

SCi planet

EYE ON SCIENCE

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 
6 CLEAN WATER AND SANITATION 	7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES 
11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 	13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 
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RELIABILITY

By: Maissa Azab



SECURITY =

SUSTAINABILITY

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This year 2019, as we discuss the Sustainable Development Goals (SDGs), we have already tackled issues relating to energy, climate, and biodiversity on land and in water. In our previous issue, we looked at goals that affect the quality of human life: Gender Equality; Reducing Inequalities; Peace, Justice, and Strong Institutions; Sustainable Cities and Communities. In this issue, we turn our attention to goals that are probably the most pressing, keeping in mind that all goals are intertwined. These goals, in particular, are felt worldwide and require the most urgent action; they are the goals that affect our basic livelihood.

Ending poverty may sound not that urgent, but not when we consider how it brutally exacerbates life-threatening issues, such as food security, clean water and sanitation, good health and wellbeing. That is why one of the most pressing goals is to ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, natural resources, and appropriate new technology.

Ending hunger entails achieving food security and improved nutrition, including the promotion of sustainable agriculture. This means ending all forms of malnutrition, doubling agricultural productivity, and ensuring sustainable food production systems. Another goal seeks to ensure availability and sustainable management of water and sanitation for all by reducing pollution, eliminating dumping, and minimizing release of hazardous chemicals and materials. Yet another goal is dedicated to ensuring healthy lives and promoting wellbeing for all at all ages. The aim is to end preventable deaths of newborns and children, as well as putting an end to different types of diseases, including AIDS, tropical diseases, water-borne diseases, and other communicable diseases.

The success in all these goals is closely linked to the goal of Responsible Consumption and Production. It aims to achieve economic growth and sustainable development through changing the way we produce and consume goods and resources. It also entails reducing waste generation through prevention, reduction, recycling, and reuse.

As always, we hope you enjoy the new issue; we also look forward to hearing your feedback through E-mail at: COPU.Editors@bibalex.org. Make sure to check out *SCIplanet* Online for additional articles, and remember to subscribe in our monthly e-newsletter.



**SUMMER 2019
Year 12, Issue 3**

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Educational & Promotional
Publications Unit (COPU)



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MARTIAN'S FOOD

By: Dr. Omar Fikry
Head, Planetarium Section, BA Planetarium Science Center

The Martian (2015) is an inspiring American science fiction movie directed by the genius Ridley Scott, starring the convincing Matt Damon. Adapted from Andy Weir's novel, *The Martian*, and scripted by Drew Goddard, Matt Damon plays the role of an astronaut whose colleagues think is dead, consequently abandoning him on Mars, where he has to survive depending on very limited resources.

The film revolves around a human mission on Mars, during which astronaut Mark Watney was believed dead after a horrible storm and abandoned. Alone on the planet in a harsh environment, Watney had to survive with extremely scarce supplies. He had to depend on his own skills, intelligence, and bravery to survive and find a means to transmit a message to Earth to let people know he is still alive. Millions of kilometers away, when NASA finds out he is still alive, it engages with an international team of scientists to bring him home. His fellow crew members plan to carry out a brave, if not almost impossible, rescue plan. The whole world cooperates to bring Watney back safely, through a series of unbelievably courageous acts.

What urges me to refer to this film (novel) is how the protagonist dealt with the raw potatoes found in the spaceship debris, and how they had to be made sufficient to keep him alive until he returns to Earth. The protagonist counted the potatoes he found in three boxes; the first containing 81, the second 52, and the third 79. He then calculated the number of days he has ahead to return home, concluding

that he has to chop the potatoes into small portions and consume only one daily so as to stay alive and focused, keeping his good thinking abilities functional in such exceptional situation.

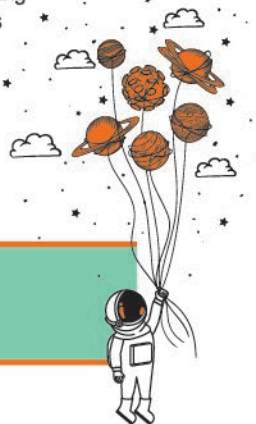
This behavior stresses the significance of responsible consumption of food in the face of impending evanescence; we can give up our food consumption habits if we are obliged to. *The Martian* example is quite exaggerated; however, it still serves as a call to all human beings to consider responsible consumption for the sake of survival. Responsible consumption is a main pillar of healthy societies. It is not only confined to the consumption of food, but has also to do with resources such as water and electricity, as well as medication. Yet, responsible food consumption is at the top of the list due to the importance of food for survival.

American writer Caroline Kaufman published an article entitled 14 Smart Ways to Cut Food Waste on www.livestrong.com, on 14 April 2019 (check references), in which she provides advice about responsible consumption of food by family members. The advice includes estimating

how much food each member needs, not preparing large quantities of food, and avoid cooking multiple recipes in each meal. Moreover, one should only buy moderate quantities of essential products, especially when it concerns fruits and vegetables because they are easily perishable. One should also select the food products that are affordable to the household, and investigate the possible alternatives in case a certain commodity becomes too expensive or difficult to obtain. Additionally, we should use our food scraps instead of simply throwing them away.

The optimal consumption of food aims at achieving responsible spending of money, saving food, and making it available for everybody. Responsible food consumption can be made possible through following a set of enlightened plans and procedures that aim to guide individuals to optimal consumption. These procedures include raising the society's awareness about responsible food consumption, and the role it plays to address economic crises and food insufficiency in many developing countries.

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FAMINE throughout HISTORY

By: Inas Essa

the opportunity for many people to get their needs is reduced. Traders monopolize local markets; they try to make the best profits by raising prices, so they do not sell food supplies immediately, but wait for the prices to rise, thereby restricting the overall supply to consumers.

Poverty often plays a role; in this case, the problem is not only where to get the food, but not being able to afford basic food needs. It is not surprising that countries where famines occur tend to be very poor. This correlation also reflects the fact that poorer countries tend to have less adequate facilities, such as transport infrastructure, sanitation, and healthcare systems, all of which play a key role in preventing or moderating the impacts of food shortages.

Many of the major famines have occurred as the consequence of war; in some cases, it is actually used as an intentional part of the political or military strategy. As of the second half of the 20th century, famines in Africa have become increasingly associated with civil war; in many cases in places that were not previously prone to famines at all. In addition to direct casualties, conflict can disrupt production and trade, as well as encourage the spread of epidemics, particularly through forced migration and blockage of humanitarian relief to those in need.

Whether it happens because of poverty, conflict, or demographic problems such as population imbalance, famine has always been one of the worst disasters to affect human life. It is a major contributor to poor health due to malnutrition, as well as the rise of death rates, in different countries at different times of history. Indeed, famine can and has been a grim reaper of millions of lives; not only that, but also in a very painful way, since death by starvation is not immediate and often hits the youngest and the elderly first and most. Malnutrition caused by starvation is not the sole bad effect of famine; infectious diseases that badly affect the immune system is another terrible facet of famine.



The Culprits

Food prices' volatility caused by bad harvests has been a major contributor to increasing famine. Food shortages lead traders to increase food prices; as a result,

As opposed to death by literal starvation, the vast majority of people that die during famines actually succumb to infectious diseases or other illnesses, with some diseases being more directly

linked to diet than others. Famines brought on by drought and scarcity of clean drinking water increase the threat of cholera and other diseases. Moreover, increased migration, the disruption of personal hygiene, sanitation routines, and healthcare systems increase the risk of outbreaks of infectious diseases combined with malnourishment.

Infamous Famines

In the 18th century, many parts in **North India** suffered an unusually dry year, caused by a shift in the weather system, which brought significantly less rain to the region. Vast swaths of crops withered and livestock perished due to lack of food and drinking water; this horrible year killed 11 million Indians.

With 1.5 million deceased and 2 million emigrated, the great famine of **Ireland** is considered one of the most famous in history; it was caused by a devastating potato disease as a result of the attack of the fungus known as the potato blight. As 33% of the Irish population relied on potatoes for sustenance during this time, the onset of the disease in 1845 triggered mass starvations that lasted until 1853. By the end of this famine, the population of Ireland had shrunk by 25%.

The early 20th century was a tumultuous time for **Russians** because of World War I, the 1917 violent revolution, and multiple civil wars. Throughout all this, Bolshevik soldiers often forced farmers to sacrifice their food. As a result, many stopped growing crops, as they could not eat what they sowed, which resulted in a huge shortage of food and seed; by 1921, five million Russians had died.

The severity of the **Soviet Famine** of the 1930s was not completely known worldwide until the 1990s, after the collapse of the Soviet Union. The main cause was the policy of collectivization, where large swaths of land would be converted into collective farms maintained by farmers. This was implemented by destroying the farmers' existing farms, crops, and livestock, and forcibly taking their land. Reports of farmers hiding crops for individual consumption led to wide-scale search parties, and the destruction of any hidden crops found. Those actions caused mass starvation, killing about 10 million people.

Much like the Soviet Famine, the **Great Chinese Famine** was caused by communist leaders and their attempt to force change upon an unwilling population. As part of their "Great Leap Forward", the owning of private land was outlawed in China during 1958; communal farming was implemented in an attempt

to increase crop production. Moreover, the Communist Regime placed great importance on iron and steel production; as a result, millions of agricultural workers were forcibly evicted from their fields and sent to factories to create metal.

In addition to that, Chinese officials' mandated new methods of planting that seeds were to be planted 1–2 meters under the soil, extremely close together, to maximize growth and efficiency. These failed policies, teamed with a flood in 1959 and a drought in 1960, affected the entirety of the Chinese nation. By end-1962, 43 million Chinese had died from the famine.

