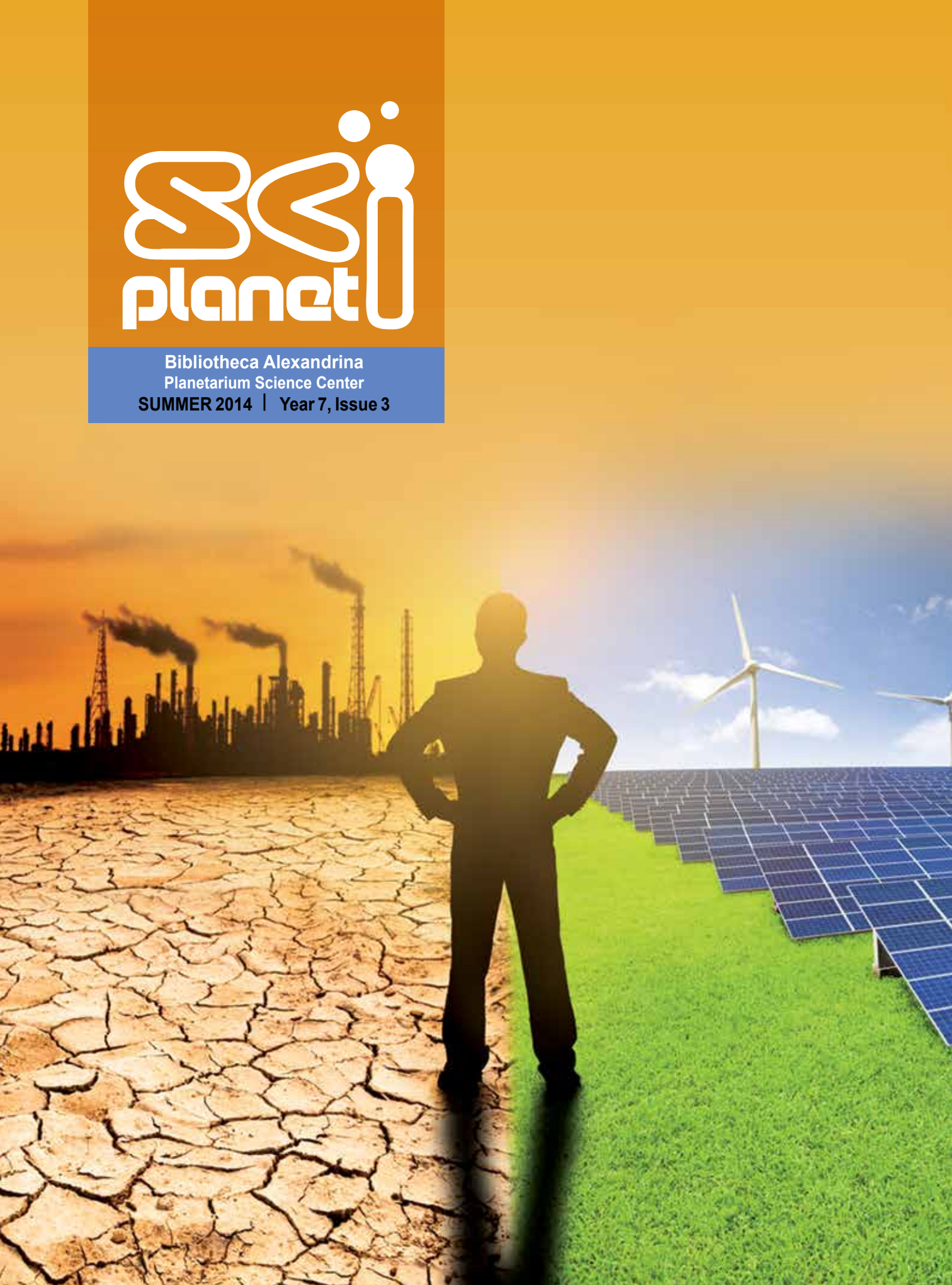




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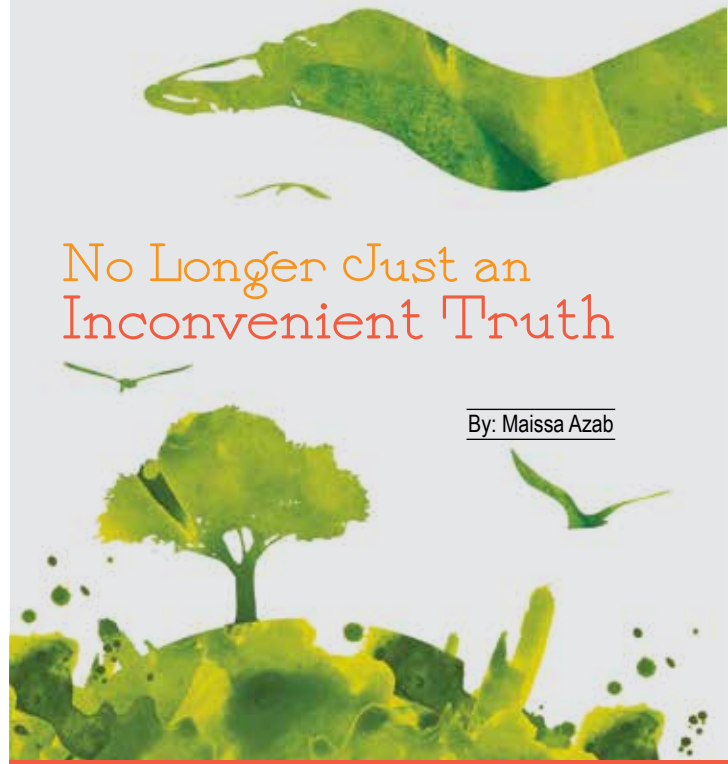


IN THIS ISSUE...

- 4 Do Not Let the Sky Fall
- 5 Mankind and Nature
- 6 Heroes of the Environment
- 8 Ozone Depletion
- 9 Me, My Health, and the Environment
- 11 Saving Genes
- 13 Animal Testing
- 14 Masdar City
- 16 Smart Grids
- 18 Ice Batteries
- 19 Space Pollution
- 20 Air and Water
- 21 Man, an Element of Nature.
- 22 Exploring the Human Civilization Enigma - 03

We are what we eat. We often hear this statement in relation to health issues; but, are we just what we eat? We are what we eat, we are what we drink, we are what we inhale, we are what we build, we are what we make, we are what we sow, and eventually, we are what we reap.

