, a tropical disease caused by a protozoan parasite that affects over 12 million people in 97 countries. They have also discovered potent antiepileptic natural products from a species of larkspur (*Delphinium denudatum*). They have then synthesized it in the laboratory for more investigations. These plant constituents and their synthetic analogues are now being tested in clinical trials.

Though they have benefited immensely from the traditional knowledge in their research, Prof. Choudhary warns against misusing these herbals. It is important to use scientific methods to evaluate the efficacy and safety of traditional medicines. "Inherent variations in the quantities of bioactive chemicals present in plants make it a challenge to produce standardized plant-based products. Preclinical, toxicological, and clinical trials on standardized plant products are absolutely imperative for the development of 'evidence-based medicine', he says.

Our research group has studied and discovered novel inhibitors of clinically important enzymes, which can be used to halt the molecular cascade involved in the enzyme-related disorders, such as Alzheimer's diseases, diabetes, and ER+ breast cancer," says Prof. Choudhary. As a result, several new classes of lead molecules were introduced to the world literature, along with an associated understanding of their mechanisms of action.

The goal is to reduce as much as possible the final product that would otherwise be produced. And when the final product of the reaction facilitated by the enzyme is an unwanted detrimental compound leading to a physiological condition, its inhibitor may be called a drug. Many molecules considered as a drug, such as an erythromycin antibiotic, are actually enzyme inhibitors blocking an enzyme's activity to destroy a pathogen or tip a physiological balance to our favor.

One of the internationally recognized discoveries of Prof. Choudhary's research group is urease inhibitors. The inhibitors of the enzyme urease, for example, have been used as anti-ulcer drugs. The urease, produced profusely by the bacterium *Helicobacter pylori* in the human stomach, increase the acidity of the stomach mucosal lining by breaking down the urea molecule (its substrate). The increased acidity cut through the lining and develop to gastritis or stomach ulcer which in some cases may progress to cancer. Anything that can block the urease is thus a potential drug for ulcers.
Fortunately, various compounds could be used as urease inhibitors, but should we prescribe them as oral agents to patients with stomach ulcers? Does it matter that these substances are of plant or bacterial origin or have been synthesized? What about side effects? Is it specific enough to not bind to proteins other than the target enzyme? What factors make an enzyme inhibitor an effective drug? These are questions Prof. Choudhary's research addresses.

Prof. Choudhary has a dream: to establish a multidisciplinary International Center for Tropical and Neglected Diseases. He wishes to have the time and energy to complete this mission soon. "This center will fulfill my dream of creating a world-class research facility with sustainable funding and global network of satellite laboratories to study the causes and treatment of innumerable tropical and neglected diseases," he says. Neglected because these poor man diseases are "not in the priorities" of the global pharmaceutical business, even though they affect the lives of billions of people in the most impoverished regions of the world.

Prof. Choudhary has also received the National Award of the Republic of Kazakhstan from the Ambassador of Kazakhstan Yerzhan Kistafin on behalf of the president of Kazakhstan. He has previously been honored by the president of Iran with the Khwarizmi International Award; president of Azerbaijan with the ECO Award in Education; and the prime minister of Pakistan with COMSTECH Award in Chemistry.

Prof. Choudhary has conducted most of his research studies at the ICCBS which is briefly introduced here.

The ICCBS at a Glance

The International Center for Chemical and Biological Sciences (ICCBS) is among the top academic research establishments of the developing world with three constituent centers, i. e. H. E. J. Research Institute of Chemistry, Dr. Panjwani Center for Molecular Medicine and Drug Research, and Third World Center for Chemical Sciences.

H.E.J. Research Institute established in 1966, and during the last four decades has achieved a number of milestones and remains at the pinnacle of excellence. Emphasis has been given on raising the standards of training of scholars in economically relevant fields of chemical and biochemical sciences, and resources mobilization for the future growth in new disciplines of relevant sciences.

Dr. Panjwani Center for Molecular Medicine and Drug Research is engaged in training of young scholars in the emerging fields of molecular medicine and drug research. The research activities at PCMD are directed at understanding of diseases especially those that are prevalent in Pakistan with the aim of finding improved and novel ways of their diagnosis, treatment and prevention.

The ICCBS has a unique distinction of WHO collaborating center, UNESCO category 2 center, and has been awarded the Islamic Development Bank Prize twice (2004 and 2010) for the best scientific research institution in the Islamic world.

The center has also won major international grants (Germany, USA, UK, Japan, Canada). The center and its faculty have received over 100 major national and international awards and honors, including UNSECO science prize, Nishan e Imtiaz, and Friendship Award of China.