As it was a Protectorate under France, Vietnam was under colonial rule for much of World War II. As Japanese expansion began in Indochina, a collaborationist French Government sided with the Japanese. As a result, the agricultural focus shifted from sustenance to war-materials, specifically rubber. The Japanese exploited what little crop farms remained; the invading forces commandeered most of these crops, causing mass starvation across much of Northern Vietnam. The resulting famine killed around 2 million Vietnamese.

The **Bengal Famine** of 1943 was set about by a whirlwind of catastrophic events; by losing their largest trading partner in Burma because of World War II and Japanese imperialism. Since the Japanese suspended the trade between Bengal and Burma, which represented the main source of their food, 7 million Bengalis and Burmese refugees passed away due to starvation.

A horrific famine had previously hit Bengal in the 18th century, killing almost one-third of the population. Largely ruled by the English-owned East India Company, reports of severe drought and crop shortages were ignored, and the Company continued to increase taxes in the region. Farmers were unable to grow crops, and any food that could be purchased was too expensive for the starving Bengalis. Without large rice stocks, people were left with no food reserves and the ensuing famine killed 10 million Bengalis.

North Korea suffered a tremendous famine, 1994–1998, brought about by a combination of misguided leadership and large scale flooding. In 1995, torrential rains flooded the farming regions, and destroyed 1.5 million tons of grain reserves. Later, a political policy of "Military First" placed the needs of the military above the needs of the common people, including food rations. Thus, the isolated nation suffered from a stagnating economy, and

was unable and unwilling to import food, and as a result, the childhood mortality rate rose to 93 out of 1000 children, and the mortality rate of pregnant women rose to 41 out of 1000 mothers. Death toll for those four years had risen, 2.5 million – 3 million people perished due to malnutrition and starvation.

Having shed light on the crises over centuries, it is clear that there is an evident diminishing in the occurrence of life-taking famines in recent decades compared to earlier eras, which is a good sign. However, this does not eliminate the risk of famine, which faces roughly 80 million people currently living in a state of crisis-level food insecurity and therefore requiring urgent action.



Hopefully, the United Nations has a sharp focus on "Zero Hunger" goal in their Sustainable Development Goals agenda, which aims at eliminating hunger and providing nutritious food for all and generate decent incomes, while supporting rural areas and protecting the environment. This goal will revitalize millions that will make the world a better place for them and end long-lived hard times of food scarcity.

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By: Inas Essa

Is it food scarcity or imbalanced distribution? This question can sum up a lot about the hunger problem all over the world. Although statistics show that the world produces enough food to feed about 10 billion people, millions still suffer from hunger, especially in developing countries. So, it is not about food production; what makes hunger dominate the scene in many cases is economics and how food is distributed, not its scarcity.

Needless to say, it is a complex situation, as there are many factors contributing to it: an increasing population on one hand, decreasing lands, water, other resources on the other hand, all of which will increase in the near future with more people to feed and fewer resources to feed them. Yet, the problem seems to dwell in the inequity rather than the shortages.

A Matter of Economics

According to the United Nations "Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life." The Committee further holds that proper health care, child care, and sanitation are required to translate food security into nutrition security.

Although access to sufficient and nutritious food is a human right that should be available to everyone, the experience of real life shows that neither markets nor governments protect it for their people who need food. As a result, this privilege has been granted only to those who produce food and regulate society to achieve this protection. In many scenarios and in consequence to this problem, as the supply of food tightens, prices increase and fewer people are able to afford their basic food needs to survive.

Victims of Nutritional Deficiency

The most affected categories of malnutrition and food shortage are children

and people living in rural areas. Children are fiercely affected by nutritional deficiencies as it dramatically affects their growth, physically and mentally, as access to adequate food during the first thousand days of life is vitally important for healthy future generations.

Statistics show that around 5 million children die each year because of poor nutrition during the crucial time of their growth, and that developing countries have a great share of the world's hungry people with 98%. People living in rural areas who depend on crops they plant are also affected dramatically by this problem since their access to food is controlled by their access to natural resources, environmental destruction, and climate change.

Steps towards a Better World

Action should be taken to eliminate hunger by shifting from a developmental model based on charity and aid to one based on human rights, embracing the marginalized, disempowered, and excluded groups previously locked out of developmental planning. A major effort is needed to avoid practices that exacerbate the negative impacts of food production and consumption on climate, water, and ecosystems. This could only be achieved by making a healthy environment that internationally guarantees human rights, which could be achieved through:

- 1) Encouraging governments to work towards policy coherence by setting compatible agricultural policies with environmental sustainability and trade rules consistent with food security.
- 2) Placing human rights at the heart of all efforts targeting the elimination of hunger and setting a strong accountability framework and the will to enforce this.

Some Achievements

The sustainable development goal of "Zero Hunger" carried out by the United Nations General Assembly, which aims to end all forms of hunger and malnutrition



by 2030, has achieved a number of goals, including:

- Reducing the number of undernourished people by almost half in the past two decades because of rapid economic growth and increased agricultural productivity.
- Many developing countries that suffered from famine and hunger can now meet their nutritional needs.
- Central and East Asia, Latin America, and the Caribbean have all made huge progress in eradicating extreme hunger.

Still, extreme hunger and malnutrition remain a huge barrier to development in several countries. There are 821 million people estimated to be chronically undernourished as of 2017, often as a direct consequence of environmental degradation, drought, and biodiversity loss. Over 90 million children under five are dangerously underweight; undernourishment and severe food insecurity appear to be increasing in almost all regions of Africa, as well as in South America.

As the problem seems to be in inequity rather than shortage, to realize the goal of "Zero Hunger", we should work hand in hand, exerting effort in promoting sustainable agriculture, supporting small-scale farmers and equal access to land, technology, and markets. On a larger scale, we need international cooperation to ensure investment in infrastructure and technology to improve agricultural productivity.

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The Chicken or the EGG?



Agriculture might sound as a peaceful activity that provides humanity with precious food. Who would think that such a giving practice that marked the beginning of human civilization could possibly be threatening to Planet Earth? According to the Food and Agriculture Organization (FAO), the agricultural sector is responsible for 24% of the greenhouse emissions causing climate change. On the other hand, it is widely known that climate change has its toll over agriculture, changing farming norms and threatening the world's food security. It is a vicious cycle where each element aggravates the other, leaving us in a chicken-or-the-egg dilemma.

By: Hend Fathy

How agriculture affects climate change?

First of all, the increasing world population implies an increased need for more arable lands and pastures to meet the growing food demand. This has unfortunately led to irresponsible practices of deforestation and land conversion. According to FAO, an estimated 18 million acres of tropical forests are lost each year for land-use conversion purposes. As such, the world is losing natural filters of greenhouse gases, which contributes to aggravating climate change.

Second, agriculture is responsible for a significant share of the notorious greenhouse gases emission; mainly methane and nitrous oxide. The livestock sector is responsible for around 45% of human-induced methane emissions. Cattle produce methane during digestion due to enteric fermentation, released via belching; it can also escape from stored manure. Another source of methane is rice farming, which takes place in continuously flooded paddies. These warm waterlogged soils provide ideal conditions for methane production; the vast majority of it is released into the atmosphere.

On the other hand, around 53% of nitrous oxide emissions are produced as a by-product of organic and mineral nitrogen fertilizers. Moreover, there are other direct emissions of carbon dioxide originating from burning fossil fuels to power agricultural machinery, as well as the irresponsible burning of agricultural wastes.

How climate change affects agriculture?

At the other side of the dilemma, climate change has serious implications on agriculture. First of all, it will shrink arable lands for several reasons, including extreme weather conditions, rising sea levels, and increasing soil salinity. Second, changing weather patterns would cause shifts in the geographical distribution of certain pests and related diseases, causing farmers to face unprecedented challenges.

Moreover, heatwaves associated with climate change are very stressful for livestock. They can result in lower productivity and fertility, as well as negatively affecting the animals' immune system, making them more prone to diseases. These can also be destructive for crops in case they occur when the plants are flowering. Warmer temperatures would also affect the length of growing seasons and alter harvest dates.

Crops that are sensitive to temperature might not grow in their normal seasons or latitudes, posing serious challenges to local farmers and markets. Northern areas, on the contrary, might witness increased productivity or introduction of new crops due to the extension of warmer growing seasons. In both cases, however, production would vary from one year to another due to unexpected weather events.

Furthermore, yield production is expected to decrease in many areas around the world due to extreme weather events associated with climate change. Hurricanes,

for instance, are already affecting crop productivity; for example, hurricanes that hit southern Africa in 2016 caused a 25% decrease in wheat production.

Several studies and reports of the International Panel of Climate Change (IPCC) have found that climate change would cause major changes in rainfall patterns around the world. Since many are rainfall-dependent, farmers find it difficult to cope with these environmental changes. While some regions are likely to witness a significant drop in rainfall, and suffer more drought strikes, other regions are expected to face the opposite.

An increased rainfall sounds good; if this water is efficiently stored, it can be used for irrigation and increase food production. However, heavy rainfalls might do more harm than good, and are mostly accompanied by hurricanes and floods. In 2009, the Philippines witnessed heavy rains that pushed farmers to spread grains on the streets to dry in the Sun. As a result, the grain was of poorer quality; additionally, the land was severely affected that they could not plant the next crop.