The truth is we, human beings, were put on this impeccable planet, full of life, vibrant with marvelous creatures, each doing its role in an immaculate circle of life, surviving inevitable natural disasters and enduring the



No Longer Just an Inconvenient Truth

By: Maissa Azab

change that comes with them. It is amazing, now that we know what we know about humankind's history on Earth, to realize how mankind had started out on Earth as just another creature.

Evidence informs us early humans drank from nearby rivers and creeks, ate available plants, caught fish and hunted harmless animals to survive another day; they strove to find shelter from predators and phenomena they could not explain. However, humans were different; not only did they have inherent surviving instincts like other creatures, they were created with different physical features and the unique ability to be creative.

Humans went from scouting shelters to building them; from eating plants and hunting animals they found in their path to farming and raising livestock; from avoiding predators to taming them; from fearing inexplicable phenomena to observing and studying them, even attempting to control them. Eventually, humans realized that their physical features, combined with their creativity, have the potential of not only securing

their own survival, but also to reign over terrains, as well as other creatures.

Unfortunately, as humans progressed, spreading their reach over the planet, tightening their grip on its resources and treasures, squeezing greedily for more power and luxuries long-ago considered myth, they have just recently, and surprisingly suddenly, realized they have started to pay the price; a price other creatures have been paying for a long time while humans were busy erecting factories and power plants, building skyscrapers and supersonic airplanes, developing all sorts of processed foods and drinks, and dedicating their life to making money to spend at the mall.

Is it too late though? It probably is for many creatures; but, it is not the end of the world yet. The end of the world will eventually come, but do we have to speed it up? Do we have to spell our own doom? I think we all agree that, if we, humans, are capable of doing all this damage, we are also capable of salvaging it; after all, we are the creative creatures with the opposable thumbs.

MAN and NATURE in Modern Egypt

By: Professor Moustafa Mokhtar Fouda
Minister Adviser on Nature Conservation
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Mother Nature always impresses us by its incredible variety, intense power, notable beauty, and its free of charge goods and services provided to mankind; such as provision of food, raw materials, fuel, freshwater and herbal medicine; regulating climate, waste and water treatment, soil erosion and fertility, pollination, and biological control; and cultural services such as recreation, tourism, aesthetic appreciation and spiritual experience.

Since ancient times, Egypt has relied on a wealth of natural resources to sustain its civilization. The country possesses a wide range of habitats and species representing both tropical and Mediterranean environments. In addition, Egypt has many other heritage resources of value to all mankind. Some are related to geological times, such as skeletons of whales in the Western Desert—a natural world heritage site in Wadi Al-Rayan Protected Area—while other sites represent the Stone Age, about 10,000–20,000 years ago in Gifl Al Kabir Protected Area, where exists caves of swimmers and beasts. These resources have been affected by a host of development pressures in recent years, including habitat fragmentation, invasive species, over fishing and collection of wild flora, pollution and climate change.

The Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA) was established to manage natural resources according to scientific principles, to develop national capacities, and to set and implement policies and

strategies for nature conservation. Considerable progress was made, especially in the management of Protected Areas; about 15% of Egypt's territory, and livelihood of local communities living inside and around Protected Areas; where about 1 million people live.

The sector identifies and addresses management issues, the management resources, such as well trained staff, infrastructure, visitor centers, ecolodges, and outposts, have also improved greatly. Management tools include zoning plans, patrolling and law enforcement, public awareness, information centers, protect coral reefs, restoration of Acacia, ex-situ conservation of threatened species, such as Gazelles and Ibex, and local communities development.

New trends in mainstreaming biodiversity into development sectors are being developed, they include tourism, fisheries and agriculture. RIO+20 conference, which was held in Rio de Janeiro, Brazil, 20–22 June 2012, outcomes have shown that the road map to sustainable development should include institutional and financial reform, implement green economy policies and strategies, and cooperation and synergies among RIO Conventions—biodiversity climate change and desertification. In addition to that, field works have shown that mangrove ecosystems can restore carbon four times than in rainforests, signs of coral bleaching are apparent in the Red Sea, and shifts of floral communities are directed toward higher elevations. Many species of birds, mammals, reptiles

and butterflies have shown changes in migration patterns in terms of timing and sites, as well as changes in their reproductive strategies. These climate change effects may lead to considerable pressure on some economic activities, such as tourism and fisheries, and hence livelihood of local communities.

In spite of all efforts made, critical problems and risks still exist, including inability to retain trained staff, underfunding, lost opportunities to generate substantial revenues, and adapt to and manage rapid and multi-faceted systems, complexity and change.

Proposed correction action for Personal Assistance management (PA management) has been approved recently, including transforming from bureaucratic management culture to objective-oriented performance culture; from centralized planning and budgetary to devolve financially and technically; from personalized decision-making to decisions guided by policy and regulation; and from financial dependent to financially self-sustaining. This is being implemented through three main pillars: firstly, enabling legal, regulatory and operational environment; secondly, revenue tools, such as entry fees, concessions, donors, and more; and lastly, proper use of revenues such as integrated business and biodiversity planning for effective allocation and management of resources.

We hope the current political regime supports the urgently needed institutional reform to enable Egypt to stand again as a leading country to nature conservation.

By: Esraa Ali

Do not let the Sky Fall!

Predictions that the world is about to end have been going on for centuries. Those predictions are extrapolated based upon the estimated effects of several long-term influences that include both natural and manmade disasters. However, the uncertain factor in those assumptions is human interference in nature, which will very likely lead to the termination of a very large percentage of the world's population.

For humans, it will be the most terrible tragedy ever; but for nature, it will just be a normal process. The bad news, someday the world will end, and not just on Earth, but for comets, moons, planets, stars, and everything in our known Universe; the good news, probably not anytime soon.

The world did not end in 2012 as many feared. Predictions were wide-ranging, but they were all about the end of the world on our planet, while the rest of the universe continues spinning on as usual. There are, in fact, multiple scenarios for known risks that can have an impact on our planet. From the perspective of humanity, these risks could include the misuse of technology, nuclear wars, or global warming. Similarly, several natural disasters may pose a doomsday threat, including gravitational interactions with other objects in the solar system, the steady increase in the solar luminosity, or perhaps resource depletion. The latter natural phenomena are part of the structure of the Universe; human beings and their actions are just minor factors that could not prevent their occurrences.

Randomly moving stars may approach close enough to have a disruptive influence on the Solar System; this encounter can trigger an increase in the number of comets reaching the inner Solar System. Among the harmful effects resulting from a major impact

event is a cloud lowering land temperatures by about 15°C within a week, halting photosynthesis for several months. The estimated time before a major impact takes place is expected to be at least 100 million years.

