BIBLIOTHECA ALEXANDRINA
PLANETARIUM SCIENCE CENTER

WINTER 2019
Year 12, Issue 1

SCI planet

EYE ON SCIENCE

SUSTAINABLE DEVELOPMENT GOALS

By: Maissa Azab

GLOBAL GOALS

With the advent of the millennium, and building on years of global movement, world leaders came together to adopt the United Nations Millennium Declaration in September 2000. The Declaration committed nations to a global partnership to combat disease, hunger, poverty, illiteracy, discrimination against women, and environmental degradation. Derived from this Declaration, eight time-bound targets were set with the year 2015 as deadline; they came to be known as the Millennium Development Goals (MDGs).

The final MDGs report realized that the 15-year effort had produced the most successful anti-poverty movement in history. Between 1990 and 2015, the number of people living in extreme poverty declined by more than half, and the proportion of undernourished people in developing regions had fallen by almost half. The primary school enrolment rate in developing regions reached 91% and many more girls were going to school. Remarkable gains had also been made in the fight against HIV/AIDS, malaria, and tuberculosis; under-five mortality rate declined by more than half, while maternal mortality dropped 45% worldwide. The target of halving the proportion of people who lack access to improved sources of water was also met.

The rigorous efforts of governments, communities, civil societies, and the private sector helped expand hope and opportunity for people around the world. Yet, the job is far from over; there is still much more to do to end hunger, achieve full gender equality, improve health services, and get every child into school. The world still needed to shift to a sustainable path; hence, the global Sustainable Development Goals (SDGs), or Global Goals, were put in place to guide policy and funding for another 15 years, beginning with a historic pledge on 25 September 2015.

The SDGs are a commitment to complete what was started and tackle pressing challenges facing our world today; all 17 Goals interconnect, meaning success in one affects success for others. The SDGs are unique in that they cover issues that affect us all; they reaffirm our international commitment to end poverty. They are ambitious in ensuring no one is left behind; more importantly, they involve us all to build a more sustainable, safer, more prosperous planet for all humanity. In short, this is the greatest opportunity we have to improve life for future generations.

This year, SCIplanet Editorial Team will be discussing the SDGs in an attempt to help raise awareness and encourage readers to get engaged. We also acknowledge that 2019 is the International Year of the Periodic Table; one of the most significant scientific achievements of all time. We wish you all a Happy New and Sustainable Year, rich with awareness and proactivity.

Reference

undp.org

IN THIS ISSUE...

BIBLIOTHECA ALEXANDRINA
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Planetarium Science Center
مركز القبة السماوية التعليمي

WINTER 2019
Year 12, Issue 1

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2019 IYPT

THE LANGUAGE OF SCIENCE

By: Maissa Azab

When I first joined the Planetarium Science Center at the Bibliotheca Alexandrina (BA) fifteen years ago, my first job was Conference Coordinator and one of my first conferences was Einstein 2005. It was a huge, high-end conference dedicated to the global, year-long celebration of the International Year of Physics (IYP 2005) as declared by the United Nations (UN). The year marked the centennial of Albert Einstein's "miraculous year", 1905, during which he wrote three of his most famous scientific papers.

The IYP 2005 was the first of several UN-declared International Years we have thus far celebrated here at the BA through a multitude of activities aiming to spread science awareness and knowledge, and fostering a science-literate society. For example, we observed the International Year of Astronomy (IYA 2009) by launching an astronomy amateurs club, and commemorated the International Year of Biodiversity (IYB 2010) by creating an original biodiversity exhibition, just to name a couple of such specific activities.

SCIplanet Editorial Team also partook in said celebrations; not just IYA 2009 and IYB 2010, but we also dedicated special issues to the International Year of Chemistry (IYC 2011) and the International Year of Light (IYL 2015). In continuation of this significant tradition and commitment, this year, we celebrate the International Year of the Periodic Table (IYPT 2019) in parallel with our overarching annual theme, the Sustainable Development Goals (SDGs).

Dubbed "A Common Language for Science" by the UN, the Periodic Table of Chemical Elements is one of the most significant achievements in science, capturing the essence, not only of chemistry, but also of physics and biology. These three disciplines form the cornerstones of science; they are intertwined with all other fields of science. Chemistry in particular promotes sustainable development and provides solutions to global challenges in energy, education, agriculture, and health, among others, which makes it a significant player in the fulfillment of the SDGs.

The year 2019 was selected for the occasion because it marks the 150th Anniversary of the Periodic System's discovery by Dmitri Mendeleev in 1869. Before Mendeleev, chemists had long been looking for ways to arrange the elements to reflect similarities between properties. The Modern Periodic Table lists the elements in order of increasing atomic number—the number of protons in the nucleus of an atom; historically, however, relative atomic masses were used by scientists trying to organize the elements.

The year 2019 was selected for the occasion because it marks the 150th Anniversary of the Periodic System's discovery by Dmitri Mendeleev in 1869.

This was because the idea of smaller sub-atomic particles—protons, neutrons, and electrons—composing the atom had not been developed yet. Nevertheless, the basis of the Modern Periodic Table was well established and even used to predict the properties of undiscovered elements long before the concept of the atomic number was developed.

Several chemists prior to Mendeleev investigated patterns in the properties of elements known at the time. The earliest attempt to classify the elements was in 1789, when Antoine Lavoisier grouped the elements based on their properties into gases, non-metals, metals, and earths. In 1829, Johann Döbereiner recognized triads of elements with chemically similar properties —ex.: lithium, sodium, and potassium— and showed that the properties of the middle element could be predicted from the properties of the other two.

It was not until a more accurate list of the atomic mass of the elements became available in 1860, that real progress was made towards the discovery of the Modern Periodic Table. In 1862, French geologist, Alexandre-Emile Béguyer de Chancourtois, listed the elements on paper tape and wound it, spiral like, around a cylinder. "Threes" of elements with similar properties came together down the cylinder; he named his model the "telluric screw".

In 1864, British chemist, John Newlands, noticed that, if the elements were arranged in order of atomic weight, there was a periodic similarity every eight elements; thus, he proposed his "law of octaves". In 1869, Lothar Meyer compiled a periodic table of 56 elements based on a regular repeating pattern of physical properties, such as molar volume; once again, the elements were arranged in order of increasing atomic weights.

Mendeleev's periodic table was also based on atomic weights, but arranged "periodically"; elements with similar properties appeared under each other and gaps were left for yet to be discovered elements. The development of the Periodic Table of Elements is one of the most significant achievements in science and a uniting scientific concept. It is a unique tool that enables scientists to predict the appearance and properties of matter on Earth and in the Universe; chemical elements being crucial to enhance the value and performance of products necessary for mankind and our planet.

So, let the celebrations begin!

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By: Maissa Azab

MIND CHANGE to combat CLIMATE CHANGE

Having worked in science communication for more than a decade, I can attest that no issue has been more pressing or dominant for our field than climate change. Indeed, it is connected to all the critical issues endangering our world today despite the intentional or actual ignorance of many people. According to the United Nations Intergovernmental Panel on Climate Change, the changing climate will have widespread effects on human life and ecosystems; it brings heat waves, flooding, droughts, intense tropical cyclones, rising sea levels, and damages biodiversity.

The scientific community has made the urgent need to mitigate climate change clear; with the ratification of the Paris Agreement, the international community has formally accepted ambitious goals. However, a wide gap remains between the aspirational emissions reduction goals of the Paris Agreement and the real-world pledges and actions of nations that are party to it. Closing the gap can only be achieved if a similarly wide gap between scientific and societal understanding of climate change is also closed.

Perilous Politics

Unfortunately, nowadays we are facing an old/new dangerous problem: reluctant politicians. Many politicians rely on a strategy of fear-mongering that aims to keep citizens blindfolded by the perils of a failing economy. This type of politicians is more focused on maintaining businesses running at any cost for current-day gains, even if it means dramatic consequences and a future of lifelong loss.

As a matter of fact, these politicians do not believe—or do not admit to believing—such consequences and fatal losses are coming. To accomplish their short-term, fortune-gaining goals, they simply imply that there is not sufficient evidence of a direct correlation between human activity and the undeniable and worldwide changes in all things natural.

In reality, no one can prove a direct relationship between a 3–7 degree warming to the coastal waters in the Gulf of Mexico to floods in Houston, the Caribbean, and the Florida coast. Yet, no climate scientist can deny that these temperatures had a contributory effect on the storms; they suggest that 30% of the rainfall in Hurricane Harvey was due to human contribution to climate change.

Indeed, burning fossil fuels leads to excessive carbon dioxide emissions and greenhouse gases, which in turn leads to the melting of glaciers and the rise of ocean waters. With warmer waters, hurricanes gather tremendous force, as the air holds more water vapor, leading to greater rainfall. In effect, human factors likely transformed Harvey and Irma from tropical depressions into major hurricanes.

Identifying a cause-effect relationship is not simple; it took decades for governments, the general public, and cigarette manufacturers to accept that smoking leads to cancer and heart disease. Once a rare disease, lung cancer now kills 1.5 million people annually; cigarette smoking killed over 100 million people in the 20th century, which is more than people killed in all wars combined.