Several Nobel laureates have visited the center and applauded its scientific contributions. They regarded this as oasis of scientific excellence in Afro-Asian world. Ministry of Science and Technology has invited top scientists of the world in the field to review the performance and productivity of the center.

The center has trained thousands of young scholars in frontier fields of science and technology. Academic contributions include thousands of international publications, international patents, and books. This is the only center where young scholars from the West (Germany, France, etc) and developing countries are coming for research training. Besides, the center conducts various research activities, such as organize Distinguished Scientists lectures, Young Scientists General Clubs, provide opportunity to enhance learning and comprehension skills through Interaction with International Visiting faculty of the ICCBS, provide access to various advance courses in different disciplines for the researchers, etc. In addition to these, the ICCBS organizes mega science events, including international conferences and symposiums. The cultural activities are also arranged intermittently to exchange the cultural diversity, and provide home like environment to foreign scientists / researchers.

The center maintains Pakistan's most sophisticated instrumentation of strategic importance, including 13 superconducting nuclear magnetic resonance spectrometers, and over 20 high resolution mass spectrometers. The center houses Pakistan's most modern Forensic DNA and Serology Lab. The industrial support wings of the center support over 700 industries annually through country's largest Industrial Analytical Center. The center also supports to strategic organizations (and thus has faced sanctions from the West).

The center has Pakistan's first DRAP-approved/ISO-17025 Pharmaceutical and Vaccine Trial Center (CBSCR). During the COVID-19 pandemic, over 3.3 million PCR tests, complete genome of SARS-Cov-2, national COVID-19 genomic surveillance program, etc, were conducted.

The ICCBS in Photographs

PROF. MALIK MAAZA FIAS RECIPIENT OF THE SPIRIT OF ABDUS SALAM AWARD

Prof Malik Maaza, the UNESCO Chair in Nanosciences and Nanotechnology and joint staff member of Unisa - The University of South Africa (UNISA) and NRF-iThemba LABS, has been announced as a recipient of The Spirit of Abdus Salam Award on Monday, 31 January 2022. The award recognizes those who, like Salam himself, have worked tirelessly to promote the development of science and technology in disadvantaged parts of the world.
"For his major role in helping to shape Africa's science and technology landscape, on top of his own prolific research output with which he has trained over a hundred young African students, as well as a number from other areas in the South."
Source: [*https://tlabs.ac.za/malik-maaza-awarded-the-spirit-of-salam/*](https://tlabs.ac.za/malik-maaza-awarded-the-spirit-of-salam/)

Malik Maaza
UNESCO-UNISA Africa Chair in Nanosciences-Nanotechnology, Muchleuneuck, College of Graduate Studies, University of South Africa, Pretoria-South Africa
Nanosciences African Network (NANOAFNET), iThemba LABS-National Research Foundation, Western Cape Province, South Africa

Prof. Malik Maaza, a native of Algeria is a joint staff of iThemba LABS-National Research Foundation of South Africa (iTL-NRF) & the University of South Africa (UNISA). He is the current holder of the UNESCO UNISA ITL Africa Chair in Nanociences & Nanotechnology (U2ACN2). He holds a PhD from the Paris VI University in Lasers & Photonics and an MSC from the University of Paris XI. His expertise lies within the multidisciplinary field of nanosciences & nanotechnology. He is fellow of the Islamic Academy of Sciences, the African Academy of Science, the New York Academy of Science, the European Academy of Science, the National Academy of Science of India as well as Fellow of the Royal Society. His scientific contributions were recognized via several international awards such as the Jose Vasconcelos Global Cultural Council award & the Galileo Galilei International Commission of Optics award. He has published & co-authored about 500 ISI-SCI publications. He has an H_{index} *~55 &* i_{10} *~225 & a total citations of ~9900.*

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Letter from the World Federation of Public Health Associations (WFPHA) on behalf of the Sustainable Health Equity Movement (SHEM) to the Executive Board of the World Health Organization (EB-WHO). 24-29 January 2022

To
His Excellency Dr Patrick Amoth
Chair of the WHO Executive Board

With copies to:

His Excellency Dr Tedros Adhanom Ghebreyesus
WHO Director General

Her Excellency Mrs Carla Moretti
Vice Chair 3 of the WHO Executive Board

The year 2022 begins with a record number of new cases of COVID-19, including in countries with high rates of vaccine coverage. This new wave reminds us that the pandemic remains out of control and that there are no possible accurate predictions about its evolution in the short- or long-term.

More importantly, the current surge in cases demonstrates that even significant scientific and technological advances, especially with the development of vaccines, are still insufficient and the evolution of the pandemic remains largely unpredictable.