It is also expected that the Sun in about 5 billion years will reach its "Red Giant" stage. Stars convert hydrogen to helium to produce light and other radiation; as time progresses, the heavier helium sinks to the center of the star, with a shell of hydrogen around this helium center core. The hydrogen is depleted so it does not generate enough energy and pressure anymore to support the outer layers of the star. As the star collapses, the pressure and temperature rise until it is high enough for helium to fuse into carbon, which means that helium burning begins.

To radiate the energy produced by the helium burning, the star expands into a Red Giant. The Sun is likely to expand to swallow both Mercury and Venus, reaching a maximum radius of 180,000,000 km. The Earth will interact tidally with the Sun's outer

atmosphere, which would serve to decrease Earth's orbital radius. These effects will act to balance the effect of mass loss by the Sun, and the Earth will most likely be swallowed up by the Sun.

Another reason for world's end, which is one on a long list of extrapolations, is resource depletion due to overpopulation. Every species on Earth, humans included, will reproduce until their population exceeds the resources needed to sustain it.

Food per capita is going down, energy is becoming more scarce, and groundwater is being depleted. Although overpopulation is usually local, it has become now worldwide. After overextending the population, natural corrections will follow, often by famine, which will destroy a very large percentage of the population.

While we observe the world today we might think that we have already arrived at the world's end as our current age is filled with cruelty and awfulness that we tend to shield our eyes from the mess we have made. Human beings are squandering the gift of time that they have been granted on this planet; however, hope lies in the fact that we still have time to correct our errors.

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MAN K I N D and N A T U R E

A Story of Fear and Knowledge

By: Basma Fawzy

As you sit peacefully in the living room on a stormy winter night, enjoying the luxury of modern sophisticated life, has it ever occurred to you how lucky you are?

You drop something on the floor and you say that it is gravity. You see the flash of lightning and you realize that thunder will inevitably follow. Thunder and lightning do not scare you anymore. Think of primitive human beings and how nature must have puzzled and scared them, then think of what we nowadays take for granted.

The popular story tells us an apple fell from a tree and hit Sir Isaac Newton's head; whether it fell on his head or not, that is not the issue. The most important fact in this story is that he did not take the apple's fall from the tree for granted. The fall of the apple inspired him to think of the question of why objects fall to the ground and not move upwards, leading him to his famous theory of gravity.

Newton was not the first one to think of gravity though. Aristotle said that objects fall to the Earth because objects have the tendency to fall towards the center of the universe, and back then Earth was considered the center of the universe. Unfortunately, that theory did not explain why planets do not fall towards the Earth.

Copernicus thus proved Aristotle's theory to be totally wrong when he asserted that the Earth was not the center of the universe and that it is only another planet moving around the Sun. Newton states in his Universal Law of Gravitation that: Every particle attracts every other particle with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

Every object in the universe is attracted to other objects; the force that attracts objects to one another is known as gravity. Gravity depends on the mass of the objects and the distance between

them; it makes an apple fall from the tree because of its mass and the small distance and at the same time it keeps the Moon rotating around the Earth without wandering far off into space or hitting Earth.

Satellites are a good proof of how humanity benefitted from Newton's theory. If scientists can measure the distance and decide on the suitable mass by which it becomes possible to make an object rotate around Earth without falling, such as the Moon, then they can definitely place satellites there that can be used for detecting weather changes or for communication.

Gravity had only puzzled people; thunder and lightning, on the other hand, scared them. Ignorant as they are of this phenomenon, imagine what people could have possibly felt. Some tales, or rather myths, that we nowadays find amusing were the ancients' only way of explaining why some phenomena happen.

"Thunder and lightning", writes Edith Hamilton, in her book *Mythology: Timeless Tales of Gods and Heroes*, "are caused when Zeus hurls his thunderbolt" (p. 19). In short, as Hamilton puts it, "Myths are early science" (p. 19).

Nowadays, science, of course, does not leave that phenomenon unexplained; lightning is an electric charge that occurs because of bad weather. In the sky, the friction between icy raindrops causes electrical charge; negative and positive charges attract each other, resulting in an electrical charge that reveals itself in the form of lightning. That electrical charge makes a huge noise that we call thunder;

because light travels faster than sound, lightning is seen first, then thunder is heard.

The ancients' fear of lightning is justified as it can strike and kill people. Now, when there is a storm, people are advised to stay indoors, to stay away from water, trees, metal objects, and not even take shelter in the highest object around.

Moreover, people nowadays can protect themselves from lightning by putting lightning rods on their houses. The lightning rod is a metal object that is used if the lightning hits the ground to transfer electricity from lightning harmlessly to the ground.

Primitive human beings were not blessed with knowledge; they were only left with phenomena that they could neither understand nor protect themselves from. The story of nature and mankind is a long one; it is a story that started with fear and ended with better understanding of nature. Next time you sit peacefully during a thunderstorm, think of scientists who never took phenomena for granted and who observed nature around them, searching for explanation, and be grateful for the knowledge they gifted us all with.

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By: Moataz Abdelmegid

Heroes of the Environment is a list published in the *Time* magazine. The inaugural list was published in October 2007; it contains 43 entries, individuals or groups who have contributed substantially to the preservation of the environment. The list is divided into four categories: Leaders & Visionaries, Activists, Scientists & Innovators, and Moguls & Entrepreneurs.

The first list was published with a touching introduction by Bryan Walsh, in which he explained the purpose of the list and how the list members were selected. His introduction started with these lines: "Though home to us all, the Earth is mute. It does not get a vote in any congress or parliament. It does not own blocks of shares in the market. It does not rise up at a protest rally. It cannot even buy a hybrid car. The Earth has no voice so someone must speak for it. We call the men and women on the following pages heroes as they were speakers for the planet".

Here, we highlight the most innovative and influential names on the list:

Mohamed Nasheed



Mohamed Nasheed is a Maldivian marine scientist, environmental activist, and politician, who is one of the founders of the

Maldivian Democratic Party and served as the fourth President of the Maldives, 2008–2012.

It was undoubtedly recorded that the tidal currents that swirl within the Maldives Islands regularly shift whole beaches of sand from one side of a cove to another, swallowing and spitting out coral and rock. By the end of this century, according to various scientific projections, the low-lying Maldives may slip below the waters entirely.

Since coming to power in an election that ended a three-decade-long dictatorship, Nasheed championed the fight against climate change. His tiny nation of fewer than 400,000 souls became a symbol both of what is at stake, and what we can do to change it.