In 1954, 60% of the American public were undecided or did not think that cigarette smoking caused lung cancer; nearly half of the doctors smoked. Likewise, throughout the past decade, polls show that almost half the population does not believe that the effects of global warming are occurring, that global warming is not caused by human activity, and/or that global warming is not a serious problem.

The deaths and suffering from climate change will not be as personal, agonizing, or sudden as that from cigarette smoking; likewise, prevention will not be the same.

Across the world, the more people feel they know about climate change, the more likely they are to take action now, and the more willing they are to do even more in the future.

If we do not take action, estimates show that 200 million people will be displaced by the year 2050 due to climate change and it is not individual effort, but a collective global action, that is needed.

Satellite photographs show that Antarctic glaciers have receded with a 2.5°C rise in temperature over the past half century; oceans have risen by 5 cm over the past century. A recent study by British scientists showed through computer simulation that the number of hurricanes and floods would have been half of what they are now if excessive pollutants gases were not present due to human activity.

The fact is: politics is leading us away from science and into ignorance. Just as there are no two sides to the argument of smoking, there are no two sides to the climate change argument. Smoking is to a person what fossil fuels are to our planet; denying the science is not foolish, but fatal.

Positive Prospects

The following is certainly not promotional, but one must acknowledge admirable actions wherever they come from. I have been very positively surprised to read none other than IKEA's Climate Action Research Report (2018) entitled *Climate Action Starts at Home*. It is heartwarming to see such a mogul of a global brand going through extensive measures to understand, inspire, and enable millions of their customers to take action on climate change. To do that, IKEA turned to over 14,000 customers in 14 countries to ask for help.

The report found that the actions that people take in their daily lives to help address climate change vary between individuals, families, communities, and countries. Recycling and energy saving in the home are the top actions reported by people taking part in the survey. Areas that see less action include advocacy, self-sufficiency, diet, and buying pre-loved, second-hand, products.

For me, the most significant result of the IKEA survey is that, while climate change is widely acknowledged by citizens, it remains a distant, complex issue. Most people recognize the problem and many are concerned about it, but they cannot connect with how it will affect them personally and what they, as individuals, can do about it. They also feel they have limited knowledge and understanding of the science of climate change, highlighting the need for clear, accessible education to inform and empower.

Across the world, the more people feel they know about climate change, the more likely they are to take action now, and the more willing they are to do even more in the future. People's willingness to change behavior in principle highlights a significant opportunity to shift many people towards more climate-friendly daily lives. Unlocking this desire and translating it into action is key for policymakers and sustainable businesses keen to create change.

Paving Pathways

Addressing climate change will require action at all levels of society; it cannot be addressed by a few individuals with privileged access to information. It requires transfer of knowledge, both intellectually and affectively, to decision-makers and citizens at all levels. In the case of climate change, education is crucial because learning from experience is learning too late.

The delay between decisions that cause climate change and their full societal impact can range from decades to millennia; learning from education, rather than experience, is necessary to avoid those impacts. Climate change and sustainability represent complex, dynamic systems that demand a systems thinking approach. It takes a holistic, long-term perspective that focuses on relationships between interacting parts, and how those relationships generate behavior over time.

Education plays a central role in several processes that can accelerate social change and climate change mitigation. Effective climate change education increases the number of informed and engaged citizens, building social will or pressure to shape policy, and building a workforce for a low-carbon economy. Indeed, several climate change education efforts to-date have delivered gains in climate and energy knowledge, affect, and/or motivation.

"Climate literacy", as UNESCO calls it, among young people, is a crucial step towards better education of upcoming generations; an essential element to foster the necessary global response to climate change. It encourages changes in attitudes and behavior, and helps adapt to climate change-related trends. Education provides children and young people the knowledge and skills to make informed decisions about how to adapt individual lives and ecological, social, or economic systems in a changing environment.

It is vital that countries develop strategies to build resilience against climate change, and education is of the essence. It is not only about alleviating the effects of climate change, but also addressing, through educational resources, adaptation measures that are country-specific. Due to the non-discriminatory and wide-ranging impacts of climate change, formal and non-formal education is essential to educate citizens of all ages. For the youngest and future generations who will be most impacted by climate change, positive influences during the stages of an individual's early life can contribute to a society that is equipped with the understanding, values, knowledge, and skills to tackle the causes and impact of climate change.

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By: Basma Fawzy

PLASTIC WASTE:

The Monster that Threatens Us

Convenience comes at a great cost. Since human beings started using plastic, life has become so much easier; the inconvenience of having to wash dishes, bottles, etc., has almost disappeared. A culture of use and throw-away has emerged; as the population increases, plastic usage also increases. As a result, plastic has accumulated and flooded our world, unleashing a monster that is suffocating Earth.

Before plunging into discussing plastic waste, let us take a look at how plastics have invaded our world. The word "plastic" means flexible items that can take any shape or form; nowadays, it is used to identify items made of polymers. Cellulose, found in plants, is a natural polymer; human beings have come up with a way to make synthetic polymers. These are created using chains of atoms that are lengthy and of repeated patterns, which make plastic what it is: flexible and lightweight. Unlike natural polymers, synthetic polymers are made of petroleum and other fossil fuels.

The first fully synthetic polymer, created without any natural substances, was invented in 1907 by Leo Baekeland. It was preceded by the first synthetic polymer invented by John Wesley Hyatt using natural substances, such as camphor and cellulose, in 1869. Hyatt's purpose was to create a substitute for ivory, which was being used in the highly popular billiards game at the time and resulted in the slaughter of elephants. He had the best intentions at heart.

By creating plastic, humanity went out of the frying pan into the fire. Plastic became the new sensation; it has since made more and more items cheap and available that otherwise would not have been so due to the scarcity of natural resources. Plastic has spread, replacing "steel in cars, and paper and glass in packaging" as author Susan Freinkel describes.

So, why is plastic so problematic? The simple answer is that plastic does not biodegrade; unlike natural substances, it lasts for a long time because it is made of chemicals that the bacteria, which cause decay, do not recognize. In other words, nature does not make it, so nature does not take it back; this results in piles of plastic buried in land and oceans.

An area in the Pacific Ocean is known as the Great Pacific Garbage Patch, so how does plastic end up in that area? Plastic waste enters the ocean from the rivers; they travel long distances until they reach strong currents, the gyre of the Pacific Ocean, where plastic waste

gets stuck, accumulating and creating a patch of plastic that does not disappear. This patch has increased over the years, and estimates suggest that it is now three times the size of France; *the Washington Post* has published that, by 2050, plastic will outweigh fish in the ocean.

Plastic waste needs our full attention before it is too late; but, what can we do? Raising awareness is the number one priority; we cannot solve a problem unless we are aware of all its dimensions. Among other examples of awareness-raising initiatives, BBC has launched Plastics Watch – Plastics Action, to raise awareness and recommend solutions as to how to reduce using plastic by using more environment-friendly items.

So, what can we do? Let us explore together the little things we can do to save our planet from plastic. We can opt, whenever possible, for environment–friendly items that we can use repeatedly and dispose of safely at the end. For example, we can carry cloth bags instead of plastic bags when we go shopping. We can also replace regular toothbrushes with bamboo toothbrushes, and use reusable bottles instead of one-use plastic bottles. For clothes hangers, we can opt for steel instead of plastic. Bring your own silver re-usable cutlery instead of using plastic cutlery and planet Earth will thank you for it.

The items listed before are all known items; however, plastic can also be found in unlikely items. If we want to help the environment, we should also give up "gum". Yes, that seemingly innocent item is not environment-friendly because it is made of "synthetic rubber", also known as "plastic". Do not buy frozen foods and opt for fresh food items because frozen foods are packed in plastic. While saving the environment, you will also be saving yourself as you will be eating non-processed food.

The list can go on and on. Plastic is literally everywhere; you name it and you will find it, but this must stop. It is convenient, but it is unhealthy and until we find a proper way to dispose of plastic, we should limit our use of it; it is hard but it is doable. Not only should we opt for plastic alternatives "when available", but we must also pressure manufacturers to use, even develop when necessary, environment-friendly alternatives to one-use plastic items and packaging.

Nothing about using less plastic is difficult; it is breaking our habit of using and throwing away plastic that is difficult. With minimum changes, you can eliminate plastic or you can even minimize the use of plastic. There are tons of plastic toothbrushes out there in the ocean, and tons more of plastic bags and bottles that need our immediate attention, and until we know a way to dispose of them safely, we have to minimize our usage.

Inside the oceans is where the problem of plastic waste is more noticeable. BBC published an online article about a sperm whale that was found dead with 6 kg of plastic waste—including drinking cups, plastic bags, and flip flops—inside its stomach. Not only whales, but all marine life is suffocating, because the oceans are filled with plastic. Sea turtles mistake transparent plastic bags for jelly fish and eat them because jelly fish is what they normally eat.