The risks humanity have to deal with go far beyond a warming planet and an unstable food production. All these implications pose serious challenges to millions of simple farmers who lack the proper means of dealing with them. Unfortunately, the more efforts are exerted for mitigation and the more losses faced, the more expensive food would become.



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By: Maissa Azab

CLIMATE SMART

AGRICULTURE

The world currently produces more than enough food to feed everyone; yet, more than 10% of the global population is still hungry. As per the 2018 Global Report on Food Crises, an estimated 124 million people in 51 countries are currently facing crisis food insecurity or worse. The previous year's report identified 108 million people in crisis food security or worse across 48 countries. A comparison of the 45 countries included in both editions of the report reveals an increase of 11 million people—an 11% rise—in the number of food-insecure people across the world.

By 2050, with the global population expected to reach 9.8 billion, our food supplies will be under far greater stress. Demand will be 60% higher than it is today, but climate change, urbanization, and soil degradation will have shrunk the availability of arable land, according to the World Economic Forum. Add water shortages, pollution, and worsening inequality, the implications are bleak.

Climate experts have long predicted severe consequences for global food security if serious steps are not taken to mitigate climate change. Rising temperatures, more frequent droughts, and more severe weather events are expected to cause agriculture in certain areas to suffer, all while the global population and its demand for food continues to skyrocket. As a result, an interest has risen in using models to predict the ways climate change will affect agriculture under various scenarios and what those effects might mean for future human societies.

A group of scientists, led by Marco Springmann of Oxford University's Oxford Martin Programme on the Future of Food, used an agricultural model to simulate the

effects of future climate change on global food production and consumption. They assumed a severe climate change scenario; one in which global air temperature by 2050 is about two degrees higher than it was in the period between 1986 and 2005. They then used a health model to predict the way these changes in food production and consumption would affect human health; they compared all of these effects to a reference scenario, which assumes a future with no climate change.

If no climate change were to occur, the model predicted that global food availability would actually increase by 10.3% by the year 2050; however, under the effects of climate change, the model predicted that global food availability would be 3.2% lower than was predicted in the scenario with no climate change. Specifically, it realized that people would eat 4% less fruit and vegetables and 0.7% less meat.

Food security is a serious issue facing humanity; it is about how we feed a growing population at a time of climate change, which is unpredictable and not fully understood. Globally, we are reliant on a very slender thread of genetic diversity;

according to the UN Food and Agriculture Organization (FAO), more than 50% of all human calories are from just three plants: rice, maize, and wheat.

Over thousands of years of agriculture, humans have selected plants for particular traits; typically their yield. High yield is important for feeding a growing population, but it means that our food crops are very homogenous. Currently, only 12 crops account for 75% of all human calories. If a particular pest or pathogen arises, or a particular vulnerability to changing climate, the entire crop becomes vulnerable because of the lack of genetic variability within it.

Climate change's negative impacts are already being felt in the form of reduced yields and more frequent extreme weather events affecting crops and livestock alike. Substantial investments in adaptation will be required to maintain current yields and to achieve the required production increases. Agriculture is also a major part of the climate problem, currently generating 19–29% of total greenhouse gas emissions. Without action, that percentage could rise

substantially as other sectors reduce their emissions.

Climate-Smart Agriculture (CSA) is an integrated approach to managing landscapes—cropland, livestock, forests, and fisheries—that address the interlinked challenges of food security and climate change. CSA aims to simultaneously achieve three outcomes:

1- Increased productivity: Produce more food to improve food and nutrition security and boost the incomes of 75% of the world's poor living in rural areas and mainly rely on agriculture for their livelihoods.

2- Enhanced resilience: Reduce vulnerability to drought, pests, disease, and other shocks; and improve capacity to adapt and grow in the face of longer-term stresses like shortened seasons and erratic weather patterns.

3- Reduced emissions: Pursue lower emissions for each calorie or kilo of food produced, avoid deforestation from agriculture, and identify ways to extract carbon out of the atmosphere.

CSA requires consideration of all three objectives, from the local to the global scales, over short and long time horizons, to derive locally acceptable solutions. The relative importance of each objective varies across locations and situations. Recognition of trade-offs is particularly important in developing countries, where agricultural growth and adaptation for food security and economic growth are a priority, and where poor farmers are the most affected by—but have contributed least to—climate change.

CSA builds on existing experience and knowledge of sustainable agricultural development. Sustainable intensification is a cornerstone; more efficient use of resources contributes to adaptation and mitigation via effects on farm productivity and incomes, as well as reduced emissions per unit of product. Sustainable intensification on existing agricultural land has considerable mitigation potential by reducing the conversion of forest and wetlands.

CSA emphasizes agricultural systems that utilize ecosystem services to support productivity, adaptation, and mitigation. Examples include integrated crop, livestock, aquaculture, and agroforestry systems; improved pest, water, and nutrient management; landscape approaches; improved grassland and forestry management; practices such as reduced tillage and use of diverse varieties and breeds; integrating trees into agricultural systems; restoring degraded lands; improving the efficiency of water and nitrogen fertilizer use; and manure management, including the use of anaerobic bio-digesters.

Enhancing soil quality can generate production, adaptation, and mitigation benefits by regulating carbon, oxygen, and plant nutrient cycles, leading to enhanced resilience to drought and flooding, and to carbon sequestration. These supply-side changes need to be complemented by efforts to change consumption patterns, reduce waste, and create positive incentives along the production chain.

Amazing Maize

In sub-Saharan Africa, “maize is life” due to its importance for food security and economic well-being; however, around 40% of Africa’s maize-growing areas face occasional drought stress, resulting in yield losses of 10–25%. To reduce vulnerability and improve food security, the Drought-Tolerant Maize for Africa (DTMA) project released 160 drought-tolerant maize varieties between 2007 and 2013.

These have been tested in both research facilities and on farmers’ fields, and disseminated to farmers in 13 African countries through national agricultural research systems and private seed companies. Yields of the new varieties are superior to those of currently available commercial maize varieties under both stress and optimum growing conditions.

An assessment study on the potential impacts of the DTMA project indicates—with optimistic adoption rates and yield increases of 10–34% over non-drought tolerant varieties—that the project could lead to cumulative economic benefits to farmers and consumers. Moreover, they estimate that drought tolerant maize could assist more than four million people to escape poverty while improving the livelihoods of millions more. The ongoing success of this initiative has largely depended upon the widespread and sustainable collaborative mechanisms that have been established among a wide range of relevant partners.

Roots Regeneration

As outlined in the book *Climate-Smart Agriculture—Success stories from farming communities around the world*, the practice of Farmer Managed Natural Regeneration (FMNR) in the West African Sahel has restored more than 5 million hectares of degraded land and improved the food security of around 2.5 million people so far. FMNR involves farmers allowing the roots of trees still present in their fields to regenerate and then managing these trees to provide timber, fuel wood, fodder, fruits, and nuts. The trees help stabilize the soil and reduce erosion, while at the same time sequestering carbon to help mitigate climate change.

Studies by the World Agroforestry Centre show that FMNR has more than tripled yields of millet in Niger. Expansion of the practice across the Sahel has seen

200 million trees re-established or planted, resulting in an additional half-a-million tons of grain every year and enough fodder to support many more livestock.

Reduction to Revenue

By committing to the Emissions Reduction Purchase Agreement with the World Bank’s BioCarbon Fund, Kenyan farmers directly monitor, and earn revenue, for reductions in greenhouse gas emissions from changed agricultural practices. Already 15,000 farmers are involved, covering around 12,000 hectares of degraded land.

Australian farmers too are benefiting from carbon credits earned through practices such as reforestation or revegetation, which reduce greenhouse gas emissions and/or sequester carbon. Through the Carbon Farming Initiative, farmers sell credits they earn to individuals and businesses that want or need to offset emissions from their business operations. This boosts farmer incomes and increases the resilience of Australian agriculture to climate change.

Green for Grain

The ambitious Green for Grain program in China is geared towards reversing erosion on steep slopes by restoring forests on hillsides and eroded grasslands. Farmers receive tree seedlings, annual grain, and cash payments for each hectare of land they plant with trees. In the Loess Plateau in the upper reaches of China’s Yellow River, more than 2.5 million households have participated in the program, converting two million hectares of cropped hillside to grassland or forest, significantly decreasing soil erosion. These areas sequester an estimated 2.5 megatons of carbon dioxide equivalent each year, equal to removing around 800,000 cars from the road.

The world is currently teetering on the brink of a dangerous cliff; if we do not collectively commit to taking serious actions, the future of humanity is quite bleak. Among the fundamental human rights that need to be secured and sustained, food-security is one of, if not the most pressing. Farming must thus become climate resilient; Climate-Smart Agriculture can take shape, and should thus serve as inspiration for future policies and investments.

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FOOD & WASTE WORLD HUNGER

There are a number of facts, which—as impossible as they might sound—are associated with the percentages of food waste to world hunger. These facts have been verified by several studies; they are:

- 1- Food wasted annually is worth one billion US dollars.
- 2- The USA alone is responsible for about 30–40% of food waste.
- 3- The food wasted by rich countries annually is equal to the food produced in Sub-Saharan Africa annually.
- 4- About 821 million people around the world are hungry.

Having identified these shocking facts, the UN has undertaken the elimination of world hunger by half as one of its goals for 2030. World hunger is not only due to shortage of food or food waste though; even in countries that do not suffer shortage of food, hungry people still exist. In many poor countries that neither suffer shortage of food nor famines, people spend more than 80% of their income on food that is mostly poor in nutrients; they are obliged to give up other necessities of life such as education and health. Moreover, when faced with financial hardship, they might give up some of their meals, eventually ending up in hunger.