Rising sea levels, the consequence of more than a century of industrial growth, may not be the Maldives' fault, but it is the Maldives' problem. What happens to these Islands in the coming years, experts suggest, could indicate what will happen to coastal regions across the globe: "We are on the world's frontline in a sense; we are its only hope," says Nasheed.

Nasheed announced that the Maldives would, within ten years, become the world's first ever fully carbon-neutral nation with an array of eco-energy projects. Environmentalists are hailing Nasheed as a climate-change standard bearer ahead of crucial talks in Copenhagen. His words "We want to shift the global debate from apathy to action" trumpeted during the speech he delivered to the British House of Commons on 6 July 2009.

Still, Nasheed knows that the day could come when no trees or land remain. Soon after taking office, he announced a plan

for a sovereign wealth fund to finance the purchase of land, perhaps in a larger country such as Australia or India, that might serve as a new home for the entire Maldivian population.

Nasheed is clearheaded about the stark reality facing small island nations in the coming century. Buying land is the Maldives' insurance policy: "We do not want to leave," he says, "But we do not want to see our children and grandchildren in tents as refugees either".

Frederic Hauge



Frederic Hauge, a Norwegian environmental activist, is head of a multi-disciplinary international environmental Non-Governmental Organization (NGO) based in Oslo, the Bellona Foundation. He co-founded the organization in 1986; his staff includes only 60 engineers and physicists.

Hauge was active in the environmental organization Natur Ogundom as a schoolboy, and eventually dropped out of secondary school to concentrate full-time on environmental issues. In 1985, he emerged as leader of a small group of environmental activists who received broad press coverage of their nontraditional methods. Among their focus was pointing out locations where toxic industrial waste

had been buried. They also fought against plans for disposal of hazardous waste from titanium mines into surface water.

Frederic Hauge and Bellona Foundation do not limit themselves to working on the local scale. In the 1990s, Bellona established a Russian branch, with a strong focus on how to deal with the large amounts of nuclear waste that had accumulated over the years. This led to several years of controversies with the Russian authorities. Alexander Nikitin, Bellona's representative in Murmansk was arrested by the Federal Security Service and charged for treason through espionage. After several years of court processes, Nikitin was acquitted of the accusations. Hauge later described this period as the toughest fight in the history of Bellona, and with an outcome he was most proud of.

Hauge's powerfully pragmatic approach is to collaborate with heavy industry, not battle it. Bellona aims to help oil majors such as Norway's State Oil Hydro and Anglo-Dutch giant Shell to become greener enterprises. He does not always see eye to eye with big business, but executives at companies as these appreciate Bellona's sound grasp of science.

Hauge is famously known for his quote "The only thing I am more afraid of than environmental threats is apathy".

Joseph Romm



Joseph Romm is an American author, blogger, physicist, and climate expert, who concentrates on methods of reducing greenhouse gas emissions and global warming, as well as increasing energy security through energy efficiency, green energy technologies, and green transportation technologies.

In 2005, Romm's brother lost his house in Mississippi during Hurricane Katrina. This incident made climate change personal to Romm as he began an in-depth research project to determine whether his brother should rebuild there. The result was the 2006 global-warming book *Hell and High Water*. On the cover of his book, he wrote: "The consequences of doing nothing were far more than what people realized".

Romm is now the author of *Climate Progress*, which is by far one of the most influential global warming blogs on the

Internet. In his blog, he combines his scientific intellect with a strong sense of environmental and moral outrage.

Romm takes it as his life mission to make people realize that global warming is a potential human catastrophe, but that it can be fixed with today's green technology applied relentlessly. What began as a once-a-day side job has become full time, with Romm scouring the Internet for climate studies and filtering them through his own firmly fixed values.

Unlike many climate bloggers, Romm comes at global warming not from an environmental background but from a national-security one. After graduating from Massachusetts Institute of Technology (MIT), he worked at the Rockefeller Foundation. His job in the twilight of the Cold War was to identify the world's new big problems; as he talked to experts across the ideological spectrum, he found them: energy and climate change. He believed that these were the sleeper issues that were really going to dominate the coming decades.

Takashi Yabe



Takashi Yabe is a Professor at the Department of Mechanical Sciences and Engineering, Tokyo Institute of Technology. His specialties are theoretical and experimental studies of interactions between laser light and substances. Today, it is valid to say that Yabe is one of the most remarkable thermal and fluid scientists and laser-fusion experts in the world.

In his research, Yabe uses a huge flat screen to help explain the tiny particles that are a major part of his work: the magnesium energy cycle and the Magnesium Injection Cycle, or "MAGIC" as he has named it. Yabe believes that MAGIC, true to its name, could help eliminate our dependence



on fossil fuels by allowing us to build a magnesium-based society in which clean energy is powered by the Sun.

The oceans contain 1,800 trillion tons of magnesium, Yabe explains, enough to meet the world's energy needs for the next 300,000 years. The metallic element with a "white-silver glitter" has never been considered a viable energy source because refining it, at temperatures up to 4000°C, requires a lot of money and energy. Since 2005, however, Yabe and his colleagues have been developing a system of lenses and lasers to harness one of the most readily available sources of energy around. "We use sunlight, and it is free", he says.

Yabe has established a venture business named Electra to realize his dream of the "magnesium-based society" using solar-pumped laser power; he currently serves as its CEO.

Sheri Liao



Sheri Liao is a Chinese environmental activist, journalist, and producer of documentaries, whose works are credited with advancing the Chinese Environmental Movement.

Liao founded an NGO named the Global Village of Beijing (GVB), which is now considered one of China's earliest environmental-advocacy groups. For Sheri Liao, the solution to the problems caused by China's breakneck modernization can be found in centuries-old wisdom in the concept of adaptation to nature. Her idea is to promote a life of harmony through reduced consumption and decreased use of harmful practices in daily lives.

In May 2008, a tragic earthquake hit China causing a death toll of nearly 90,000 people and a massive widespread destruction. Liao and a number of environmental activists spread their environmental messages to a village in southwestern China's Sichuan Province named "Daping" that was devastated in the earthquake. They initially went to help with rescue efforts, but ended up converting the villagers to eco-friendly practices that also help fuel the bottom line.

Now organic farms churn out high-end produce for affluent consumers, and many residents live in houses that have been

rebuilt using materials such as locally harvested bamboo. The idea, as Liao puts it, is to promote “a life of harmony”; an approach that preaches balance between the body and the mind, the individual and society, and people and the planet.

Al Gore



Albert Arnold Gore Jr., famously known as Al Gore, is an American politician, advocate, and philanthropist, who served as the 45th Vice-President of the USA. Al Gore had stumbled into the issue of global warming as a student at Harvard; he grasped the science quickly, and as his political star rose, he never relented in his determination to alert people that we are baking our planet and ourselves with our lust for fossil fuels.