Aside from the effect of plastic on marine life, when we eat fish, we eat plastic as well, because plastic micro-particles have been found in the flesh of the fish we eat. Moreover, plastic fibers have found their way into tap water. This means that, if you are drinking water from the tap, you are probably drinking plastic with it. Scientists are not sure how plastic fibers got there, but what is obvious is that as long as plastic affects other creatures, then definitely it would affect us as well. We are not immune to the plastic plague. We are part of the environment; "what goes around comes around" is a saying that has proven itself correct when it comes to plastic waste.

So, will plastic just stay there in the ocean forever? We certainly hope not. A tiny ray of hope emerged when a group of scientists "accidently" created an enzyme that breaks plastic into smaller chunks. This might help, but it will probably take a long time before these enzymes are efficiently applied to the plastic recycling process.

Plastic has made our lives easy, but gradually all this will change as plastic accumulates in the ocean and on land. We have a long way to go, but with enough awareness, recommendations, and solutions, we can defeat the monster. For ideas about how you can help the environment and reduce plastic, check BBC's Plastic Waste - Plastics Action. We bring about change when we take little steps together.

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TWO BIRDS ONE STONE

By: Hend Fathy

On a planet encountering so many enormous challenges as ours, it is inevitable that humans would strive to figure out ingenious solutions to counteract the devastation caused by the impact of these challenges on Earth's systems. One example is Waste-to-Energy (WtE), which can indeed hit two birds with one stone.

While waste presents a pressing challenge on the environment with an estimated 2.12 billion tons produced globally each year, the world is desperately seeking renewable energy sources to substitute depleting harmful fossil fuels. What science offers in the case of WtE is a technology that helps us "clean" the environment and generate "clean" energy at the same time; that is just wonderful.

Past and Present

Typically, there are two main waste management strategies used to reduce its hazards on the environment and public health; namely, landfills and incinerators.

Landfills are the oldest form of waste treatment; they are sites for the disposal of waste materials by burial. In the past, landfills were merely holes dug in the ground, whereas now they are required to be impermeable containers for better isolation. Landfills have several drawbacks, however; besides being ugly and smelly, rainwater finds its way into most of them, specifically old ones, and picks up different harmful and toxic materials, forming what is known as leachate. The leachate then leaks outside the landfill, seeping into the groundwater or harming neighboring environmental habitats. At the same time, the decaying wastes inside the landfills emit dangerous gases into the atmosphere, contributing to air pollution and global warming.

Originally known as destructors, incinerators were introduced as early as the 1870s; the first incinerator was built in Nottingham, England. They can be described as thermal treatment facilities, where waste materials are combusted and converted into ash. One significant advantage of incinerators is that they considerably reduce the volume of waste by about 87%. Moreover, burning kills harmful pathogens, making it an effective solution to deal with medical wastes for example.

Old-fashioned incinerators, including those built just a few decades ago, are ill-reputed, however; although some are still in use, some of them are being shut down for good. The problem is that these facilities lack proper pollution control systems. These emissions, as well as the resulting ash, include heavy metals, chemicals, and deadly poisons, which pose serious hazards to Planet Earth and all its inhabitants.

More recent incinerators, on the other hand, are constructed according to strict regulations to achieve higher environmental protection standards. They are equipped with special filters to clean the emitted gases from harmful components. Moreover, samples of ash are regularly collected and analyzed to monitor contamination levels, and further process it when needed. The fact that the incineration process produces heat as a by-product ushered in the potential of transforming the resulting heat into energy; hence, WtE thermal conversion plants were introduced.

Present and Future

Although incineration is not the only available WtE technology out there, it is the oldest and most commonly used one. Incinerators can be described as "Thermal Conversion" plants; one such plant can treat up to thirty-five metric tons of waste every hour, producing about 1,500 kWh of thermal energy per ton. Incineration is recommended for treating wastes with low moisture and high calorific value. The heat produced from combustion is harnessed and used to either power turbines for electricity generation or to provide direct space and water heating.

Another type of WtE technologies is "Thermochemical Conversion"; generally speaking, they are favored to incineration, because they do not include burning; hence, involving less toxic emissions that require further

treatment. Thermochemical Conversion comprises a number of processes, including, but not limited to, pyrolysis and gasification.

Pyrolysis can be applied to any organic or carbon-based materials. In this treatment process, waste is chemically decomposed under extremely high temperature in the absence of oxygen; the final product is the valuable synthesis of gas and biofuel. Gasification is a similar process, where waste is broken down to the molecular level through partial oxidation and exposure to high temperatures, after which the molecules are recombined to form fuel gas.

A third type of WtF technologies is "Biochemical Conversion", which are preferred for wastes with high percentage of organic biodegradable matter and high moisture content, as agricultural wastes for example. Biochemical Conversion comprises two processes: anaerobic digestion and alcohol fermentation. In anaerobic digestion, wet organic wastes are composted in highly controlled oxygen-free environment; the process produces biogas that can be used to generate electricity. In alcohol fermentation, organic fraction of biomass is transformed into ethanol through biochemical reactions that involve specialized microorganisms.

Case Studies

Countries that adopt WtE technologies find value in what others consider garbage. Sweden, for instance, sets an example to follow in the field of waste recycling, with energy recovery being one form of it. It is a country that has literally run out of waste and actually asks for more!

In 2015 only, Sweden imported 2.3 million tons of waste from Norway, UK, and Ireland, among others. Wastes that cannot be recycled are turned into energy to generate electricity or operate heating systems that are widely used in such a cold state.

In a country with a rapidly growing population as Egypt, huge amounts of waste and the increasing demand on energy represent major challenges. Yet, the country has great potential in the WtE field, with over 80 million tons of garbage being disposed every year. Moreover, Egypt has huge quantities of agricultural waste, including rice straw, cotton stalks, and maize cobs, all of which can be used to secure bioenergy.

A great step was taken in July 2018, when the Egyptian Ministry of Electricity encouraged investors to operate WtE plants by declaring that it will pay EGP 1.03 per kWh. Another promising endeavor was when Shehata al-Moqadis, Head of the Garbage Collectors Union, signed a Memorandum of Understanding in May 2018 with an Italian company to build a waste recycling plant. According to al-Moqadis, the plant will have the capacity to process 600–1100 tons of waste daily to generate electricity or produce gas.

Do It At Home

Is WtE action confined to governmental efforts? The answer is "No"; there are millions of households around the world that turn their organic waste to energy using home-based biogas units. Biogas is a mixture comprising around 60% methane and 40% carbon dioxide; it is produced when organic matter is broken down by microbiological activity at warm temperatures in an anaerobic environment. There are several designs for home-based biogas units available in the market; they mainly consist of an inlet, a digestion chamber where the magic happens, a biogas tank, and a gas outlet pipe.

To operate a biogas unit, the first thing to do is to assemble it by connecting its constituents and filling up the digestion chamber with water. The unit is then activated using animal manure or a bacteria kit provided by the manufacturer; the activation process needs to be carried out only once for initiation. Once the biogas unit is ready to operate, the inlet is fed with food wastes and leftovers; the bacteria will break down the organic matter and convert it into biogas. The gas outlet pipe connected to a cooker, for example, will provide free recycled cooking gas.

Biogas units can be set up in balconies or backyards. However, they are particularly efficient for those living in rural areas with room to host bigger-sized units and access to organic agricultural waste or livestock manure, allowing the house to depend entirely on the produced biogas. Besides providing people with clean, sustainable, and free energy that can be used as fuel for cooking, heating, or lighting, having a biogas unit at home embraces the values of recycling and sustainability and teaches them to younger generations.

In a country with a rapidly growing population as Egypt, huge amounts of waste and the increasing demand on energy represent major challenges.

It is crucially important to remember that the first line of defense against waste challenges is our practices; unfortunately, the world today is driven by a consumerist approach. Industrialists strive to maximize their profits by producing one-time use products or releasing frequent updates of a single product; this urges people to buy again and again, consequently disposing of much more garbage. Companies do not prioritize the use of environmentally-friendly materials, nor advocate reducing, reusing, and recycling values. Developing rational consumption practices is a win-win solution to save our money, maintain our health, and protect our fragile planet.

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Using HYDROGEN for CLEAN ENERGY Generation

By: Fatma Asiel

Finding new clean energy sources has become a global concern; not only due to the imminent depletion of fossil fuels, but also due to the climate change crises resulting from the use of traditional fuels, as well as the widespread forms of pollution around the world. All these reasons have pushed the serious search for clean energy.

This led to using different clean energy sources, such as wind, water, and solar energies, in addition to other natural resources that generate electricity instead of fossil fuels. However, these sources have not become entirely reliable due to some issues that have to do with cost, storage, etc. The use of hydrogen in clean energy production has marked a breakthrough in the field; hydrogen has become one of the most important, realistic, and effective clean energy sources.

Why Hydrogen?

It is the simplest and most widespread element on Earth; it consists of one electron that orbits its only orbit. Yet, we never find a single hydrogen atom on its own; it is either combined with oxygen to form water, or with carbon to form hydrocarbon—the main constituent of many fossil fuels—or combined with other elements in several other compounds.

How is Hydrogen Energy Generated?

There are several methods to extract pure hydrogen for the purpose of energy production. The most common extraction method is electrolysis, or the process of using electricity to split water into its constituents—hydrogen and oxygen—through chemical reaction.