There are several solutions proposed to eliminate world hunger; some are easy and some are difficult to carry out. Famous examples include:

- 1- **Ending land evisceration:** Some rich countries that do not own enough arable land tend to take advantage of the land that poor countries—including Ethiopia, Madagascar, and Sudan—do not have the means to farm.
- 2- **Supporting farmers in poor countries:** This is necessary because lack of technology and modern farming techniques lead to significant damage to agricultural crops. Research has shown that African farmers are less productive than American counterparts due to the previously-

mentioned factors. As such, it is important to support those farmers through workshops tackling modern farming and storage techniques, or support them financially to purchase the tools required to increase productivity and control agricultural pests.

3- **Raising awareness about food wasting:** It starts with parents teaching their children to eat moderate quantities of food and not waste it. The remaining food can be packed and given to the poor in the neighborhood, orphanages, or charity societies. On a larger scale, awareness campaigns targeting citizens can be organized, including advertisements that show the negative effects of food wasting on the local and international communities. Also, ideas regarding how to end food waste and deliver it to those in need can be proposed.

4- **Supporting women in poor countries:** Teaching women some handcrafts can help them increase their income and afford better food for themselves and their children. Women also should be supported to protect their children from malnutrition diseases, and shortage of foods rich with high nutritional values.

We should not wait for international organizations and governments to take action regarding hunger and food waste; we must start with ourselves, putting an end to wasting food at our own homes as a positive step towards the eradication of world hunger.

By: Fatma Asiel

Have you ever thought that the food waste you dispose of after each meal could be someone's most precious wish in a different side of the world? World hunger is not about insufficient food production. On the contrary, the world's annual food production of agricultural crops, livestock, and even processed foods, is sufficient to feed the entire world population. However, one-third of produced food is wasted.

Wasting food is in many forms; it is not just the food wasted while cooking or the residues disposed of after meals. It actually starts as early as harvest, especially in developing countries where large quantities of crops often rot due to lack of storage facilities. Also, these countries lack modern technological means and machinery that help protect agricultural crops before harvest, which makes them more vulnerable to pests.

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By: Naglaa Hassan

DIGGING HOPE

Many people, at the urban or rural level, in all the Continents around the world suffer from a serious problem, which is the lack of fresh and healthy drinking water. Clean water is essential for healthy living and good nutrition; our body cannot benefit from the food it receives if we drink contaminated water.

The demand for clean water increases with the steady population growth, in addition to the increased environmental pollution and the high consumption of water, all leading to extreme scarcity of clean water. The problem is aggravated during summertime, becoming a crisis. It has become essential to find ways to conserve water; not only to provide permanent sources of drinking water, but also to ensure that our children and grandchildren will have a source of water essential for life.

Luckily, many Non-Governmental Organizations (NGOs) seek to solve this problem through a number of methods, such as raising public awareness of water conservation, setting limits for personal use, and thinking of many quick-impact sources, such as digging lakes or wells.

Many children and women in remote areas and villages in Africa and other places have to travel long distances daily to get clean drinking water; therefore, the idea of digging wells and operating them manually has been a successful and immediate solution to this crisis. This solution has many advantages, such as providing clean drinking water to remote and rural areas that have no other sources of water such as rivers, in addition to saving time and energy, as families do not have to walk for long distances. Wells are considered an easy-to-use means; they are dug at points where groundwater is identified and a pump is installed. Wells are also low cost compared to other water resources. They serve a large number of people; a single pump-operated well provides water for about 300–400 persons. Wells also help develop the agricultural life in nearby vegetable and fruits farms.

Underground water accumulates and slowly flows through permeable rocks called cavity. The cavity can be a layer of gravel, sand, or rocks with pores that are capable of retaining moisture. The relation between these pores, their sizes, and their number determines the probability of the water release to the surface; so, it is important to take a number of technical steps and precautionary

measures to ensure that the groundwater is extracted according to the health system and does not cause contamination.

Unfortunately, wells are often built using donations or through NGOs without following health services or paying attention to the local population's opinion. The NGOs only pay the cost of digging the wells, ignoring the necessary measures to keep the wells working for a specific period of time. It makes no sense for an organization to dig the land and install a pump without taking into consideration whether the people will be able to maintain the well and keep it working for 10–20 years. Wells become useless if they are not maintained or repaired when they are damaged.

Moreover, during emergencies after seasons of floods or droughts, when water supplies run out, people resort to digging wells to make up the shortage of water quickly. As a result, it is difficult to maintain the rules of observation and ensure the health system. For example, arsenic is naturally found in the deep layers of Earth; this problem is one of the most severe drawbacks of groundwater, because wells using long pipes help push arsenic, which is a dangerous carcinogenic substance, to the surface.

Several factors, including culture, climate, and geological factors, interfere with the determination of the feasibility of digging a well. Hence, the cooperation between governments, NGOs, and local experts is essential to determine the correct technique for conserving groundwater and develop wells. One of the proposed solutions is to collect money regularly from well beneficiaries to maintain its efficiency and cleanliness, and to activate a system to license the wells before digging and operating them for drinking or agricultural purposes. On the other hand, the solution to dispose of the arsenic problem is to determine the maximum limit for digging wells, so as not to reach the depth at which the concentration of arsenic increases, in addition to treating the water from arsenic before use, or allocating those wells for washing and cleaning purposes only, and not for personal use.

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By: Sara Khattab



The Right Food for the Time



Ensuring healthy lives and promoting wellbeing for all at all ages is one of the sustainable development goals to be achieved by 2030. It is also expected to increase life expectancies and decrease the deaths of newborns and children under five years of age. Good health is essential for sustainability; in order to maintain good health and increase life expectancy, we have to start with the essential dietary plan.

It is important to take into account the extra demands of your body according to your age. Throughout your life, your body goes through many physical changes and is affected by many external factors, including decreased quality of life and poor health surroundings. Babies, children, teenagers, adults, older adults, pregnant and breastfeeding women all have different nutritional needs. It is necessary that all people of different ages know how to eat and what are the essential nutrients to be consumed according to their life stage.

What we eat during infancy affects our long-term health, immune system, metabolic programming, and overall aging. The first year of life is the peak time for growth and changes throughout the body. In order to sustain the baby's body size and rate of growth during the first twelve months of life, the baby's energy, vitamins, and minerals requirements can be three times greater than the requirements of a typical adult.

Calories are the measurement used to express the energy delivered by food. Most adults require 20–30 calories per kg, while infants who weigh 6 kg require almost 82 calories per kg. During the early years, energy needs remain high; children aged 1–3 years old require 83 calories per kg. Afterwards, energy requirements decrease and are based on weight, height, and physical activity.

The American Academy of Pediatrics (AAP), World Health Organization (WHO), and UNICEF all recommend that infants breastfeed exclusively for the first six months of their life. Even after introducing solid foods, breastfeeding should continue for the first year at least. Breast milk contains all the necessary nutrients in the proper portions that will help keep the baby healthy and aids the baby's growth. It also contains antibodies that help the baby fight off viruses and bacteria, so it lowers the risk of being sick. Researches proved that babies who are breastfed exclusively for the first six months, have fewer ear infections, respiratory illness, and bouts of diarrhea. It is also linked to improved cognitive development.

Ages 4–6 months old, you cannot introduce solid foods as infants are not ready for digestion in this age. For additional details about when is the best time to start feeding the baby, you can read my article *When to Feed Your Baby Solid Foods?* posted on SCiPlanet website. Once babies start eating, you have to be careful about what you are going to feed them until they are one year old. There are foods that should be avoided because they can pose a threat on their health. You can find more about these foods in my article *To Feed or Not to Feed!* also posted on SCiPlanet website.

Children food needs depend on their growth to match their growth patterns and their level of physical activity. Appropriate weight gain and development is not the only indication whether the food intake is appropriate or not. They should have a huge storage of nutrients enough for their rapid growth spurt experienced during adolescence. It is important that parents prepare balanced meals that contain all the essential nutrients for their growth and development during their life.

The meal should contain proteins, which help a child's body build cells, break down food into energy, fight infection, and carry oxygen. Carbohydrates are the body's most important source of energy; they help the body use fat and protein to build and repair tissue. They are in many forms, including sugars, starches, and fiber; however, kids should be eating less sugar. Fats are also a good source of energy for kids and are easily stored in a child's body; they are important in helping the body use the other nutrients needed by the body. The meal should contain calcium, which is essential for the growth of healthy bones and teeth; it is also necessary for blood clotting, and for nerve, muscle, and heart functions.

It is important that the meal contains foods with high levels of Vitamins A and C. Vitamin A is essential for children and adults as it helps growth, assists the eyes in adjusting to dim and bright lights, keeps skin healthy, and prevents infection.



The need for protein, vitamins, and minerals increases with age.

Vitamin C, on the other hand, holds the body's cells together, strengthens the walls of blood vessels and helps the body heal wounds. We must not forget water; infants and children need more water intake than adults, because children have larger body surface area per unit of body weight and a reduced capacity for sweating when compared to adults, which makes them at higher risk of suffering from dehydration.

The need for protein, vitamins, and minerals increases with age. Due to the accelerated growth period a teenager goes through, the body demands more calories, so it is necessary to increase the intake of certain nutrients. Boys require an average of 2800 calories per day, while girls require an average of 2200 calories per day. In this period, nutritionists recommend complex carbohydrates on simple carbohydrates; complex carbs provide sustained energy and should make up 50% to 60% of a teenager's calorie intake.