More than a few ignoramuses mocked the Congressman, Senator, Vice-President, and Presidential candidate for his scientific insight. Only after Gore left politics did he find a formula for accomplishing his life's work, creating a global media brand around the PowerPoint presentation that became his aptly titled book and documentary *An Inconvenient Truth*.

Since the film's release, *An Inconvenient Truth* has been credited for raising international public awareness of climate change and reenergizing the environmental movement. The documentary has also been included in science curricula in schools around the world, which has spurred some controversy. The film was awarded the Academy Award in 2006, and it has been generally well-received politically in many parts of the world and is credited for raising further awareness of global warming internationally.

Gore and The Alliance for Climate Protection created the “We Can Solve It” organization, a web-based program with multiple advertisements on television focused on spreading awareness for climate crisis and global warming and petitioning for the press putting more attention on the crisis, the government doing more to help the environment, and their ultimate goal is the end to global warming. Although focused mostly upon the USA, and Americans, it is an international petition and effort; it already has over one million signatures.

Al Gore's film, along with its companion book, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, helped to bring the issues of climate change and environmentalism into the public eye. Al Gore's film and book also helped the former Vice-President win the Nobel Peace Prize, together with the Intergovernmental Panel on Climate Change, in 2007.

In recent years, Gore has remained busy traveling the world speaking and participating in events mainly aimed towards global warming awareness and prevention. His keynote presentation on global warming has received standing ovations, and he has presented it at least 1,000 times according to his monologue in *An Inconvenient Truth*. Gore and his family drive hybrid vehicles to set an example for the parts of *An Inconvenient Truth* where he calls for people to conserve energy.

In March 2010, two non-profit organizations founded by Al Gore, The Alliance for Climate Protection and The Climate Project, joined together; and in July 2011, the combined organization was renamed the Climate Reality Project. In February 2012, the Climate Reality Project organized an expedition to the Antarctic with civic and business leaders, activists, and concerned citizens from many countries.

On the other hand, many environmental criticisms were leveled at Gore. These criticisms included that he has an alleged conflict of interest from his role as both an investor in green-technology companies and as an advocate of taxpayer-funded green-technology subsidies, he allegedly makes erroneous scientific claims, he consumes excessive amounts of energy, and he allegedly refuses to debate others on the subject of global warming.

As the world approaches various thresholds of a complete environmental tragedy, and with the human population continuing to rise by 75 million or more per year, with torrid economic growth in all corners of the world, with the burdens of climate change, deforestation, pollution, greenhouse gas emissions, species extinction, ocean acidification, and other massive threats intensify, the need for such men and women to rise up and speak for the silent planet is an immediate necessity so the world may slow down and listen.

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Earth is an amazing planet; it is the only planet we know so far that supports and contains life. For millions of years, it has existed with living organisms not only benefiting from it, but being a fundamental part of it. The famous saying “from ashes to ashes” is literally true; living organisms are one with the Earth and they always have been. That is until humans came.

With all other creatures being supposedly inferior to humans, they live a certain documented life that rarely deviates from the normal. An animal or an insect does not do things that harm our Planet; it is because humans are the most complex of creatures that they meddle with things they should leave alone. We are solely responsible for harming our Planet and destroying the environment; the ozone layer is one of many things we nearly destroyed.

Oxygen exists normally as the di-oxygen molecule, O₂; however, from about 20 km to 40 km from the Earth's surface, ozone—an oxygen molecule consisting of three atoms with the chemical symbol O₃—exists with higher than normal concentrations. Since it exists at this altitude in relatively high concentrations, it has been labeled the ozone layer.

The Sun emits Ultraviolet (UV) light of different wavelengths; the shorter the wavelength of an electromagnetic wave, the more harm it can do. Short UV rays have the ability to burn cells or alter DNA when they hit a cell, in a way that can lead to mutations causing cancer. What ozone does is effectively prevent the shorter UV rays (labeled UV-C and UV-B) from reaching the Earth through a chemical process.

When UV rays hit an ozone molecule, it splits it into an oxygen molecule and an oxygen atom; this prevents the ray from reaching Earth as it has been absorbed by the ozone molecule. The reaction reaches a certain equilibrium where UV rays cause more splitting, and with time some other molecules combine again to form ozone, and so on, in an endless cycle known as the ozone cycle. This cycle is essential to life on Earth.

In 1970, Professor Paul Crutzen, a Dutch chemist, noticed that nitrous oxide, a gas released from Earth, reaches the stratosphere—the atmospheric layer in which ozone is present. It then transforms

OZONE DEPLETION

By: Ahmed Ghoneim

into nitric oxide, which is a catalyst that increases the rate of ozone breaking, moving the equilibrium more towards less ozone and more oxygen.

He theorized that human activity, mainly increased use of fertilizers in the soil that emit nitrous oxide, has increased the concentration of nitric oxide in the stratosphere more than its natural percentage, causing the ozone layer to deplete. In 1974, Frank Rowland, Chemistry Professor in California, further theorized that Chloro-Fluoro-Carbons (CFCs), which were used in a variety of industrial and home applications such as refrigerators and air conditioners, had the same effect of nitrous oxide, albeit much more grave.

First of all, CFCs do not diminish once released; almost all CFC compounds manufactured from the 1930s until that point in history were still present in the atmosphere. Furthermore, when they reach the stratosphere, they get broken down by UV light to release chlorine, which has a similar but much more catastrophic effect

on ozone to nitric oxide. It was discovered that it is ten times more effective in depleting the ozone layer.

The depletion in the ozone layer increases the amount of harmful UV-B and UV-C rays that reach Earth; this affects all forms of biological life negatively. In humans, it increases risk of skin cancer and eye damage. It has been noticed that it also caused skin burns in other animals, particularly whales, which affects their migration patterns and disrupts the ocean's ecosystem. It has a negative effect on crops as well; some crops such as rice depend on certain bacteria growing to survive, while these bacteria were found to die from UV-B exposure.

Humans, the superior creatures, have attempted somewhat successfully to repair the damage they caused to the ozone layer. Since the discovery of ozone depletion in the 1970s, governments have enacted measures to reduce or stop altogether the production of chemicals that contribute to this phenomenon.

In 1987, the Montreal Protocol was opened for signature. This Protocol banned the production of CFCs and some other harmful chemicals that deplete the ozone. Ever since this Protocol was enforced, there has been a significant decrease in the depletion of the ozone layer which was expected to continue.