Although effective, this method is not economically efficient. Therefore, scientists have searched for other methods to extract hydrogen from water; another economic alternative is using solar cells supported by a light anode made of metal oxide Bismuth vanadate. Yet, experiments are still being conducted on this technique to prove its efficiency and potentials.

Advantages of Hydrogen Energy

Hydrogen energy has several advantages that places it ahead of the clean energy options humans can rely on in the future. First of all, it is a "clean energy" that is friendly to the environment and its creatures. Hydrogen energy does not produce any exhaust fumes, toxins, or excessive heat; it also does not affect the planet's temperature or the stability of life.

Renewable energies, such as solar and wind powers, are non-depletable; similarly, hydrogen energy is renewable, as the world would not run out of hydrogen. In fact, hydrogen is the main constituent of the universe, representing 75% of it. Hydrogen energy is amongst the most efficient energy sources, whether renewable or non-renewable.

That is, the amount of hydrogen energy used to operate a machine will make it work for more time compared to the same amount of any other energy source.

Disadvantages of Hydrogen Energy

Despite these advantages, hydrogen energy has some disadvantages, forming challenges that hinder us from utilizing it; at least for now. Yet, scientists are still researching to overcome these challenges. A major challenge is storing hydrogen and transferring it from one place to another. Hydrogen is very thin; it, thus, requires high pressure to be transformed into liquid form so as to be stored. This liquefaction process is not practical at all, and only little amounts can be transferred. Hydrogen is a highly flammable element; it is odourless, which makes it very difficult to discover leaks. As a result, it can cause unpredicted fires.

Uses of Hydrogen Energy

Fossil fuels were initially used for spaceships and rockets; however, they are costly and harmful to the environment. Recently, it has been found that hydrogen energy is more suitable for operating spaceships, as it is renewable, environmentally friendly, and light-weight. As such, it does not require huge tanks for storage as the traditional fuels.

Scientists seek to make hydrogen energy the alternative to fossil fuels—coal, oil, and natural gas. Despite the challenges, scientists are taking steady steps towards operating all devices, machines, factories, and cars with hydrogen energy in the future.

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By: Jailane Salem

Healing Ozone

The ozone layer is part of the Earth's stratosphere, which is the second major layer of the Earth's atmosphere, sandwiched between the troposphere below and the mesosphere above.

In our journey of development, we have created many harmful substances that have damaged our planet; one of our victims being the ozone layer. Chlorofluorocarbons (CFCs) are an example of harmful man-made chemicals that have damaged our ozone layer.

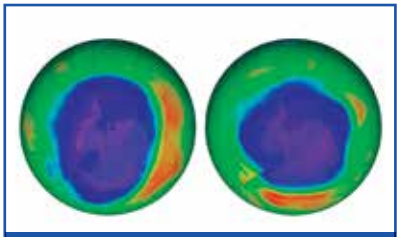
The ozone layer is important because it absorbs ultraviolet (UV) radiation from the Sun; thus, protecting us from their harmful effects. UV exposure is known to cause cancer and cataract, as well as harm plant life.

Ozone molecules are three oxygen atoms linked together (O_3). The number of ozone molecules has been decreasing due to the large amounts of CFCs being released from the manufacture and use of refrigerators and air conditioning units, as well as aerosols, among many other products. While CFCs do not harm people and the environment at sea level, once they reach the ozone layer they react differently.

CFCs pass through a process known as photo-dissociation once they come into contact with UV radiation, causing the chlorine atom to break off from the molecule. The free chlorine atom reacts with the ozone molecule, breaking it up and attaching itself to one of the freed oxygen atoms in order to stabilize, forming the chemical compound chlorine monoxide. With the increase of CFC production, eventually it caused a hole in the ozone layer.

By late 1970s, indications that there was something wrong with the ozone layer became evident, but efforts to reverse the damage were only initiated in 1987, when the Montreal Protocol was finalized. The Protocol was a global agreement to phase out the production and use of Ozone-Depleting Substances (ODS), which included CFCs as one of the main culprits.

According to the United Nations Environment Programme (UNEP), "the Montreal Protocol includes a unique adjustment provision that enables the Parties of the Protocol to respond quickly to new scientific information and agree to accelerate the reductions required on chemicals already covered by the Protocol. These adjustments are then automatically applicable to all countries that ratified the Protocol". Over the years it was ratified to include more ODS as evidence was provided.



The ozone layer on its way to healing.

At the beginning of 2018, scientists made public a study, which showed that high levels of ozone-destroying chlorine are decreasing and that there was evidence that the ozone hole was recovering. Scientists predicted that the ozone layer will go back to its original state in 50–100 years, as CFCs remain in the atmosphere for long periods of time, but their effects will dwindle as no new source emits them.

Alas, a plot-twist! While at the beginning of the year improvements were being recorded, it was reported later in May that an unknown source has been emitting harmful CFC. A newly-published study has shown that "as expected, the rate of decline of concentrations of CFC-11 observed was constant between 2002 and 2012. However, since 2012, this decline has slowed by around 50%". This production of the banned chemical is against the Montreal Protocol; whoever is defying it is violating international law.

Investigations were able to identify the source of violation; studies showed sites in China where gases were still emerging; many Chinese companies were still using CFC-11 in manufacturing foam insulation. A refrigerator factory owner admitted the practice, saying that it was a cheaper choice, while some manufacturers were not aware of the environment impact.

The Chinese Government was able to find these sites and close them down. New evidence shows that the ozone layer is continuing to recover from man-made damage; the ozone layer above the Northern Hemisphere is expected to heal in the 2030s and is likely to heal completely by 2060.

Repairing the damage is raising hopes to reduce the impacts of climate change, as some of the gases causing the ozone layer depletion also contribute to warming the atmosphere. Phasing out the CFCs and related gases, which are also super climate pollutants, can avoid up to 0.5ºC increase in global temperature by the end of the century.

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THE INCREDIBLES

By: Shahenda Ayman

Our ecosystems consist of armies of creatures; without them, the whole ecosystem will collapse. Some microorganisms, such as bacteria, help us clean the environment; others help plants by converting free nitrogen from air and feeding the roots. Some insects and earthworms help in agriculture by increasing the fertility of the soil and increasing the organic quality of soil.

In the marine ecosystem, narwhals or "unicorns of the sea", measure the temperature changes in Greenland's arctic waters, because they can dive far deeper than humans, so scientists can track global warming. Climate scientists at the University of Washington attached thermometers and small satellite transmitters to the narwhals and found that waters in Greenland's Baffin Bay are 0.9°C warmer than formerly calculated.

Like narwhals, sea lions and seals can easily dive deep below the water surface and go to places where few people have gone before. Researchers at the University of California Santa Cruz outfit them with special equipment to measure salinity, temperature, and other conditions, so they can develop better models of ocean water circulation and track climate change effects.

In the wild, rhinos have a pivotal role in maintaining the Savannah grasslands; any decline in the rhino population affects the structure and composition of the grasslands badly. By choosing certain plants over others, rhinos increase biodiversity by giving other species of plants the ability and space to grow. Grasslands sustain several species; whether directly as a source of nutrition, or indirectly by sustaining the predators' food source. Preserving these grasslands is very important for preserving the ecosystem, and the only way to conserve it is by conserving the rhino.

The African elephant, on the other hand, plays a vital role during droughts; they have the ability to locate water more than 19 km away, then they use their tusks to dig for it. This act not only helps them survive, but also provides water to other animals that share these harsh environments with elephants. They also use their tusks to dig up ground minerals, allowing other animals access to the vital minerals that their diets lack. Other than that, elephant dung is filled with various digested seeds, which are then deposited on the ground with their very own source of fertilizer, growing into new grasses, bushes, and trees.

Ants are considered the most abundant insects on our planet; their presence in nature is essential to the wellbeing of the habitats in which they live. They act as decomposers by feeding on organic waste, insects, or other dead animals. They also aerate the soil and recycle nutrients through digging galleries and tunnels; by doing so, they till the soil by bringing pebbles and particles to the top. They even help in reducing the use of chemical fertilizers and the need for irrigation. A 2011 study concluded that in dry climates, ants and termites increased wheat crop yields by 36%.

Seed-harvesting ants transport seeds to their nutrient rich nests, where plants can safely grow, free of harm from herbivores. Ants sometimes travel far distances with seeds, granting plants their desired dispersal goal for less light, space, nutrition, and water competition with other plants. After seeding, plants need pollination; the transfer of pollen grains from the plant's anther to the stigma of the same plant, or another plant of the same species. This transfer of pollen can be through wind, birds, bats, and of course, honey bees.

A foraging honey bee may only be about 15 mm long, but it is loaded with special adaptations designed to maximize the collection of pollen and nectar. Bees are not the only creatures that help in pollination; nectar-eating bats are crucial pollinators for over 500 plant species, many of which are ecologically significant. When bats drink a flower's nectar, they subsequently pick up pollen and transfer it as they feed.