It is not just the virus that is winning, but it is also we humans who are losing many battles. We could and should be doing more and better!

From what we have learned in the past two years, there are at least three main areas of action to move forward with: (1) equitable vaccine distribution, (2) consolidation of a global surveillance and response system, anchored in strengthened national health systems, and (3) direct action on the climate crisis and socio-environmental determinants of health, from the perspective of One Health.

Thus, WFPHA and SHEM ask the EB-WHO to bring the following proposals to the WHA:

1) Aligned with the Multilateral Leaders Task Force on COVID-19 Vaccines, Therapeutics and Diagnostics, WHO Member States must implement an equitable distribution of vaccines against COVID-19, which presupposes patent wavering, the sharing of knowledge and the transfer of technology, enabling the expansion of production and distribution based on ethical and epidemiological criteria, at no cost to the end consumer. This must be combined with the WHO's decisive support to vaccine production initiatives amable for patent pooling and technology transfer contributing to global equity Covid vaccine coverage.

2) The WHA must agree to develop and, on an accelerated timeline, negotiate and adopt a new Pandemic Treaty that, in addition to improving global preparedness and response to health emergencies, helps all countries – especially low- and middle-income – to strengthen their national health systems to

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ensure everyone's right to health. The Treaty must also consider the social determinants of health, contemplating intersectoral measures around social, environmental, and economic responses to support health actions.

3) The WHA must recognize that COVID-19 is more than a pandemic and is best characterized as a syndemic. The world suffers from the synergy of COVID-19 and other communicable and non-communicable diseases with political, economic, and environmental macro-processes that jointly cause deep changes that favor the emergence of zoonoses, and which reflect and generate social inequalities and inequities among and within countries. The construction of a "new normal", better and fairer than the one that brought us here, requires facing all the dimensions of this complex reality, where the global unfair economic order must be faced and the right to development can be achieved by all nations and peoples.

The proposals listed above are based on the understanding that complex problems with multiple determinations require multiple, complex, and transformative measures. In this sense, '*all governments, all societies*' type of responses is necessary to face this COVID-19 syndemic, that is, properly coordinated global responses, involving States and civil societies.

In addition to the WHO and the ministries of health of the different countries, it is paramount that the United Nations, gathering Chief-of-States, in its role as the most important space for international political concertation, also understand and act on the syndemic character of the current crisis.

Hence, the Sustainable Health Equity Movement (SHEM), a civil society organization that brings together 150 institutions in the areas of science, public health, medicine, nursing and other civil society entities from around the world, representing, as a whole, more than 500 institutions and around 20 million professionals and activists, **suggests holding a High-Level Meeting on *"Complex-determination and an integral and collaborative response to the COVID-19 syndemic"*, on the occasion of the 77th UNGA, in September 2022.**

In this regard, the WFPHA and SHEM request the WHO Executive Board to take to the WHA the above-mentioned proposal to recommend to the President of the UNGA and UN Secretary General the organization of the proposed High-Level Meeting.

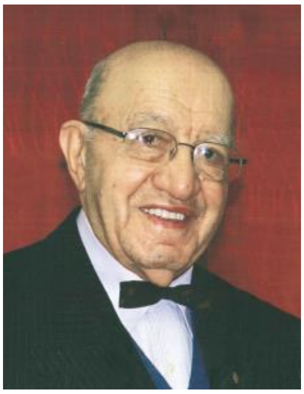
Yours sincerely,

Prof. Walter Ricciardi
WFPHA President

Prof. Luis Eugenio de Souza
WFPHA Vice-President

FELLOWS NO LONGER WITH US

THE LATE PROF. ŞINASI ÖZSOYLU (TURKEY)