In 2014, scientists have revealed new chemicals that contribute to the depletion of the ozone layer. The Montreal Protocol bans a total of 13 compounds from production; at least a dozen new chemicals, however, have been discovered in the stratosphere. The source of these chemicals remains a mystery, for there are currently no documented manufacturers of them.

A particular substance, CFC133a, has been found to increase rapidly in the stratosphere over the past few years; although outlawed, it is still being produced and used. The current explanation for this is that there are parties that are illegally producing it despite the Montreal Protocol.

This is a wake-up call. Even though the world's efforts have seemed to be successful in the past, it appears that there are yet more challenges to face. New chemicals, un-abiding entities producing old chemicals and even other threats to the environment have not yet been tackled. Sure the developed world has no trouble ceasing production of CFCs because they have alternatives. However, do they have the courage to do the same with fossil fuels? When will the human population realize that they are destroying Earth and take action?





A clean environment is essential for human health and well-being. Exposure to environmental pollution remains a major source of health risk throughout the world, though risks are generally higher in developing countries, where poverty, lack of investment in modern technology, and weak environmental legislation combine to cause high pollution levels.

However, it is extremely difficult to assess the complex interactions between the environment and human health; this makes the use of the precautionary principle particularly useful. The best-known health impacts range from ambient air pollution, poor water quality, to toxic chemical exposures, climate change, and degraded urban environments. The resulting impact is estimated to cause over 25% of deaths and diseases globally, reaching nearly 35% in regions such as sub-Saharan Africa.

Outdoor or ambient air pollution is a major environmental health threat affecting everyone in both developed and developing countries. According to the World Health Organization (WHO), around 80% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and strokes, while 14% of deaths were due to chronic obstructive pulmonary disease or acute lower respiratory infections; 6% of deaths were due to lung cancer.

There are six common air pollutants. These are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats. Exposure to these pollutants is associated with numerous effects on human health, including increased respiratory symptoms, hospitalization for heart or lung diseases, and even premature death.

Most air pollution is man-made and includes both “mobile” sources—cars—and “stationary” sources—smoke stacks. Moreover, in those cities where residential

use of coal and wood for cooking and heating is permitted, the emissions from households using these fuels can make an important contribution to the level of urban outdoor air pollution.

People living in low- and middle-income countries disproportionately experience the burden of outdoor air pollution with 88% of the 3.7 million premature deaths occurring in low- and middle-income countries, and the greatest burden in the WHO Western Pacific and South-East Asia Regions.

On the other hand, water pollution, defined as any contamination of water with chemicals or other foreign substances that are detrimental to human, plant, or animal health, is also one of the greatest dangers to human health. These pollutants include fertilizers and pesticides from agricultural runoff; sewage and food processing waste; lead, mercury, and other heavy metals; chemical wastes from industrial discharges; and chemical contamination from hazardous waste sites.

Worldwide, nearly two billion people drink contaminated water that could be harmful to their health. Even our clearest streams, rivers, and lakes can contain chemical pollutants. Heavy metals such as lead and mercury can produce severe organ damage. Some chemicals can interfere with the development of organs and tissues, causing birth defects; others can cause normal cells to become cancerous.

Some chemical pollutants enter water sources as runoff from agricultural fields—pesticides; or as drain water—from kitchens and bathrooms—from human homes and businesses. These pollutants also seep

into groundwater reservoirs from landfills and underground sewage containers; after they enter groundwater sources, they contaminate freshwater drinking supplies and are difficult to clean up. Moreover, some of our waterways also contain human and animal wastes.

The bacteria in these wastes can cause high fever, cramps, vomiting, and diarrhoea. These illnesses are particularly dangerous for young children; in fact, they account for almost 60% of early childhood deaths worldwide. Although sewage treatment plants have reduced the occurrence of water-related illnesses in some nations, less developed nations still struggle to find safe, fresh water. In some regions of the world—parts of India, China, and Africa, for example—water-related illnesses are still a leading cause of death.

In recent decades, a wide range of modern pollutants have emerged. For instance, roughly 40 million metric tons of electronic waste (e-waste) are produced globally each year, and about 13% of that weight is recycled mostly in developing countries. Developing countries with rapidly growing economies handle e-waste from developed countries, and from their own internal consumers. About 9 million tons of this waste—discarded televisions, computers, cell phones, and other electronics—are produced by the European Union.

Exposure routes can vary dependent on the substance and recycling process. Generally, exposure to the hazardous components of e-waste is most likely to arise through inhalation, ingestion, and skin contact. In addition to direct occupational—

ME, MY HEALTH, THE ENVIRONMENT &

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formal or informal—exposure, people can come into contact with e-waste materials, and associated pollutants, through contact with contaminated soil, dust, air, water, and through food sources, including meat.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal bans the exchange of hazardous waste, including e-waste, between developed and developing countries.

The process of climate change, including both increases in global average temperatures (global warming) and changes in other climate characteristics such as the spatial and temporal distribution of precipitation, has important implications for human health. Scientific research has shown that the temperature of the Earth has risen to an alarming figure during the past few years. It will most probably rise further if we do not stop polluting the environment.

In recent years, not only many forests have been burnt because of the extremely hot weather, but also human health has been severely affected. In fact, the health of human populations is sensitive to shifts in weather patterns and other aspects of climate change.

These effects occur directly, due to changes in temperature and precipitation

and occurrence of heat waves, floods, droughts, and fires. Indirectly, health may be damaged by ecological disruptions brought on by climate change—crop failures, shifting patterns of disease vectors—or social responses to climate change—such as displacement of populations following prolonged drought.

In recent years, however, it has become apparent that promoting human health sometimes undermines environmental protection. Some actions, policies, or technologies that reduce human morbidity, mortality, and disease can have detrimental effects on the environment. For example, food is necessary to sustain human life.

Malnutrition can weaken the human immune system and exacerbate many health problems. Each year six million children under the age of five die from starvation, and hundreds of millions of people are malnourished. The production of food, however, can have a variety of adverse environmental impacts, including deforestation, habitat destruction, loss of biodiversity, and air and water pollution.

Although different modes of food production—industrial vs. non-industrial—have different environmental impacts, no method of producing food leaves the

environment unscathed. Mosquito-borne illnesses, such as malaria, are a major public health problem in the developing world. Some of the methods applied to prevent mosquito-borne illnesses, such as draining swamps and spraying pesticides (especially DDT), can have adverse environmental impacts, such as destruction of habitats and species.