Bats are exceptionally important to our ecosystem although they are often portrayed as creepy creatures; in reality, of more than 1,200 species of bats, only three types are blood-sucking vampires. Insectivorous bats help farmers save billions of dollars of crops each year, while reducing the need for chemical pesticides. They perform nocturnal insect control services by consuming millions of pest insects each year. In many places of the world, mosquitoes are vectors of deadly diseases, such as malaria and dengue fever; a single brown bat can eat up to a thousand mosquitoes in one hour.

Those are not the only animals that are crucial for sustaining our ecosystems, frogs are far more important to humans than just being used for dissection experiments. Frogs actually act as bio-indicators, indicating whether the ecosystem is healthy or not. Frog skin is porous and permeable, allowing substances present in the environment to be absorbed within their fatty tissues. Since these amphibians have the ability to live terrestrially and aquatically, they can indicate contamination dilemmas for both habitats. Since frogs will most often be the first animals to react to biological hazards, they are helpful for warning humans to take action.

Birds, of course, perform a broad variety of ecological roles, including forest decomposition, insect pest control, nutrient recycling, bio-indication of ecosystem health, plant pollination, and seed dispersal. Some ground-dwelling birds even help aerate and turn up soil with their claws. Though ant, termite, bat, and frog species might be the masters of their trades, birds certainly seem like the jack of them all.

Unfortunately, many of the species listed above are in danger due to parasitic threats, deforestation, habitat loss, pollution, and other environmental concerns. There are many simple ways you can help, including using eco-friendly products, being aware of your environmental impact, and making daily conscientious and compassionate choices. We are all in this together!

The Earth, its ecosystems, and its creatures are all deeply connected. Thus, the existence of many species depends on the survival of others; human beings are not an exception. Believe it or not, many animals actually help people by just performing their natural roles in their environment, and we are benefiting from their services for free. Let us not pay them back by killing them off!

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Marine Heat Waves

By: Mona Shehata

Marine heat waves are defined as a duration when the water surface temperature is 90% warmer than prior sea surface temperatures; this may last from days to months.

The waves may reach thousands of kilometers, affecting fisheries and marine ecosystems, as well as crops and wildlife on land, and of course, human life. Global warming has caused ocean waters to become warmer; ocean currents move the warm water to colder areas, causing marine heat waves that affect this area mostly in a negative way; such as: slowing salmon growth, stressing non-moving creatures, such as oysters and shellfish, and interfering with the natural cycles of seaweeds, modifying their habitats.

However, these variations in ocean temperatures are irregular and scientists had struggled to construct patterns for these heat waves and their impacts due to lack of description for them. Once experts agreed on a definition, they realized that the heat waves occurred 54% more frequently 1925–2016. Many people did not realize the environmental consequences until it was too late; for example, in 2011, a marine heat wave destroyed a kelp forest, replacing it with turf seaweed off the West Coast of Australia. The ecosystem change became permanent even after the ocean temperatures were back to normal.

Scientists later discovered a connection between climate change and marine heat waves, using satellites and previous data available. The 2016 marine heat wave in tropical Australia was caused by greenhouse gas emissions, resulting from Man's actions, which cause global warming. These heat waves resulted in an increase by around 50 times the possibility of extensive bleaching of the Great Barrier Reef.

Due to the increase of seawater temperatures caused by global warming, corals expel beneficial algae that live inside their tissues. The decrease of the algae, which are responsible for absorbing greenhouse gases in the ocean could influence the ocean's ability to absorb these gases. This also leads to the release of carbon dioxide through collapsing seagrass areas. For example, losing seagrass meadows in the Shark Bay area led to an increase in bacteria, a decrease in blue crabs and scallops, negative effects on the health of green turtles, and a decrease in long-term carbon storage where they live.

With the continual rise in ocean temperatures and the occurrence of marine heat waves, the marine ecosystems that numerous people rely on for food and their livelihood will be more unstable and unpredictable. For instance, marine heat waves affect fisheries and aqua-farming businesses, having a large impact on some peoples' lives as it affects their work and income.

Another example is the North Pacific warm water "Blob", a large mass of relatively warm water, which led to the shutting down of recreational and commercial fisheries, bringing about the loss of millions of dollars. Over the course of two years, this "Blob" resulted in the emergence of a destructive bacteria epidemic by the coast and altered the weather drastically in the Pacific Northwest.

Researchers should first work on using technology to predict future variations that will lead to warm ocean water, to find out if the temperature will increase and how long these waves will last. Second, they should extend their results to decision and policy makers, so that they know the marine heat waves' effect on the environment and their duration.

This knowledge will help fisheries and aquafarming businesses know when to open or close, and when to harvest. These forecasts may aid in limiting the dangers; however, they do not solve the main problem of climate change. If this issue remains unresolved, then marine ecosystems will change permanently due to high water temperatures.

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ILLEGAL WILDLIFE TRADE

By: Jailane Salem

While irresponsible management of our natural resources, as well as unsustainable environmental policies, have massively affected the habitats of wildlife globally, these are not the only threats that face animals of the wild. Mankind has always been fascinated with what is deemed exotic and rare. To put on a mesmerizing animal hide, to eat a rare dish made from unusual meat, to decorate with an exquisite ornament made from something as unique as ivory satiates the appetite of those who covet the uncommon and exceptional.

These extraordinary artifacts have often been used as status symbols, denoting wealth, prestige, and power. The use of wildlife products has been part of all cultures around the globe and is nothing new. What is new, however, is the higher demand on wildlife products, which is pushing certain species to almost becoming extinct, while others have already suffered that fate; such as the Western Black Rhinoceros, which was declared extinct in 2011.

All our progresses as mankind can be pinned down to our ability to create suitable environments for our survival. We were able to tame nature and make it work in our favor rather than against us. In the past, when people were intrigued by wildlife and hunted down exotic animals to use as food or to make products, we never created a significant imbalance in nature. The serious damage was limited to the applied methods; that was the case until the commencement of the Industrial age.

With the introduction of modern technologies and methods, a shift in the effect we had on wildlife occurred. In the past, hunting tools were limited to wielding spears and creating traps; nowadays, however, poachers use guns, drones, tracking devices, and planes to hunt down rare wild animals. Wild animals stand no chance against these sophisticated measures.

What drives the current appetite for wildlife products though? Many people still view wild animals and plants as trophies to be possessed; others use them in medicine, believing they have miraculous effects. A large amount of money can be made in the wildlife trade; while a lot of it is illegal, the profits spur people to keep doing business.

In the absence of appropriate forest management policies, environmental and social safeguards, and responsible demand, trade can negatively impact forest conservation

When we think of organized crime, usually what comes to mind is drug trafficking, illegal arms trade, and human trafficking, among other illegal criminal activity. However, it also includes the illegal trade in wildlife products, often times tied to other criminal networks that facilitate the movement of wildlife products across continents and seas. The short-term rewards outweigh any future disasters; this is why many animals and plants are in great danger today.

Elephants are native to Africa and Asia, but the elephants in dire danger are African elephants; hunted down mainly for their tusks, this majestic animal has suffered incredibly. African elephants have been heavily affected by the illegal wildlife trade; so much that their numbers have dwindled down by 60% over the past decade and an estimated 700,000 exist in Africa.

The demand for ivory was at an all-time high in the past century; the elephants' tusks would be made into ornaments and jewellery and sold for hefty prices. Even though an ivory ban was enforced in 1990 in an attempt to reverse the damage done to the elephant populations, the illegal trade continues. Conservation efforts have yielded positive effects, and there are campaigns run by NGOs that try to deter people from buying ivory goods, as well as educate people on the harms the ivory trade has done to elephants. While these efforts are commendable, as long as there is still a demand for ivory products, elephants will remain vulnerable to the ruthlessness of poachers and ivory traders.

As mentioned earlier, a species of rhinos has gone extinct recently; now, others are threatened with the same fate. Rhinos are targeted for their horns and they are in high demand, especially in Asia, which makes it lucrative for poachers to target them. Black and White rhinos are heavily endangered; while in the past they roamed freely across Africa, they are now facing extinction. Those living in the wild lead a precarious life; only around 5000 Black Rhinos remain in the wild. Their dwindling numbers make their horns even more of a prized possession and hikes up their cost.

These are but two examples of the crisis facing wildlife today; the sheer amount of wildlife affected is catastrophic and saddening. While there are park rangers whose jobs are to protect wild animals, they too face danger. Poachers resort to violence in order to get to the animals and do not back down when confronted;

in fact, many park rangers are killed in the line of duty. Many NGOs also work tirelessly in order to promote conservation and try and slow down the dwindling numbers of endangered animals; however, the most effective change can only exist when people stop creating demand for wildlife products.

While elephants and rhinos are often mentioned when talk of wildlife trade is brought up, other endangered animals are also affected; such as marine mollusks. When visiting a coastal city, you probably come across seashells being sold as souvenirs; have you ever thought of the animal that occupied that shell?

People buy these shells for decoration, but they are not seashells that have been washed ashore and collected; they have been obtained through large scale operations. They are often caught in such big quantities, which puts the survival of these species at risk. There are regulations that prohibit catching certain species of mollusks; yet, many ignore such regulations.