It is recommended that teenagers have fat in their meal, but not more than 30% of their meal. Fat supplies energy and assists the body in absorbing fat-soluble vitamins, such as, A, D, E, and K. However, too much fat could have negative effects on health; it can lead to increased weight, even with physical activity. Fatty foods also contain cholesterol, which can clog an artery and cause heart diseases. There are three types of fats; monounsaturated fats are the healthiest and found in olives, olive oil, peanuts, peanut butter, peanut oil, and cashews. The second type is polyunsaturated fats found in corn oil, sunflower oil, and sesame seed oil. Saturated fats are the third type and are the most cholesterol laden; they are found in meat, dairy products, coconut, and palm oils.

The dietary requirements of adults, 19–50 years of age, differ according to gender depending on body mass and according to activity levels. Males usually require more of vitamins C, K, B1, B2, B3, choline, magnesium, zinc, chromium, and manganese, while females require more iron. Pregnancy and breastfeeding are the most nutritionally demanding periods of an adult woman's life. As the nourishment of the baby is from the mother, it is important that she gets all the nutrients needed to maintain the baby's growth. It is important for pregnant women to consume high-folate foods, such as green leafy vegetables, fruits, and legumes, because folic acid is essential to reduce the risk of a baby born with spinal cord birth defects.



Pregnant women need almost 27 milligrams of iron per day to prevent iron-deficiency-related anemia; even after delivery, breastfeeding mothers will require about 10 milligrams per day. For strong bones and a healthy heart, muscle system, and nervous system, it is necessary for pregnant women to consume foods with calcium. If the mother does not meet the needed calcium requirements, the baby will absorb its calcium needs from the mother's bones. Pregnant and breastfeeding women need around 1000 milligrams of calcium per day. During this period, pregnant and breastfeeding mothers might need an additional 300–500 calories per day to provide the extra energy the body needs. What breastfeeding mothers eat will reach their children through the milk so they have to be keen on eating balanced meals, to ensure that the baby receives all the needed nutrients for its growth.

Growing old does not mean that you will not eat right or stay fit. Older adults face a variety of changes in their body, including lean body mass, muscle loss, thinner skin, less stomach acid, metabolic rate, and less physical activity, which affect their nutritional requirements. As you age, your energy requirements decrease than when you were younger, as you tend to move and exercise. So, if you continue to eat the same amount of calories as you did when you were younger, you could easily gain extra fat. Elderly people should aim to be active, at least to have a 30-minute walk daily, in order to strengthen their muscles and maintain their health.

According to studies, 20% of elderly people have atrophic gastritis, which is a chronic inflammation that damages the cells that produce stomach acid. Low stomach acid can affect the absorption of nutrients, such as vitamin B12, calcium, iron, and magnesium. To compensate the lack of vitamin B12, elderly people should consume lean meat, some fish, and some seafood; they can also receive a vitamin B12 supplement, but after consulting a doctor. They have to consume three servings of calcium-rich foods daily to help maintain their bone health.

Eating more fiber-rich foods at this age can help lower the risk of heart disease and prevent Type 2 diabetes. Whole-grain breads, cereals, beans, peas, fruits, and vegetables provide fiber. Elderly people should increase their potassium intake through eating fruits, vegetables, and beans along with lowering sodium, cooking food with little or no salt, can lower the risk of high blood pressure.

To conclude, regardless of age, a balanced diet that includes all the essential nutrients for the body's age is recommended for everyone. The concern is inadequate intake of certain nutrients, whether the excess or lack of nutrients, which lead to detrimental health problems.



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TOWARDS

By: Esraa Ali

A SUSTAINABLE

WORLD



Sustainability is no longer a political/scientific endeavor but rather a crucial goal sought after by contemporary humanity. The actual meaning of “sustainability” may vary from one field to another; in other words, the end-product of one field may conflict with the other. For example, if sustainability for one field means protecting existing ecosystems, it means satisfying human needs first for the other. The ethical dimension of sustainability, thus, causes confusion for its achievement.

To cover that dilemma, a comparatively young field of research has emerged; namely “sustainability science”. It roots back to academic discussions and the United Nations reports in the 1980s and early 1990s within countries collaborating to achieve sustainable development. Later on, the field was officially introduced and further developed at the World Summit on Sustainable Development, held in Johannesburg in 2002, and received great political success.

Sustainability science, similar to sustainability itself, primarily addresses how humans should use the Planet; in other words, the human moral bond to the world. A field by definition advances understanding of natural and social systems, and how their interactions affect and form a challenge for achieving sustainability. It integrates knowledge from all areas, including social and human sciences. This field is defined, hence, by the problems it addresses rather than the disciplines it employs.

Upon bringing sustainability science to the table, several scientists found it difficult to measure and conceptualize sustainable development, and to make it a subject of scientific inquiry. However, dedicated publications and networks were established later on, and distinct sustainability science curricula were created at several research institutions, universities with Majors and Graduate degrees, and even schools devoted to training a new generation of sustainability scientists.

Being characterized by its solution-oriented approach, sustainability science as a field of inquiry leads the research agenda of addressing grand development challenges. As per the National Research Council report published in 1999, sustainability science shall meet the needs of present and future generations to sustain the Planet’s life support systems, while “substantially reducing hunger and poverty”.

In sustainability science, the discussion of “well-being” frequently emphasizes hunger eradication, poverty alleviation, improving access to clean water, amongst other topics carrying forth the original values of sustainable development. Likewise, sustainability science is recently providing special attention to sustainability problems, such as mitigating pressures on climate change, conserving ecosystem services, and protecting biodiversity. Hence, sustainability science approach is essential for effective decision-making for global sustainability.

Good development for people

Science and technology education plays an important role in sustainable development, and finding sustainable solutions requires new advances in science, discoveries, and innovations. However, enhancing scientific literacy is a main goal of school science curricula, and the main purpose of science and technology education is preparing students for scientific studies at the university only.

This fact needs to be examined in terms of its relativity to the society, and hence sustainable development. Ecologist William C. Clark proposes that sustainability science “serves the need for advancing both knowledge and action by creating a dynamic bridge between the two”. In other words, the goal of science and technology education should rather be acquainting young people with the tools to use scientific knowledge in their everyday lives and improving it.

As such, to embrace sustainable development within science education, it needs to involve a personal approach in the curricula that appeal to emotions towards local issues. The learning needs to become more meaningful and useful. It needs also to show a clear balance between “doing and action”, where education quality

should be measured by student abilities rather than by following the instructions.

Good development for the planet too

The Earth is our home, but we are not giving it much love and care as it deserves. Here comes our role towards such an amazing place; we need to do our part and act on reversing the damage we have done. It is no longer a matter of a problem to occur in coming years, but as science says: "It is right around the corner!"

Sustainable science education shall enhance and change people's behaviors towards Earth. Long-term, cross-scale, and multi-institutional sustainability science collaborations show that knowledge and action together can advance technical and policy solutions to confront grand challenges and promote sustainability now and in the future.

I encourage you, dear reader, to watch and listen to the song Earth by Lil Dicky released on 22 April 2019 in celebration of "Earth Day", on how to save the Earth.

Science has a commitment towards the society to fulfil; nevertheless, a vigorous connection between knowledge and action is needed. Today, sustainability science is at the forefront of global efforts to end sustainability problems; not only hunger, poverty, and inequality, but also climate change, biodiversity loss, and ecosystem degradation. We need to support this field and promote it more—in the Arab region too—to understand the interactions between people and their environment, towards achieving a sustainable world.

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COOKING: SMOKE: A Killer in the Kitchen

By: Dr. Ola Mohamed
 Lecturer, Faculty of Fine Arts, Alexandria University

According to reports released by the World Health Organization (WHO), about three-and-a-half million people, mostly women and children, die each year from respiratory diseases caused by harmful indoor air pollution by wood cooking stoves. Primitive wood cooking stoves are among the top five threats to public health, in addition to their environmental threat to poor developing countries. These stoves, in addition to inefficient wastes used by three billion people around the world, produce black carbon emissions that contribute significantly to climate change and have devastating health impacts.

Several studies are currently conducted in this field on traditional cooking and kerosene-based lighting, which emit smoke. These studies aim to reduce cases of acute pneumonia and other common respiratory diseases among people inhaling that smoke daily. Due to extreme poverty, millions of houses in developing countries need to be helped by building clean and efficient cooking ovens all over the world by 2020. Several researches and reports have recommended a wide range of initiatives to combat energy poverty, and to promote the development of clean energy. This could be achieved by delivering safe cooking technology and electricity to the areas lacking modern energy services; thereby, reducing carbon emissions in society. Combating poverty shall in turn save energy, especially when linked to increasing efficient energy use to provide energy services.

There is no doubt that it is hard to convince poor rural families to change their traditional cooking habits; adding to it the challenge of designing a cost-effective, harmless oven. The problem lies in the used fuel and lack of ventilation. Although modern integrated fan ovens produce far less smoke, they are very expensive. Nearly 50% of Africa's population live in extreme poverty, and many of them cannot afford electricity, kerosene, or cooking gas to prepare their food to survive. Although kerosene generates emissions of a range of alarming health harmful pollutants, in addition to the risk of burns and poisoning, alternatives are still better; such as biogas, liquefied petroleum gas, electricity, and natural gas. Thus, we must protect our health and the planet using clean ovens.