Finally, medical care itself creates a great deal of waste and pollution that can harm the environment. Hospitals use large amounts of electricity, oil, coal and natural gas, and produce tons of hazardous medical waste, such as used syringes, bandages, and gloves, and leftover tissue and blood which contribute to environmental pollution.

In conclusion, it is important to understand the various forms of pollution and how it is created to identify the best way to stop it. Most sources of outdoor air pollution are well beyond the control of individuals and demand action by cities, as well as national and international policymakers in sector as transport, energy waste management, buildings and agriculture.

Although e-waste management has made great progress in the past decade, and many laws and regulations have been implemented in different parts of the world, the informal e-waste recycling processes still exist. How to effectively and universally implement these policies and measures is still a key point.

Averting the onset of pollution in any area could be the start and the simplest preventive solution to the problem. This calls for a conscientious effort to adopt good practices or habits by the people, the passage and the proper implementation of appropriate government laws, and the strict compliance especially by potential industrial pollutants.

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SAVING GENES FOR A RAINY DAY

By: Hend Fathy

Approaching the topic of gene banks, the first thing that popped into my head was the story of Prophet Noah, who crowded a pair of every type of creature into an enormous arc, riding out a catastrophic flood to repopulate a ravaged Earth.

In today's Earth, where biodiversity is endangered by the human-induced catastrophic impacts of climate change, ecosystems failure, deforestation, pollution, etc., researchers are busy collecting genetic samples from animals and plants, storing them away to preserve the blueprints of the different life forms for ages to come.

Having lost their natural habitats or failed to keep functioning within them, many creatures have found home in tubes frozen in liquid nitrogen. If this seems hardly conceivable to you, let me introduce you to gene banks.

According to the International Union for Conservation of Nature (IUCN) Red List website, there are 61 Extinct-in-the-Wild (EW) species and 4,286 Critically Endangered (CR) species. Understanding the potential great loss, different initiatives around the world preserve genetic information for animals to provide a chance for future reproduction.

To that end, scientists cryopreserve* diverse specimens of sperm, eggs, hair, skin, and blood from target species. This frozen material can be used in numerous applications such as reproduction using stem cells and cloning, genetic rescue, genome editing, and de-extinction.

Founded in 1972 at San Diego Zoo's Institute for Conservation Research, the Frozen Zoo® is a key player in conservation efforts. It includes samples from over

10,000 individuals, representing more than 1,000 species and subspecies. The Frozen Zoo® has been leading the world's attempts to save the African white rhinos, of which less than ten individuals currently remain in captivity.

Having the efforts of natural breeding failing over the years due to several factors, the team is now counting on the notion of genetic rescue—the process of restoring a species to full genetic health—and the advances in stem cell research using the species' cryopreserved samples. The team aims to create a healthy northern white rhino embryo that can be implanted into a similar rhino species surrogate, allowing for a natural birth of the threatened creature.

Oliver Ryder, Director of Genetics at the Institute for Conservation Research, states that “the possibility to save cells allowed us to undertake research right from the beginning that was relevant to reproducing endangered species”. “Each cell of an individual is capable of producing the entire individual”, he continues.

It is worth mentioning that scientists are not only concerned with endangered animals. Different countries established gene banks to store samples of their national livestock breeds, in an attempt to maintain food security for future generations.

The preservation of plant genes is a much older practice; for thousands of years, farmers have stored away seeds to ensure future harvests. Unlike animal gene banks that mainly target endangered species, seed banks are basically concerned with the genes of today's abundant vital crops.

Massive fields around the world support few crops that feed millions, which puts our food supply in a very delicate situation. What happens if climate change introduces new pests or renders an area inhospitable to these crops? Maintaining crop diversity is, thus, an essential reason for saving plants genes.

Different varieties of plants have different genetic traits that evolved and adapted to different conditions over time. Corn and wheat, for example, are grown

in different areas with different climates, creating many varieties of them.

There are two methods to preserve botanical genes depending on the degree of freezing. Either seeds are dried and stored at normal freezing temperatures, allowing them to survive for decades, or freezing them at cryonic temperatures—vastly increasing their shelf life—though at a far much higher cost.

Resting at more than 1,100 kilometers south of the North Pole is the Svalbard Global Seed Vault—AKA Doomsday Vault—which functions as a global repository and backup for all other seed banks. The vault is designed to survive catastrophes, and can hold up to 2.25 billion seeds in total, protected by 1-meter thick walls of steel-reinforced concrete. Priority for space is given to vital seeds that ensure food production and sustainable agriculture. The vault is managed by the Norwegian Government, the Global Crop Diversity Trust (GCDDT), and the Nordic Genetic Resource Center (NordGen).

Gene banks are much more than a global backup system for species to use at the deletion of important files; studying these genes would help us better understand how the world works. Scientists would be able to deduce the genetic traits crucial to the survival of different creatures and, hence, cater conservation actions addressing them. Genetic engineers can use this knowledge to make living organisms more adaptive to climate changes and more resistant to disease breakouts, saving them from extinction, and saving the legacy and future of Planet Earth.

Glossary

***Cryopreservation** is a process where biological material susceptible to damage by chemical reactivity or time are preserved by cooling to extremely low temperatures.

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Predicting toxicity, corrosivity, and other safety variables, as well as the effectiveness of a new product for humans, in addition to testing chemicals, medical devices, and new drugs involve the use of animals. Many of these experiments cause pain to the animals involved, or reduce their quality of life in other ways.

ANIMAL TESTING

By: Sara Khattab

the cells or tissues of animals—relative replacement.

These modern methods include sophisticated tests using human cells and tissue, computerized patient-drug databases and virtual drug trials, computer models and simulations, and stem cell and genetic testing methods.

Alternatives to the use of animals in toxicity testing include replacing animal tests with non-animal methods, as well as modifying animal-based tests to reduce the number of animals used. Several non-animal methods have been formally validated and accepted by some countries as replacements for an existing animal test; such as embryonic stem cell test using mouse-derived cells to assess potential toxicity to developing embryos, has been validated as a partial replacement for birth-defect testing in rats and rabbits.

Human skin model tests are now in use, including the validated EpiDerm test, which has been accepted almost universally as a total replacement for skin corrosion studies in rabbits. The use of human skin leftover from surgical procedures or donated cadavers can be used to measure the rate at which a chemical is able to penetrate the skin.

Microdosing can provide information on the safety of an experimental drug and how it is metabolized in the body by administering an extremely small one-time dose that is well below the threshold necessary for any potential pharmacologic effect to take place.

Computer modeling also can replace certain kinds of animal use, particularly in education. Some biology classes started to practice dissection on a computer model rather than on real living frogs. Even medical

schools are beginning to develop “virtual reality” devices for students to practice on. Plastic models and realistic manikins also can take the place of live animals for some educational purposes.