Tropical timber is yet another species under threat due to overexploitation and illegal trading. There is an increasing global demand, especially from industrialized countries such as the United States of America for timber products. This is a multi-billion dollar industry that is wreaking havoc on forests worldwide, especially tropical forests. “According to some estimates, logging in violation of national laws accounts for 8–10% of global production and trade in forest products. It also represents 40–50% of all logging in some of the most valuable and threatened forests on Earth”.

Precious forest lands are being cleared to make room for fast-wood forests. While it is important to have that option in order to meet the global demand for wood products, the negative impact this has on natural forests cannot be overlooked. Short-term solutions have a negative effect on both the environment and the societies dependant on timber products; overexploitation of tropical timber leads various species of timber, such as Rosewood, to endangered status.

The World Wildlife Fund for Nature (WWF) advocates for overturning the current trends in timber consumption and “believes that demand for responsible forest products in international trade can provide enormous incentives for sustainable forest management. However, in the absence of appropriate forest management policies, environmental and social safeguards, and responsible demand, trade can negatively impact forest conservation”.

Illegal wildlife product trade is a massive business estimated to be worth GBP 15 billion per year, making it the fourth largest crime by value in the world. Almost 7000 species are affected worldwide, “on average, over 1000 rhinos are slaughtered a year, 55 African elephants are killed a day, two tigers are poached each week, and every five minutes a pangolin is snatched from the wild”.

A joint program between the International Union for Conservation of Nature (IUCN) and WWF called TRAFFIC, aims to monitor wildlife trade to make sure it is not a threat to conservation efforts. Of course, they have their work cut out for them given the complicated nature of the trade, and the overlap between legal and illegal sources of wildlife products. “TRAFFIC has gained its greatest reputation from supporting the Convention on International Trade in Endangered Species (CITES). Since TRAFFIC was created in 1976, it has helped with the evolution of this international wildlife trade treaty”.

TRAFFIC focuses on providing the resources necessary to aid in conservation efforts, as well as spreading awareness on the endangered species affected by wildlife trade. There have been steps also to include technology companies in the fight against the illegal wildlife trade. Many criminals use Facebook and other social media platforms to advertise their illegal products, and there has been a movement to try and implement measures to stop such illegal activities.

It is without doubt that our planet has passed through drastic changes that will affect generations to come. The unfortunate fact that our own mismanagement and hubris has brought about calamitous results cannot be denied. However, while wild animals still roam the land, and wild plants still flourish; we owe it to them and ourselves to do all that is within our means to protect them and try to reverse the fates. While you may not buy wildlife products that are known to be endangered yourself, you might know others who do: it is your duty to educate them about the reality that their purchase creates. The only way forward is through championing sustainable behavior, and the time to act is now.

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MOUNTAINS
The Road to a Sustainable

By: Sara Khattab

Earth embraces a variety of ecosystems, which fall under two categories: aquatic and terrestrial ecosystems. An important terrestrial ecosystem is the mountainous environment. Mountains cover almost 24% of the world's land area and exist at different elevations; they are steeper, larger, and higher than hills, and more than 600 meters in height.

So, how are mountains formed? Well, the continuous movement and collision of the huge tectonic plates that form Earth's crust create a landform higher than the surrounding land area. Mountains are classified according to the type of rocks they are composed of, their shapes, and their placement on land; such as: fold, fault-block, dome, volcanic, and plateau mountains.

Mountainous regions provide homes for distinctive human communities, which represent almost 10% of the world's human population, and encompass a great diversity of habitats where different species are found. For example, the Sierra Nevada mountain range is estimated to be home to around 10,000–15,000 species of plants and animals.

The characteristics of mountain ecosystems vary according to the altitude, biomes, and bodies of water surrounding the mountain. Climate on mountains tends to be colder and wetter; at the higher altitudes of mountains, the air is thinner where there is less oxygen to breathe, the pressure increases, and the temperature decreases. This climate is called Alpine climate, referring to the weather of the regions above tree-line or highland climate. Summer and Spring are short on mountains; hence, they are covered with snow most of the year.

Due to the harsh climate and fragile nature of the mountains, large numbers of native plants and animals are listed as "at risk" or "endangered" by different organizations worldwide. Mountain ecosystems are subject to both natural and anthropogenic drivers of change; they face a number of natural disasters: avalanches, erosion, lava flows, and earthquakes, which can destroy the habitats. Mountain animals and plants can adapt to the surrounding environment to survive.

Animals, specifically those living at higher elevations, have thick fur to protect them against cold weather. Some, such as the Alpine marmot, hibernate during the harsh winter months; they also have special hooves, composed of a hard outer edge and a soft center, that allow them to hold on to rocks while climbing the mountains.

On the other hand, plants on high mountains grow close to the ground as a protection from the wind; that is why trees do not grow at high elevations. The stems of those plants extend deep beneath the soil surface, which allows them to store food and moisture. Other plants form a waxy substance on their leaves that seals moisture in, because mountains have thin soil and cannot retain moisture.

Mountainous ecosystems offer many essential ecological services; not only for the people living there and the people living nearby, but they also contribute directly and indirectly to the wellbeing of almost half of the world's population. They play an essential role in influencing global and regional climates and weather conditions.

The amount of rain that the lowland areas surrounding the mountains receive depends mainly on the mountains, which

Mountains provide 60–80% of the world's freshwater; all the major rivers in the world have their source in mountain glaciers known as "water towers".

block wind and receive more rainfall. When air flows over a mountain, it is forced upwards, then it cools, causing moisture to condense and rain falls. When the air descends the protected side, it warms and is drier, because the moisture in the air had faded out during the ascent. Rain falls more on the windward side of a mountain and the leeward side of the mountain receives lesser amounts of rainfall, which may result in drier climates.

The snow covering the tops of the mountains acts as a mirror increasing the amount of reflected solar radiation, which reduces the overall amount of energy absorbed at the Earth surface. As the snow melts, the mirror thins and more solar rays penetrate the Earth, leading to the increase of the Earth temperature and the quantity of water vapor in the atmosphere increases too. Moreover, this continuous rise in temperature will lead to the fast melting of the glaciers and snow on the mountains, which can cause floods.

Mountains provide 60–80% of the world's freshwater; all the major rivers in the world have their source in mountain glaciers known as "water towers". In humid areas around the world, the proportion of water generated in the mountains can comprise up to 60% of the total freshwater available in the watershed, while in semi-arid and arid areas, this proportion is over 90%.

Almost half the people on the planet depend on mountain water, either for drinking, as a source of energy, or for growing food. Mountain water is a source of hydroelectric power, most of which is used on the plains below. Historically, water-wheels have provided energy in mountain regions, mainly for grinding grain; currently, hydropower turbines are used to generate electricity. Changes in the volume of mountain glaciers and seasonal melting patterns impact water resources in numerous parts of the world.

Mountainous environments are also home to a wide range of raw materials that are used in the production of different goods; such as: dairy products, honey, spices, oil olive, medicinal plants, and others. Tourism plays an important role in the economy of some mountain ranges where people can enjoy hiking, exploring, relaxing, and boosting their energy levels. Nevertheless, the inhabitants of the mountains face multiple challenges; such as: long distances to markets, poor educational and healthcare facilities, unemployment, and above all, natural disasters and fragile ecology, not to mention mismanagement of mountain resources.

The increased rates of environmental changes, accompanied with economic and social changes, affect the ability of mountain ecosystems to provide their usual services necessary for the well-being of the world's population, not only the mountain community. The challenge is to find new and sustainable opportunities that can benefit both mountains and lowland communities, and help eradicate poverty without contributing to the degradation of the fragile ecosystems.

Among the targets of the Sustainable Development Goals (SDGs) is "to ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development". International and regional organizations, as well as special groups specialized in saving the mountains, are working hard to enhance the understanding of mountainous ecosystems and the conservation of its biodiversity and sustainable development. They are also working on developing policies that help in the management of mountain ecosystems, including climate change mitigation and adaptation.

It is necessary to improve and build the existing land/water ecological knowledge base regarding technologies, as well as agricultural and conservation practices, in mountainous regions with the participation of local communities. Governments have to diversify mountain economies by strengthening tourism and wildlife activities; with the help of relevant organizations, they are working to identify mountain areas threatened by natural hazards and air pollution from neighboring industrial urban areas to take the appropriate measures. The conservation strategy includes building an inventory of different forms of soils, forests, crops, plants, and animal genetic resources, giving priority to the endangered species.

Mountain biodiversity plays an essential role in supporting the global environment, as well as economic, social, and cultural sectors through connections to invasive species, air pollution, climate change, mining, hydropower, tourism, forests, and agriculture. That is why it is vital to manage mountain regions, to avoid degradation and subsequent increases in poverty and hunger.