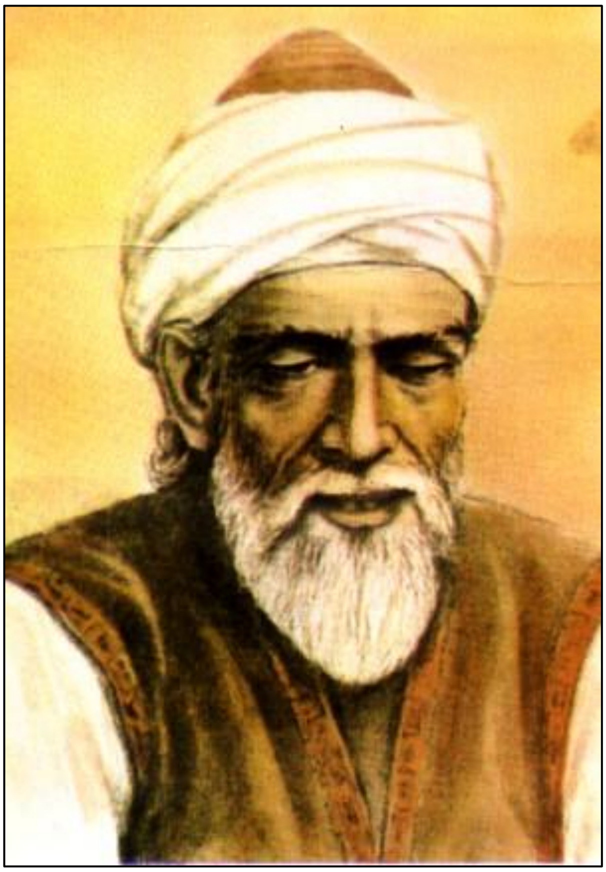
It is with a sense of sadness and sorrow that the President and the Director General of the Islamic World Academy of Sciences (IAS) in Amman, Jordan, announce the passing away of the eminent Turkish scientist **Şinasi Özsoylu**.

Born in Erzurum, Turkey, on August 29, 1927, Prof. Ozsoylu graduated from Istanbul University Medical Faculty in 1951. He had been a Fellow of the Islamic World Academy of Sciences since 1988.

He was a resident doctor at Ankara University, Hacettepe Children's Hospital (1955-1958); chief-resident at the same institution for a year; a second year resident in St. Louis Children's Hospital (Washington University Medical School, St. Louis, USA) (1959-1960), staying on at the Department of Pharmacology of the same School until 1961. During the next two years, he undertook training in Pediatric Hematology at the Children's Hospital Medical Centre (Harvard University School of Medicine, Boston, USA). In 1963, he returned to Hacettepe Faculty of Medicine, Ankara, and became Associate Professor (1964) and then Professor of Pediatrics and Hematology (1969).

Dr. Ozsoylu had his ECFMG examination in 1960 and the American Board of Pediatrics in 1963. He was a member of the Turkish Medical Society, Turkish Pediatrics Society, Turkish Child Health Society, Turkish Hematology Society, Turkish Hemophilia Society and World Federation of Hemophilia, Mediterranean Blood Club, International Pediatric Society, European Society for Pediatric Hematology and Immunology, International College of Pediatrics, European Science Foundation and the Union of Mediterranean Pediatric Societies. He has become an interdisciplinary Hematology expert for the International Pediatric Association. He was an Honorary member of both the American Pediatric Society (1993), and the American Academy of Pediatrics (1995). He was a former President of the European Society for Pediatric Hematology and Immunology, and a former member of TUBITAK (Scientific and Technical Research Council of Turkey) Medical group. He was on the editorial boards of 19 medical journals, and editor of the New Journal of Medicine. He received the Dogramaci Award (1979), the Parlar Award (1989). He authored over 800 publications (over 400 in the USA and Europe) and has written two books and co-authored another two. Prof. Ozsoylu joined Fatih University in 1994.

ABUL WAFA MUHAMMAD AL-BUZJANI (940-997 AD)*



Abul Wafa Muhammad Ibn Muhammad Ibn Yahya Ibn Ismail al-Buzjani was born in Buzjan, Nishapur in 940 AD. He flourished as a great mathematician and astronomer at Baghdad and died in 997/998 AD. He learnt mathematics in Baghdad. In 959 AD he migrated to Iraq and lived there until his death.

Abul Wafa's main contribution lies in several branches of mathematics, especially geometry and trigonometry. In geometry, his contribution comprises the solution of geometrical problems with the opening of the compass; construction of a square equivalent to other squares; regular polyhedra; construction of a regular hectagon taking for its side half the side of the equilateral triangle inscribed in the same circle; construction of a parabola by points and geometrical solution of the equations:

$$x^4 = a \text{ and } x^4 + ax^3 = b$$

Abul Wafa's contribution to the development of trigonometry was extensive. He was the first to show the generality of the sine theorem relative to spherical triangles. He developed a new method of constructing sine tables, the value of sin 30° being correct to the eighth decimal place. He also developed relations for sin (a+b) and the formula:

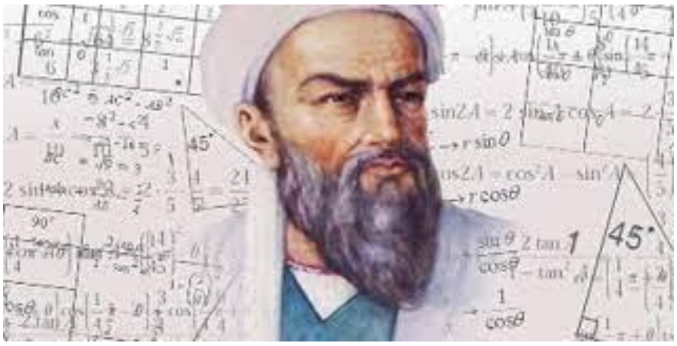
$$2 \sin^2 - \left(\frac{a}{2}\right) = 1 \cos a, \text{ and}$$

$$\sin a = 2 \sin \left(\frac{a}{2}\right) \cos \left(\frac{a}{2}\right)$$

In addition, he made a special study of the tangent and calculated a table of tangents. He introduced the secant and cosecant for the first time, knew the relations between the trigonometric lines, which are now used to define them, and undertook extensive studies on conics.
Apart from being a mathematician, Abul Wafa also contributed to astronomy. In this field, he discussed different movements of the moon, and discovered 'variation'. He was also one of the last Arabic translators and commentators of Greek works.

He wrote a large number of books on mathematics and other subjects, most of which have been lost or exist in modified forms. His contribution includes Kitab 'Ilm al-Hisab, a practical book of arithmetic, al-Kitab al-Kamil (the Complete Book), Kitab Al-Handsa (Applied Geometry Book). Apart from this, he wrote rich commentaries on Euclid, Diophantos and al-Khawarizmi, but all of these have been lost.

His books now extant include Kitab *'Ilm al-Hisab*, *Kitab al-Handsa* and *Kitab al-Kamil*.



His astronomical knowledge on the movements of the moon has been criticized in that, in the case of 'variation' the third inequality of the moon as he discussed, was the second part of the 'evection.' But, according to Sedat, what he discovered was the same that was discovered by Tycho Brache six centuries later. Nonetheless, his contribution to trigonometry was extremely significant in that he developed the knowledge on the tangent and introduced the secant and cosecant for the first time. In fact, a sizeable part of today's trigonometry can be traced back to him.

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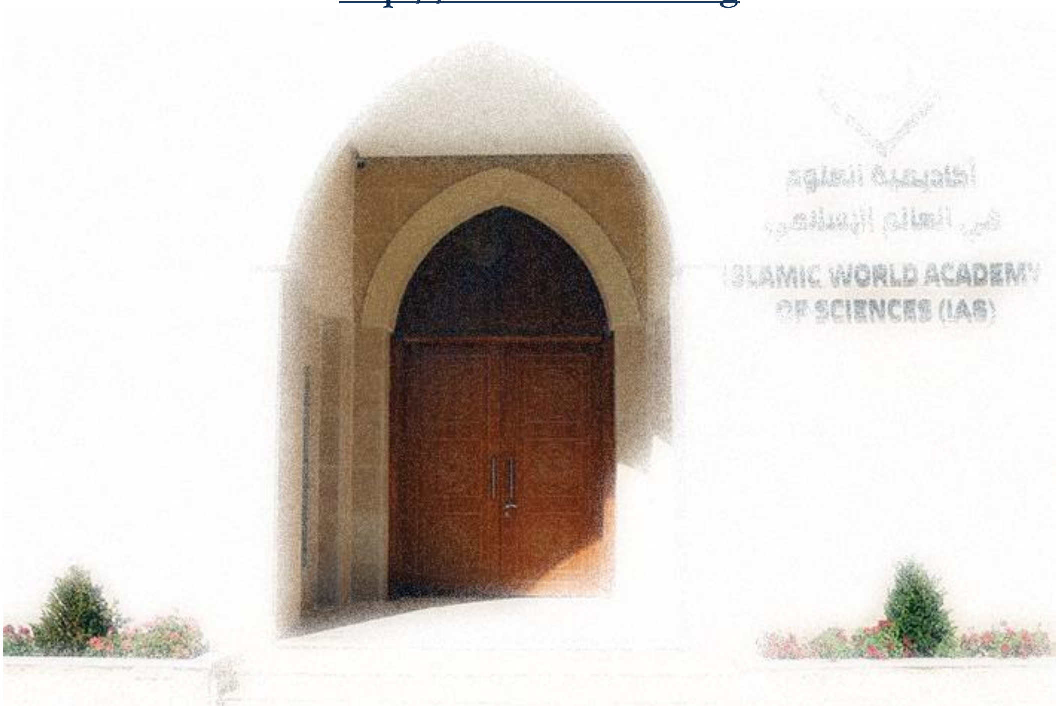

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