Inhalation of smoke emitted by these cooking stoves can cause a range of acute and chronic diseases, such as pneumonia, emphysema of lungs, lung cancer, bronchitis, cardiovascular diseases, and low birth weight. Approximately 1.9 million deaths each year are attributable to that, according to WHO statistics. Since women often shoulder culinary duties, and children are usually attached to their mothers, they are the main victims of smoke-related respiratory diseases, as small particles of dust penetrate deep into their lungs. Thus, a wide range of initiatives have been undertaken to combat energy poverty, and to promote clean energy development by raising awareness about the devastating health impact of household air pollution caused by cooking.

Inefficient cooking stoves also contribute to climate change due to greenhouse gas emissions, such as carbon dioxide, methane, carbon black, and fine particles. The international community needs to exert more effort to find practical and applicable solutions for clean cooking that allow people to lead a healthier lifestyle. Clean and efficient ovens should be provided because they significantly reduce fuel consumption and exposure to smoke emitted from harmful stoves. This shall avoid emitting high levels of toxic cooking smoke, which damages people's health across the developing world.

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WAR & DISEASE

By: Basma Fawzy

War does not come alone; it brings with it death and disease. While conflict accounts for many deaths, disease accounts for even more; in the American Civil War, two-thirds of the deceased were claimed by disease. This is why infectious diseases at the time were dubbed the “Third Army”; they were deadlier than the deadliest enemy. With disease, you are fighting the unknown; you can make a truce with the enemy, but disease is relentless. With every war, infectious diseases emerge; sometimes diseases that had long disappeared resurface.

diseases were, thus, controlled. However, during and after World War I, soldiers were mobilized, traveling long distances. The conditions during World War I were perfect for an outbreak; people were exposed to new forms of viruses to which they had no immunity. We have to also remember it was “pre-antibiotic”.

The Blue Death



The Spanish Lady



In 1918, World War I ended; yet, another battle continued. At the time, the Spanish Influenza or the Spanish Flu, sometimes called “The Spanish Lady”, was still claiming lives. It was so vicious that one-fifth of the world’s population was affected; it accounted

for the death of 50 million people worldwide, making it one of the deadliest epidemics in human history. The Spanish Flu killed more people than World War I did.

The Spanish Influenza was caused by an H1N1 virus of avian (related to birds) genes. The virus was thought to have originated in Spain; hence, its name. Recently, however, scientists state that the deadly virus did not originate in Spain. Some claim it originated in British Army camps; others argue that it appeared in US Army training camps. The War played a significant role in spreading the deadly virus.

The world before World War I was different from the world after; before the War, people did not travel for long distances. Many people would live all their lives in one area; to a great extent, infectious

The Blue Death, or Cholera, is an infectious disease caused by the bacterium *Vibrio cholerae*. Cholera is contracted by eating contaminated food or drinking contaminated water; it is present in areas with poor sanitation, such as war areas. A person infected with cholera suffers from watery diarrhea that leads to severe dehydration. As a result, the skin of the infected person turns blue; hence, the name.

Cholera can be easily prevented, specifically with proper sanitation; however, in chaotic times such as war, hygiene can be neglected. Yemen was hit hard by Cholera after the war started in 2015. War makes it impossible for people to gain access to

clean water; destruction of roads makes it impossible to get the needed medical assistance. With hordes of soldiers and civilians living in crowded areas, cholera spreads fast.

War on Vaccination



According to UNICEF, the implications of war on vaccines are severe; of those unvaccinated children, two-thirds live in areas torn by war. Unfortunately, children die of diseases that can be easily avoided through immunization.

The Resurgence of Polio in Syria



Polio, also known as infantile paralysis, is an infectious disease that is caused by the polio virus; it attacks the brain and spinal cord, eventually causing paralysis. Polio vaccine is used to protect the human race from the virus' deadly consequences. In spite of modern-day medical breakthroughs, the world is still not free of polio. According to World Health Organization, if only one child still suffers from polio, the whole world is still at risk.

For almost thirteen years, Syria was free of polio; however, in 2013, there was a polio outbreak. Before the conflict started, Syrian rates were among the highest in vaccination; with the ongoing war, they cannot keep that record. With a chaotic situation on the ground, it becomes difficult to keep vaccines in suitable temperatures so as not to be damaged, and it is also difficult to reach all the children. As a result, 35 children were left paralyzed due to contracting polio; the deadly virus has also spread to Iraq.

Measles and the Bosnian War

Measles is a life-threatening disease; it can lead to death or severe complications. Those with measles can develop swelling of the brain, which eventually causes hearing loss or intellectual disability. Measles can easily be controlled by vaccination, but because of war, this is not the case. Like Syria, Bosnia witnessed an increase in those affected with measles due to the same reason: lack of vaccinations due to war. The Bosnian War took place in the 1990s, but its effects resonate until today; Bosnia is currently the European country with the largest number of measles cases.

War and Medical Advancement

The relationship between war and disease is more complicated than that. War is an agent of disease and death; yet, the experience of World War II informs us that, while preparing for war, human beings can fight diseases in the process. During World War II, the United States of America realized that diseases can be fatal, more fatal than their worst enemy, and as much as they prepared for battle, they prepared also for diseases that the soldiers may contract.

The partnership between the United States military, industry, and academia proved important for many years after the War. They were interested in vaccines because it meant less sick days for the soldiers and because disease could bring more deaths than combat. Vaccinations were not a new invention or the result of this partnership; however, it meant that many researches and laboratory work could see the light. It led to many innovations that benefited many people, not just during wartime. During World War II, with the fearsome attack of the Spanish Lady during World War I vividly in mind, the first flu vaccine was developed.

This was not the first time in which war was significant in fighting disease. Today,

we speak lightly of tetanus as an injection that should be taken whenever someone is wounded. However, during World War I, soldiers suffered from tetanus, which is caused by bacteria that can inflict human beings through touching mud or rusty elements. The bacteria release toxins in the body that cause serious consequences, such as powerful muscle spasms, which can crash bones, and making people unable to breathe. During World War I, the soldiers were susceptible to contracting the deadly tetanus; while the vaccine to tetanus was introduced in 1924, the War helped set the stage—experimenting with the dosage by trial and error—for a cure to the fatal disease.

War and disease go hand in hand; in the battlefields, disease claims more lives than combat. War brings disease, but it can also be a reason for scientific discovery; not that this should be an incentive for war. Humanity has many battles to fight; let us not allow our differences distract us from fighting real enemies, such as disease. Collaboration and funding research to combat disease should not be done only in times of war, and not only for winning wars.

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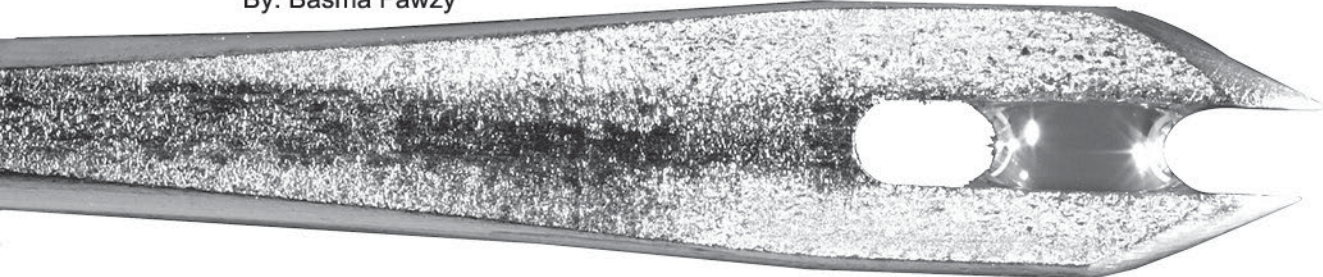


War does not come alone; it brings with it death and disease.

SMALLPOX

The Dead Deadly Disease

By: Basma Fawzy



Vaccinations have made our world a safer place; a place where fatal diseases can be fought and, hopefully, defeated. Nevertheless, it takes time and great efforts to eradicate deadly diseases, one at a time, not to mention the continual rise of new diseases. This article is not, however, about the battles we are yet to fight; it is about the battle we have actually won and the only disease completely eradicated: smallpox.

The beginning of smallpox is not definitely known. Some scholars speculate it may have been first spotted in Ancient Egypt, because some mummies were found to contain similar skin lesions attributed to smallpox, but nothing is certain. Some argue that smallpox is the disease responsible for killing many people during the Plague of Athens in 430 BCE, and during the Antonine Plague of 165 CE. Whatever its history, experts believe that over the centuries, smallpox claimed more lives than any other infectious disease, making it one of, if not the deadliest disease mankind has ever known.

The virus that causes smallpox is *Variola major*, its symptoms are similar to those of the flu: fever, fatigue, headache, backache, and rash with red sores. Those sores then harden and form a crust that eventually falls. Smallpox is deadly, but it can be cured; yet, those cured suffer massive scarring: missing lips, nose, or loss of eyesight. Smallpox is a contagious disease with an incubation period that ranges 7–17 days; during this period, no symptoms appear and the infected person

cannot transfer it to others. People can also contract the disease by coming in contact with contaminated items.

Smallpox was used as a biological weapon in war centuries ago. North American colonists are believed to have used smallpox against Native Americans by giving them blankets and linens infected with the disease. It is not certain whether Native Americans contracted the disease through the contaminated blankets or through other means because smallpox was by that time all around them.

We owe the discovery of the first smallpox vaccination and maybe the first vaccination ever to Edward Jenner in 1796 who noticed that those inoculated with the Cowpox virus were later protected from smallpox. He took material—lesions from infected skin—and used it to protect others to produce a similar effect; he called this material *Vacca*, which is Latin for cow, and the process itself was named vaccination. Jenner's discovery is one of the most significant medical discoveries; it did not just protect us from smallpox, but it opened the way for many vaccinations to come.