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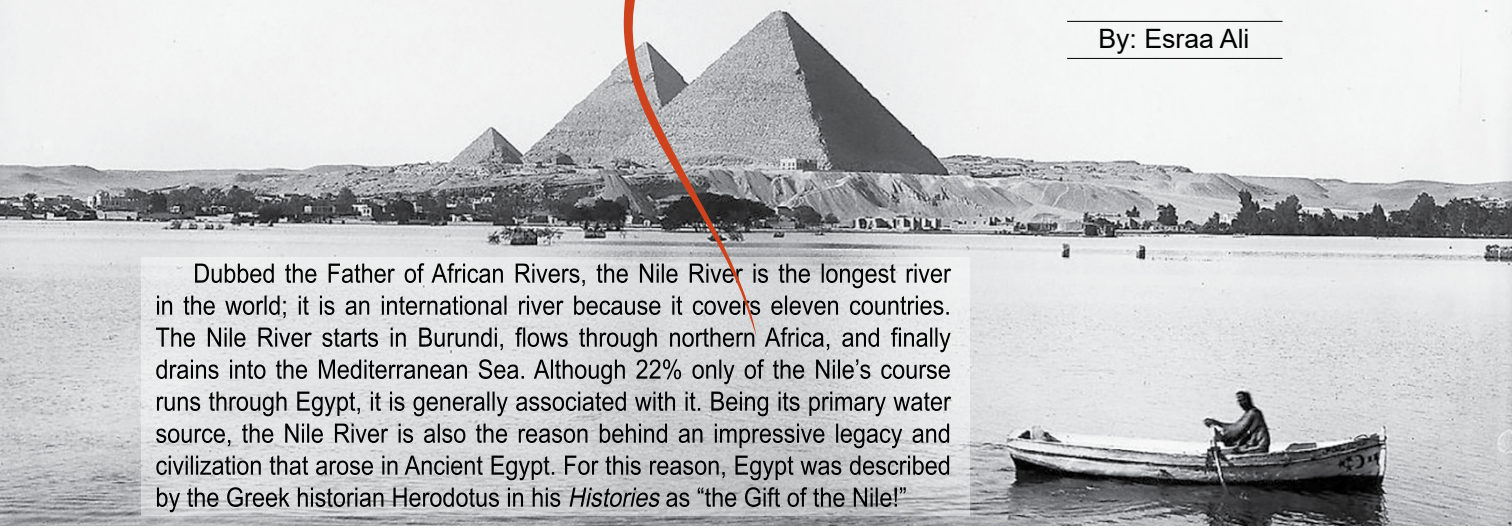
THE GIFT OF THE NILE

By: Esraa Ali



Dubbed the Father of African Rivers, the Nile River is the longest river in the world; it is an international river because it covers eleven countries. The Nile River starts in Burundi, flows through northern Africa, and finally drains into the Mediterranean Sea. Although 22% only of the Nile's course runs through Egypt, it is generally associated with it. Being its primary water source, the Nile River is also the reason behind an impressive legacy and civilization that arose in Ancient Egypt. For this reason, Egypt was described by the Greek historian Herodotus in his *Histories* as "the Gift of the Nile!"

The Nile, the Key of Life

The geography of a place affects human life; it does not only determine its inhabitants, but also impacts their lifestyle, as they adapt to its climate. This fact is no different for Egypt, where the unique geographic location of the ancient country has influenced its inhabitants throughout the ages. Egypt has an abundance of ecological regions supporting various animals and plants. It is divided into four natural regions according to differences in elevation of its land: the Nile Delta, the Western Desert, the Eastern Desert, and the Sinai Peninsula.

The Nile River, Egypt's lifeline, is the most important feature of its geography. Despite being located in the highly arid North African Desert with its extreme temperature, Egypt has a significant location on the banks of the River, which creates a fertile green valley amidst the Desert. The diversity of the Nile Basin's climate is one of its distinguishing features; the climate of the southern parts is hot and dry, while the northernmost parts experience moderate temperatures.

The Nile Delta's eco-region is also very fertile and suitable for agriculture. It is home for a wide range of habitats that host several animal species, including birds, turtles, mongooses, and crocodiles. Unique plants also inhabit the region; the Egyptian Lotus and Papyrus just to mention a couple.

The Mother of All Lands

On the banks of major rivers, great countries worldwide have developed, and so did Egypt. The water of the Nile River allowed Ancient Egyptians to settle in the Nile Valley. In addition to satisfying domestic water needs, the Nile River was one of the main sources of entertainment for Ancient Egyptians as they swam, fished, and sailed across it.

At the center of Egypt, the Nile River made it possible for farmers to grow their crops, thanks to its annual flood, which brought rich black soil to its banks. The Nile River facilitated irrigation and navigation, in addition to providing fish to catch, reeds to make paper, and mud to make building bricks. Ancient Egyptians knew how to maneuver the Nile and its offerings to turn their fertile land into a prosperous civilization well-known worldwide to have been ahead of its time for its knowledge and technology.

Tools and objects found by archeologists have conveyed thought processes and physical actions of Ancient Egyptians. They discovered and invented several things, such as paper from the papyrus plant, and built the Pyramids of Giza on the banks of the Nile River to house the bodies of their pharaohs that are still preserved, thanks to Egypt's dry climate; just to name a few.

Trick or Treat

Around the Nile River, one of the world's oldest civilizations arose about 3000 BCE. Pharaonic Egypt flourished for around 3000 years; it was then taken over by foreign rule for consecutive brief periods. Egypt was pursued by several

Egypt was described by the Greek historian Herodotus in his *Histories* as "the Gift of the Nile!"

civilizations and empires for its unique location midway between Africa and Asia, and for the Nile River as well; for its richness, and for providing an easy trade and communication route between Egypt and the world. As a result, Egypt's ancient civilization lasted until the Romans conquered Egypt, converting it into part of the Roman Empire in 30 BCE.

Despite the eventual collapse of the Ancient Egyptian civilization, the Nile River continued to flow. With the advent of modern colonialism, Egypt was regarded an African country; neither Pharaonic nor Arab State, for the importance of its location. The British, who inherited a colonial practice, gained effective control over Egypt in 1882, and pursued strategies that were not in its interests. The British planned to dominate the sources of the Nile in order to strangle Egypt and isolate it from the Sudan. To achieve this aim, the British made use of the technological progress at that time, and constructed dams and other water projects in the Sudan to start a conflict over the distribution of the Nile's water supply.

Even after Britain relinquished its control over Egypt mid-20th century, the conflict over the Nile water supply continued among the countries of the Nile Basin. They signed a number of treaties to control the rights to use the Nile's water; however, the rising populations, rapid economic development, pollution, and environmental degradation have led to decreasing the water availability for Egypt.

The wiser you become, the lesser you will be surprised!

Several dams were built in southern Egypt in the 20th century, principally in an effort to control the annual flood and store sufficient water in the reservoir, including Aswan's most popular and well known dam: the Aswan High Dam. However, these dams decreased the amount of sediment deposits, leading to a drastic decrease in land fertility.

This led Egyptian farmers to opt for fertilizers to offset that change for growing their crops, making it more expensive. The fish population offshore of the Delta has also been reduced dramatically because of the loss of nutrient-laden silt. Dam supporters, on the other hand, realize that these harmful effects are worth it for securing both water and power supplies. Dams are not the only main reason endangering the Nile Delta and its inhabitants. The region is also threatened by the Mediterranean Sea Level Rise (SLR) due to the human-caused global warming, as warned by climate experts. The cities of Alexandria, Rosetta, and Port Said, in particular, are expected to face serious environmental impacts. Thus, more conservation efforts are needed, especially in the Nile Delta, to fend off such upcoming dangers.

Egypt's Vision 2030

The Egyptian authority is working hard towards achieving the Sustainable Development Goals (SDGs) through its Sustainable Development Strategy (SDS): Egypt Vision 2030. Inspired by its Ancient Egyptian civilization, which links the present to the future, Egypt Vision 2030 is in line with the SDGs, and follows its general framework for improving life quality and welfare. The SDS deals with three main dimensions that broadly cover the SDGs: economic, social, and environmental dimensions.

As we are more concerned in this context with the environmental dimension, it is important to note that this aspect in the SDS became more comprehensive than before. Rather than addressing only the pollution of environmental systems, this dimension addresses main elements of managing natural resources, ecological systems, and biological diversity. Since water scarcity is a key challenge for the growing Egyptian population, in addition to the consumption of almost two-thirds of the fresh water by the agricultural sector, securing a sustainable water source and managing it has become a high priority on the Egyptian Government's 2030 Agenda.

History Repeating Itself

Sustaining the Nile River by necessity entails nourishing an ancient civilization, and flourishing it as well. The Nile River for Ancient Egyptians meant more than a permanent source of water, it was rather a source of life.

This concept was reflected in their afterlife beliefs. Their *Book of the Dead*, also known as *Papyrus of Ani*, was an attempt to describe what the dead will find in the afterlife and how they should behave. During judgement, they answer their gods' questions, which include a question about the Nile River. In their confessions, the deceased should deny polluting the Nile water by claiming "I have not waded in the water".

Our ancient ancestors understood the nature of the Nile River, its importance, and how to sustain it, but we have just started to realize this several centuries later. Indeed, the SDS is an indication we have just realized what our ancestors have thousands of years ago.

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PANDAS

A BLACK AND WHITE ISSUE

By: Shahenda Ayman

In 1990, China's lovely giant pandas with their distinctive black and white coats were listed as endangered species. However, in 2016, the International Union for Conservation of Nature (IUCN) changed their status from "endangered" to "vulnerable". This declaration came after the growth of the panda population from 1,114 in 1988 to 1,596 in 2013, reaching 1,864 in 2014. The growth was a result of the effective forest protection and reforestation strategies implemented by the Chinese Government; still, climate change and other factors are predicted to eliminate more than 35% of the panda's bamboo habitat in the next 80 years. The panda population is, thus, projected to decline again, reversing the gains made during the past two decades.

Giant pandas, officially known as *Ailuropoda melanoleuca*, are the rarest of the bear species. They live in the Chinese bamboo forests and exclusively rely on bamboo for their diet, ingesting more than 13 kg daily just to survive. Pandas also play a crucial role in the bamboo forests ecosystem; they spread seeds, helping the plants grow, and offer an opportunity to many wild animals to survive; including: dwarf blue sheep, multicolored pheasants, and other endangered species, such as the golden monkey, takin, and crested ibis. Moreover, pandas are China's national symbol and have significant economic benefits for local communities through ecotourism.

Research suggested that the changing climate and warming temperatures will possibly force the bamboo forests to move to higher grounds, where temperatures are cooler, depriving pandas from their natural habitat and main source of food. Furthermore, bamboo trees are subjected to periodic synchronous flowering and die-off—this monocarpic perennial plant dies after the one time in its life that it flowers and sets seed—forcing giant pandas to relocate to areas with healthy bamboo. For example, 250 giant pandas starved to death following a widespread flowering episode that occurred 1975–1983 in the Pingwu and Nanping districts of the Sichuan Province.

Similarly, habitat destruction, agriculture, and infrastructure development pose a big threat to panda habitats. Giant pandas have been allowed to stay only at altitudes higher than the land that can be used for productive agriculture. Major highways and railways crisscrossing the bamboo forests deprive the pandas from moving from one forest fragment to another, which presents a lethal challenge to pandas. It is worth mentioning that, in 1980, panda habitats covered 40,599 km^2; by 1990, it had been cut to just 12,340 km^2.

In order to preserve the giant pandas and their habitats, and avoid listing them as "endangered species" again, their forests must be protected. These forests host some of the most important services to the communities that live in it and around them. For instance, forests allow crops growing and animals grazing, store and clean fresh water, and supply firewood, lumber, and many useful plants. Additionally, they manage storm runoff, sequester carbon in the soil, and help prevent erosion.

Researchers noted that investing in panda habitats has improved the living conditions of local residents. They used data from the Chinese Statistical Yearbook showing that the annual income in the Sichuan, Shaanxi, and Gansu provinces, located next to panda reserves, rose by an average of 56%, 2000–2010. The annual income of the farmers in the counties within these provinces was raised by 64% on average.

Other conservation actions should include maintaining and increasing suitable connected habitats, and restoring habitats with bamboo species or their genotypes, which are adapted to a warmer climate. It is also essential to minimize habitat loss and fragmentation caused by agriculture and other land uses.

In short, conserving the giant panda habitat must be considered a national duty carried out by the Chinese Government because, with all the devastating human activity happening in their habitat, pandas can be listed as an endangered species again. Moreover, protection effort and enthusiasm from the global conservation community should be strengthened to save these cherished creatures and the communities that live near their natural habitats.

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THE BENGUELA MARINE ECOSYSTEM

By: Inas Essa

Mother Nature is always generous with its gifts; yet, we should be careful with its resources and never take them for granted. As pollution, climate change, and the misuse of natural resources have been affecting the precious resources dramatically, UNESCO has announced its Sustainable Development Goals (SDGs) for a better world by 2030.

One of the most precious resources that have been facing many challenges is the Benguela Marine Ecosystem, which runs along southwestern Africa and the coastline of Angola, Namibia, and South Africa. It is one of five wind-driven coastal upwelling systems in the global oceans, and it is an important center of marine biodiversity. It is characterized by high productivity due to its distinctive bathymetry[1], hydrography[2], chemistry, and trophodynamics[3]. In addition to holding rich deposits of minerals, its offshore sediments contain rich deposits of diamonds and other precious metals, as well as oil and gas reserves.

The system supports rich fish stocks of sardines, anchovies, horse mackerel, other small pelagic fish, as well as zooplankton and crustaceans. The Benguela Current also plays a significant role in global ocean and climate processes through heat transfer from the Southern Hemisphere to the Northern Hemisphere. The natural beauty of the coastal regions, many of which are still pristine, has also enabled the development of significant tourism in some areas.

Pressing Challenges

Recently, many threats have emerged, becoming more and more pressing; as a result, the Benguela Marine Ecosystem is in real danger. Those challenges can be divided into three main sections.

First, there is the collapsing of several fish stocks as a result of overfishing and ecologically destructive fishing practices following the rapid expansion of fisheries and their heavy exploitation by foreign fleets. Second, there is the regional conflict, which forced more people to live along the coast, where development and industry were poorly-planned, resulting in the decline of coastal habitat. Moreover, the location of the ecosystem makes it more susceptible to the impacts of climate change.

Finally, the incompatible laws and management systems of nations governing marine resources; they do not only lack the resources, they are lacking expertise and legal tools to promote effective management as well.

One Goal Across Boundaries

Many efforts and convictions have been arranged to come up with solutions for those challenges with a long-term vision in thinking towards tomorrow.

The Benguela Current Large Marine Ecosystem Programme sponsored about 100 projects in the region to support strategies emphasizing ecological monitoring. The program offers opportunities for scientists and researchers in the region needed to develop the human capital that would allow the Governments of Angola, Namibia, and South Africa to execute scientific research to maintain effective management of the marine resources. These Governments coordinate their efforts to control marine and land-based pollution and to ensure sustainable fisheries, policies, and regulations that include measures such as suspending fishing to let stocks replenish, marine parks for threatened species and habitats, and oil spill contingency plans.

Since the Benguela Current is a shared resource between Angola, Namibia, and South Africa, conventional coastal and ocean management approaches are not enough. through a series of projects funded by the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) has been assisting the three countries in jointly managing the precious ocean resources they share. Remedying decades of fragmented management and overexploitation of resources in the Benguela ecosystem requires a coordinated effort and consistent action in the years ahead; not only by the three government agencies, but also by local stakeholders and the international community.

The project helped bring the three governments together to examine the ecologic, socio-economic, and governance issues across key sector; such as fishing, tourism, and oil and gas extraction. The countries agreed on and signed a mutual strategy that reflects this integrated approach. By working together, Angola, Namibia, and South Africa are taking critical steps to ensure the long-term future of their shared ocean-based economies and societies. Together, the three nations move towards a better future with shared goals that will help in creating a better world by 2030.

Glossary:

1) Bathmetry: The measurement of the depth of water in oceans, seas, or lakes.
2) Hydrography: The science of surveying and charting bodies of water, such as seas, lakes, and rivers.
3) Trophodynamics: The dynamics of nutrition or metabolism, and is fundamental in understanding the flow of energy through food webs.

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The Renovated Planetarium

A New Operating System for a Brand New Experience

The Bibliotheca Alexandrina (BA) celebrated the reopening of the Planetarium Theater after its closure for several months for maintenance, renovation, and upgrading. The renovation featured a technological breakthrough in the planetarium operating system, using the latest laser technology, in addition to upgrading the theater to accommodate a larger number of audience. The new operating system is the latest in planetarium operating systems in the world; it provides a clearer, more dazzling experience, and more realistic simulation.

The official opening was held on Tuesday, 29 January 2019, in the presence of Dr. Mostafa Elfeki, Director of the Bibliotheca Alexandrina, as well as a number of public figures and guests of honor; including: Dr. Yousry Elgamal, former Minister of Education; the Governor's secretary; Mr. Hisham Seoudi, Head of the Engineers Syndicate; in addition to the Consuls of the United States of America, Italy, and Palestine; and the representatives of cultural centers. The ceremony featured speeches by Dr. Elfeki, Dr. Elgamal, and Dr. Mohamed Soliman, Head of the BA Cultural Outreach Sector. A presentation of the stages of renovation and the capabilities of the new operating system followed. Everyone commended the efforts exerted by the BA work team to restore the glamour of the planetarium, while retaining its outer shape, which simulates the Earth revolving around the Sun represented by the library's building.

The renovation also included the introduction of three new shows, translated and dubbed into Arabic by the PSC. The first show is *The Secrets of Gravity*, in which Limbrador, a student at the school of magic, wonders how things fall on the ground without using magic. Limbrador meets the robot Albi at the Albert Einstein Museum; Albi takes him on a tour around the universe, through time and space, explaining Einstein's theories of gravity and its laws. The second show, entitled *Two Pieces of Glass*, discusses the wonders that can be discovered using telescopes; the show also presents the scientists who contributed to making this possible. Finally, *The Future by Airbus* is a show that invites us to look towards the future, 50 years from now, to wonder how the world will be different from today, and how aviation will change at the time.

The Planetarium opened its doors to receive visitors of the different age groups on 30 January 2019.

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 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**.

Planetarium Science Center
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Memoirs of a Green Husband

To know the Green Husband's story, check the article on page 8.
Illustrated by: Mohamed Khamis