Nowadays, no one can contract smallpox; the disease has been totally eradicated with the last case diagnosed in 1977 in Somalia. During 1980, it was announced that our world was free from smallpox; since then, vaccinations against it were stopped. Ending smallpox was not an easy feat though. One of the things that made the eradication of smallpox possible is the fact that it only affected human beings. Hence, once all human beings were vaccinated, the virus no longer spread. Other viruses cannot be as easily fought, since they find other media in other creatures, such as the Dengue fever, which can be spread by infected mosquitoes. Moreover, the symptoms of smallpox are easy to identify, which helps in early detection; additionally, the eradication of smallpox involved collaboration at an international level.

Smallpox no longer threatens our world like it used to in the past; however, the virus still exists. Stockpiles of "live" viruses are in two laboratories for research purposes: one is at the Centers for Disease Control and Prevention (CDC) in the USA, and the other is in Russia. The World Health Organization (WHO) has recommended the destruction of the virus; however, due to interest in the *Variola* virus and ongoing research, destruction has been postponed by the Health Assembly.

The eradication of smallpox provides hope to humanity; with enough work and collaboration, many infectious diseases can be eradicated. Yet, we still have a long way to go.



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By: Mennat-Allah Kassem

The Long-Awaited **Virus-C** Cure

There has been many speculations about recently discovered medications to cure hepatitis-C patients. Thus, it is our duty to shed light on and investigate the effectiveness of these medications, as well as the global efforts exerted to vanquish the disease in the very near future.

Hepatitis C is a contagious disease that negatively affects the liver; it is caused by the hepatitis C virus, which results in acute and chronic inflammation of the liver. Hepatitis C is known to be transferred through blood; there are several means of infection, including reusing medical tools such as syringes, or not sterilizing them correctly, in addition to transfusion of infected blood.

Previously, Interferon was used together with Ribavirin for 48 weeks as a primary treatment for hepatitis C; they were known to be of low effectiveness and substantial side effects. Based on some studies conducted globally, the viral response to these medicines was 41%, indicated by the absence of the virus in the blood 24 weeks after the end of the treatment; another study conducted in Egypt indicated a viral response of 45–55%.

A leap in the treatment of hepatitis C occurred with the recent discovery of new medications known as Direct Acting Antivirals (DAAs), which are characterized with high effectiveness and slight side effects. They have proven effective in the treatment of genotype 4, where recovery rates increased and the viral response reached 90% using a group of medicines. These medicines are divided into two groups; their effectiveness varies according to the genotype and target.

In reality, there are many global efforts to eradicate virus C; here we shed light on efforts exerted in Egypt—where the greatest number of patients are—setting an example to be followed in the wake of launching a massive campaign to eliminate the disease.

Surveying the number of patients is one of the most important steps for the success of the campaign; according to statistics, 92.5% are infected with genotype 4, 3.6% are infected with genotype 1, 3.2% are infected with multiple genotypes, and less than 1% are infected with other genotypes. The spread of the disease dates back to the period between 1960 and 1980, when glass syringes were used with more than one person without sterilization during the wide-range campaigns to eradicate schistosomiasis.

There are six genotypes of the hepatitis C virus, numbered 1 to 6; there are also subtypes indicated by letters; for example, genotype 1A or 1B, etc. The majority of patients are infected with a single genotype, but sometimes a patient is infected with multiple genotypes at the same time; the method of treatment varies according to the genotype a patient is infected with.

That is why extensive efforts have been exerted in Egypt in recent years to eradicate virus C. When Sofosbuvir was proven to cure more than 90% in comparison to Interferon in the USA, the Egyptian Government negotiated successfully in 2014 with American drug companies to make the medicine available for a reasonable price in Egypt with a treatment duration of 12 weeks.

With the success of the negotiation, the Egyptian Government opened 56 treatment centers in 2016, aiming to reach 100 centers, in addition to establishing a database to record all the patients, who have reached 1.8 million, with follow ups after one, three, and six months, to monitor the recession of symptoms. The Government also acquired the license to produce the medicine locally. As a result, the price of the medicine went down to less than USD 100 for a three-month treatment course; moreover, public hospitals provide the medicine for free, and the efforts are continuing to eliminate the disease.

Furthermore, the Egyptian Ministry of Health cooperated with global entities, including the World Health Organization (WHO), to achieve a strategic plan revolving around seven points to get rid of virus C:

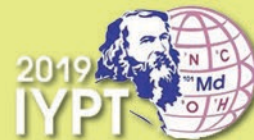
1. Reinforcing a monitoring system to follow the spread of hepatitis C and how it spreads, as well as measuring the effectiveness of prevention programs.
2. Executing prevention programs to end the spread of virus C using different means, such as safe injection, and evaluation programs to ensure the quality of implementing these practices.
3. Improving transfusion services to reduce the spread of the disease by testing the donor's blood and ensuring the proper use of blood products.
4. Preventing other types of the disease, such as hepatitis A and hepatitis B, using the appropriate vaccination and vaccinating newborns and people who are vulnerable to infection by virus B.
5. Raising the communities awareness of the means by which virus C spreads and how to avoid them.
6. Making full care and appropriate treatment available to reduce the spread of the disease.
7. Prioritizing scientific research into the disease and converting these into practices.

It is necessary to follow these guidelines, in addition to medical treatment, to reap the fruit of the Egyptian Government's efforts to vanquish virus C in the very near future.

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Silver is also applied to artificial bones and scaffolding used to keep bones in place while they mend.

By: Shahenda Ayman

The PERIODIC TABLE & MEDICINE

The Periodic Table of Elements is one of the most significant achievements in the history of science; it is not only about the essence of chemistry, but also of physics, medicine, earth sciences, and biology. After shedding light on its origin in our *SCIplanet* first issue this year, then unraveling some of the women's contribution to discovering its elements in our second issue, in this issue we explore the importance of its elements in the field of medicine. The *Ebers Papyrus* is the first written account of using metals for treatment; it describes the use of some elements to cure diseases since 1500 BCE. Recently, metals have been used in treating many diseases, including cancer.

Since 1978, platinum-based drugs have been used to treat all kinds of cancer, whether on its own or with the assistance of other drugs. As chemistry and biology are intertwined when it comes to treating diseases, we need to understand an important chemical structure in the human body to know how platinum-based drugs do their work: DNA. It is a double helix connected together through the interactions between its building blocks known as the nucleotides. Within these nucleotides, there are motifs that are rich in nitrogen atoms; scientists call these motifs

"bases", and through these bases platinum drugs do their job.

Benefiting from its place in the Periodic Table, platinum can interact with other atoms and molecules in various ways; for stability reasons it drops some chemical bonds in order to make others. When a platinum-based drug enters the human body, chlorine is displaced by water, and the water is then displaced by one of those nitrogen-rich bases from the DNA. The drug thus attaches itself to the DNA, cross-linking two strands of DNA together. The cell starts a repair mechanisms to "unstick" the

drug and accumulate enough of this kind of arrangement; the cells' repair mechanisms then get overwhelmed and the body initiates a process that kills those damaged cells for good.

Gold, the "King of Metals", is the first metal ever known to man; it has been used in medical drug making and in treating various diseases since Ancient Times. About 10% of the world's total consumption of gold reserves are used in dentistry. Scientists have discovered gold dentures even in the mouth of the Egyptian mummy of the pharaoh Chephren, buried sometime between the Third and Second millennia BCE. Currently, tooth supporting structures used in restorative dentistry practice are made of gold alloys along with other metals, such as platinum, silver, copper, nickel.

Gold has extensive healing properties; it can destroy bacteria, strengthen the body, and improve immunity, as well as positively influence the work of the heart and internal organs. In 1929, French scientist Jacques Forestier was the first to use injections of gold sodium aurothiomalate as treatment

for patients with rheumatoid arthritis. Medical products with gold nanoparticles are currently widely used in the treatment of chronic arthritis.

Gold compounds are used in drugs to treat malignant tumors, pulmonary tuberculosis, skin diseases, and autoimmune diseases. Medical drugs that contain gold nanoparticles are also used to combat the *Helicobacter pylori* bacteria, which causes stomach ulcers. Nowadays, immunosuppressant drugs that contain gold nanoparticles are prescribed for patients with chronic infections or oncological diseases.

Recently, potent anticancer drugs were discovered by researchers at a US biotech company, the drug can be safely targeted directly at the tumor using gold nanoparticles. As a result of the gold's biocompatibility, the nanoparticles can be injected intravenously, and will naturally accumulate in the specific area of leaking vascularity, such as tumors. Another US company is developing a therapy using tiny particles of gold wrapped around silica (gold nanoshells). These nanoshells are injected into the body then they accumulate in the cancerous tumor; then, the area is illuminated with a laser and the gold nanoshells convert the light to heat destroying the tumor.

One of the most widely used and studied medications for treating bipolar disorder is **Lithium**. It reduces the severity and frequency of mania, relieves or prevents bipolar

depression, and prevents future manic and depressive episodes. Doctors assume that lithium strengthens the nerve cell connections in brain regions that are involved in regulating mood, thinking, and behavior, as it acts on a person's central nervous system. The dose of lithium varies among individuals and according to their illness phases. Although bipolar disorder is often treated with more than one drug, some people can control their condition with lithium alone.

Zinc plays critical roles in collagen synthesis, immune function, and inflammatory response; in hospitals, it is commonly used as a treatment for burns, certain ulcers, and other skin injuries. The human skin holds about 5% of the body's zinc content; as a result, any zinc deficiency slows the wound healing process. A 12-week study showed that 60 people with diabetic foot ulcers who were treated with 200 mg of zinc per day experienced significant reductions in ulcer size compared to a placebo group.

About 9.4% of the global population have skin acne; people with acne have lower levels of zinc. Studies suggest that both topical and oral zinc treatments can effectively treat acne by reducing inflammation, inhibiting the growth of *P. acnes* bacteria, and suppressing oily gland activity. Zinc also decreases oxidative stress and reduces levels of certain inflammatory proteins in the body.

Previously, people used **Silver** in many purposes without fully understanding how it works. For example, it was used to prevent the growth of dangerous germs as an antibiotic; silver coins were put into water and wine casks to keep the liquids

fresh on long ocean voyages; physicians put several drops of silver nitrate into newborns' eyes to prevent infection; and battlefields wounds were wrapped in silver foil and silver sutures to close deep wounds during World War I.

Silver works as a biocide; silver ions penetrate the cell walls of bacteria without injuring mammalian cells, thus, destroying the chemical and structural bonds essential for the bacteria's survival and growth. Silver has proved to be effective against bacteria that became resistant as a result of chemical antibiotics overuse. For example, Methicillin-Resistant *Staphylococcus Aureus* (MRSA), a life-threatening staph germ often found in healthcare facilities, is resistant to almost all chemical antibiotics. As a result, many facilities are employing silver-embedded equipment—including: surgical tools, needles, stethoscopes, furniture, door handles, furniture, linens, and even paper files—in order to fight it back.

Recently, breathing tubes and catheters are coated with silver to help fight infections. Silver is also applied to artificial bones and scaffolding used to keep bones in place while they mend; bandages and ointments also contain silver to keep bacteria at bay, allowing the body to heal faster.

The Periodic Table is the map that helps us better understand the chemical elements found in nature, their relationship with one another, and how they react with each other. The combination of elements creates products, materials, and technologies that shape our lives and cure our diseases.

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DO OUR BODIES CONTAIN PLASTIC?

By: Doaa Hosny

This question might sound weird; how would our bodies contain plastic while we definitely do not consume it? After all, we only use plastics in the form of food containers, shopping bags, etc.; right? Unfortunately, the ugly truth is that our bodies do in fact contain plastic! Research has found that our bodies contain fine particles of plastic known as "microplastics". These are extremely fine plastic particles, some of which cannot be seen by the naked eye. They are produced indirectly from decaying plastic containers, bags, and other plastic products. They can also be produced directly, as they are among the ingredients of some cleaning and makeup products. Microplastics are also harmful for the environment, where the particles can be as big as 5 millimeters.

How do microplastics find their way into our bodies? As a matter of fact, they do that in different ways. For example, when we use plastic food containers and cutlery—especially ones of poor quality—fine plastic particles decay and mingle with the foods and drinks. This occurs particularly during heating, or when serving hot foods in these containers; as a result, microplastics enter our bodies along with the food we eat. Moreover, our bodies absorb small quantities of microplastics found in makeup and cleaning products; such as toothpaste and skin exfoliation products. Last but not least, rivers and oceans are sadly brimming with large quantities of plastic wastes, which are often consumed by fish and birds by mistake. When we consume these creatures, microplastics find their way into our bodies.

As plastic is a synthetic material that requires millions of years to decay, it has a devastating effect on the environment. Buried plastic wastes make it difficult for plants to absorb nutrients and water from the ground, which has a negative effect on their growth, and consequently, on the environmental balance. Studies have also found that plastic wastes negatively affect the digestive system of marine creatures, sometimes blocking it entirely, leading to death. Naturally, all of this has its toll on humans.

Until now, there are no decisive findings regarding the direct effect of microplastic on human health. Well, it is quite difficult to convince people to let plastics into their bodies voluntarily to study the effects for research purposes! However, preliminary results of some recent studies suggest that microplastics accumulation in the human body can lead to serious damages, including toxicity and some types of cancer. They also suggest that such accumulations could damage the reproduction and nervous systems, specially in fetuses.

Finally, how do we stop microplastics from getting into our bodies? This requires cooperation between individuals and associations concerned with the environment to find fundamental solutions to the problem of plastic wastes in general. It is also essential to raise awareness about the importance of reducing, reusing, and recycling plastic in order to minimize waste. On the personal level, it is important to choose plastic-free products and synthetic-fabrics-free clothes. It is also important to use healthy plastic food containers that do not interact with heat, so that the particles do not mingle with food.

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The Planetarium Science Center SUMMER PROGRAM



By: Rania Farouk
Marketing Specialist,
BA Planetarium Science Center

2019

Every summer, the Planetarium Science Center (PSC) prepares and presents its summer program for students 4–20 years old. The professionals in charge of the program prepare and provide a selection of new and different science programs for each age group; here we present some of them.

The PSC is keen on presenting science activities to children starting from kindergarten age (four years and above). The aim is to attract children to science at an early age, by presenting science in an interesting, practical, and interactive manner. In the “Apollo’s Little Mission” program, Apollo starts a mission to explore his new home on the Moon. How will he go there? What will he find in his journey? What will he do in the spacecraft? How will he play without gravity? Together, we will answer these questions in the program.

In the “Science Beats” program for children aged 6–9 years, participants enjoy a fun and varied journey by performing interactive science activities under a number of scientific concepts; such as from light to optics, from water to clean energy, amongst others. In the “Build Your Career” program, children are introduced to some jobs; such as bank officer, tour guide, civil engineer, amongst other professions. The aim of the program is to help them choose a future that suits their dreams and preferences. As for participants aged 12–16 years, a program was developed about the invisible world; the microscopic world: the secrets of legal medicine, the

world of optics, and the role of chemistry in our lives. The program is entitled “Science Bank”, in which they are introduced to some incredible science facts and gain interesting information about these topics.

Moreover, several robotics programs are designed to suit different age groups, 4–16 years old. The participants learn how to build a robot model and the basics of design; then, they create a code to program the designed model to perform a certain task using several programming tools, such as WeDo, EV3, Arduino. Due to these programs, students are trained to participate later in local and international robotics competitions.

In addition to these programs, there are specialized programs for students aged 12–16 years, in various scientific fields, such as the “Astronomy Club” and the “Architecture and the Children” programs. We have also developed a specialized program for university students, in which they are introduced to modern strategies for future science teachers to develop their life and work skills; the program is based on learning 21st-century advanced skills. Furthermore, in the “New Generation of Educators” program, a live training on

education is offered using interactive activities that teach participants how to successfully lead future students.

By the end of the Summer Program, the PSC holds a ceremony inviting all the Summer Program’s participants and their parents. The ceremony features a movie summarizing the activities, in addition to a science show; the best students are also acknowledged. This year, there is also the “Scientists Got Talent” competition, in which talented students will present their scientific talents on stage.

The PSC always considers what could be presented in the coming years of up-to-date, useful, and entertaining programs in its Summer Program, to impact the participants by presenting science in a simplified, modern, and interactive manner.



This year, there is also the “Scientists Got Talent” competition, in which talented students will present their scientific talents on stage.

PLANETARIUM SCIENCE CENTER

"Science for All"

History of Science Museum

Opening Hours

Sunday–Thursday: 9:30–16:00

Guided Tours Schedule

Sunday–Thursday:

10:30, 11:30, 12:30, 13:30, 14:30, 15:30

Fees: EGP 2.- for non-audience of the Planetarium

ALEXploratorium

Discovery Zone

Opening Hours

Sunday, Monday, Wednesday, Thursday:

9:30–16:00

Tuesday: 9:30–12:30

Saturday: 12:00–16:00

Guided Tours Schedule

Sunday, Monday, Wednesday, Thursday:

10:00, 11:00, 12:00, 13:00, 14:00, 15:00

Tuesday: 10:00, 11:00

Friday: 14:00, 15:00

Saturday: 12:00, 13:00, 14:00, 15:00

Fees: EGP 10.- (EGP 5.- for students)

Listen and Discover

Fees:

DVD shows: EGP 4.- (EGP 2.- for students)

3D shows: EGP 20.- (EGP 10.- for students)

12D shows: EGP 20.-

Available Planetarium Shows

The Great Barrier Reef; 42 min.

The Secrets of Gravity; 45 min.

Two Small Pieces of Glass; 22 min.

The Future by Airbus; 27 min.

Enlightened Mind; 19 min.

The Mission; 24 min.

Kaluoka'hina:

The Enchanted Reef; 33 min.

Stars of the Pharaohs; 35 min.

Seven Wonders; 30 min.

Oasis in Space; 25 min.

For schedule and fees,
please visit the Planetarium
Science Center's website:

www.bibalex.org/psc

The Bibliotheca Alexandrina Planetarium Science Center (PSC) invites its visitors to spend a day of fun learning, where they can enjoy amazing scientific shows that cover a diverse variety of scientific fields and are suitable for a wide range of groups at the Planetarium Theater.

Visitors can also enjoy tours of the History of Science Museum, which highlights scientific discoveries throughout three eras: Pharaonic Egypt, Hellenistic Alexandria, and the Golden Age of Islam.

Moreover, visitors can enjoy a collection of interactive exhibits that targets children and adults, workshops, DVD and 3D shows at the ALEXploratorium as well as shows at the 12D Theater.



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BAPSC



What Should We Eat?



Mohamed Khamis

Check the article on page 12, and match each character to the recommended food choices.
Illustrated by: Mohamed Khamis