Redesigning studies to collect as much information as possible from the same set of animals can also reduce animal usage. For example, if one researcher is studying rat brain tissue, when killing the rat, he can allow other researchers to use the kidneys, liver, or other parts of the animal for their own studies. Some alternative methods involve using lower organisms in place of species higher on the evolutionary scale. Such studies may use plants, microorganisms, invertebrate animals, or even early-stage vertebrates rather than vertebrate animals.

Unfortunately, replacement of animals is not always possible. Until now, some important kinds of testing just cannot be done without animals, at least nowadays. In these cases, researchers can still work to reduce the number of animals used in a given study. With careful experimental design and sophisticated statistical techniques, it is often possible to use far fewer animals and still obtain valid results.

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By: Lamia Ghoneim

MASDAR CITY:

THE SUSTAINABLE CITY OF THE FUTURE

Imagine living in a city with no cars and no pollution-filled crowded streets, never having to fight your way through traffic or smell the stench of car exhausts or cram yourself in a tightly packed bus just to reach work every morning.

Now imagine your morning commute starts in the quiet cabin of a self-propelled electric pod, guided by magnets, powered by the Sun, travelling through a maze of underground tunnels at a comfortable speed of 15 mph (24 km/hr). No transport cost, fuel consumption or air pollution; your daily transport completely sustainable and environmentally friendly.

In our polluted, fossil fuel dependent world, such a scenario seems impossible; an environmentalist's dream that is far beyond our reach. Not anymore. This dream city does exist, albeit in the most unlikely place.

In a desolate stretch of Arabian Desert, rising just outside the oil-rich State of Abu Dhabi, there lies "Masdar City", the world's most sustainable, green, and low carbon eco-city. A model city where residents live with solar power and driverless vehicles, shaded streets cooled by a huge wind tower, and a Big Brother-style "green policeman" monitoring their energy use.

What is Masdar?

Initiated in 2006, Masdar City is a 700-hectare development outside Abu Dhabi with a projected population of 40,000; in addition to 50,000 commuters. Expected to be fully functional in 2025, Masdar is designed to be carbon-neutral, completely powered by renewable energy, to require 60% less water per capita than neighboring cities, to use significantly less energy per capita, and to recycle all its waste.

With Phase One of construction now complete, Masdar is up and running, complete with an operating "Masdar Institute of Science and Technology"; a research university dedicated to cutting-

edge solutions in the fields of energy and sustainability.

The city is named for the Government backed renewable energy company—Masdar meaning "the source" in Arabic—a company with a mission to reduce the State's CO₂, accelerate the development of renewable energy, and to secure long-term income from international renewable energy projects.

Their challenge was to create a city that can be a model for sustainability, thereby demonstrating what can be done for a fossil fuel free future, and to be able to provide a medium upon which to refine green technology.

Clean Energy and Smart Design

How can a city in the middle of the bare, resource poor, and scorching hot desert operate carbon free?

First, engineers had to provide a clean energy source with enough capacity to fuel the Masdar City of now and the future. Their design took the Desert's greatest threat, the Sun, and turned it into its greatest asset.

The first step was in 2009 with the completion of a USD 50 million, 22-hectare field of 10 megawatt solar photovoltaic power plant—the largest solar farm in the Middle East—to power Masdar City in its beginning. That power plant couples with a smaller one Megawatt solar facility spanning the city's rooftops to supply all of Masdar City's energy needs.

Even with established clean energy sources to power the eco-city, the city's architects needed to find a way to limit energy consumption in a place where weather conditions require high energy for cooling needs.

To save energy and still maintain a cool atmosphere in the hot desert region, Masdar City's architects sought out a surprising source of inspiration: the past. The architects studied ancient civilizations to conjure up a solution to cooling as well as energy consumption concerns.



Inspired by ancient Arabic designs combined with modern technology, the architects are minimizing the city's cooling requirements applying passive techniques such as aligning the city's streets with the prevailing wind, making them narrow so as to channel the wind more efficiently, and designing building facades that are able to minimize solar glare.

The city is surrounded by a terracotta wall, which separates it from the desert, with the site raised slightly from the land, which helps cool the air significantly, and the buildings are situated close together, unlike many developments in the UAE, creating shaded, pedestrian thoroughfares.

Engineers are also utilizing an old technology known as "Wind Towers", which dates back up to 3,000 years, to the ancient Egyptian civilization. Already erected is a 45 meter high wind tower, which works in two distinct ways: On calm days it heats up and hot air flows upwards through the column. This establishes a street-level breeze and cools the surrounding area by a perceived 5°C. When there is wind the tower's louvers are adjusted to direct cool air down the column, exiting at street level. The narrow streets of Masdar efficiently channel this air away from the base of the tower, maximizing the cooling effect.

The developers are also using state of the art thermally efficient construction materials along with the ancient architectural features to achieve an unprecedented level of energy efficiency. High and low heat density materials are used to take advantage of the desert sun so as to minimize heat gain and maximize cooling breezes.

Water Conservation and Sustainability

Water conservation is essential for a sustainable environment, which is why Masdar City planners went to great lengths to ensure the reduction of the city's water consumption. Using high efficiency appliances, low-flow showers, a water tariff and smart water meters ensured no water is wasted.

Also, Masdar City plans to recycle most of its used water, starting with the greywater* recycling program, which in addition to the water saving fixtures employed have managed to reduce consumption by 54 percent.

To keep waste at bay and ensure the carbon footprint created in the building process remains as small as possible,

workers of Masdar City use green recycling techniques and materials.

Streets are lined with concrete mix made from granulated blast furnace slag—a byproduct of steel production waste that would have otherwise ended up in a landfill. Also, almost all metal works used in Masdar City buildings are made from recycled metal scraps, such as recycled aluminum for building facades and extrusions, and recycled steel scraps for reinforcing bars in Masdar Institute buildings.



Driverless Vehicles

Mostly aimed at being highly pedestrian and bicycle friendly city, Masdar's shaded cool streets encourage the oldest forms of transportation and are completely free of gasoline-run automobiles; all vehicles must be abandoned in a garage outside the City's massive wall.

Instead, for those who tire of walking and cycling, Masdar offers an integrated smart transportation network, beginning with the aforementioned electric pods, known as Point-to-point Rapid Transit system (PRT) that operate underground and are guided by magnetic sensors, and powered by solar energy.

Originally, the pods were supposed to span the entire city, but due to the high cost of the underground system, the pods do not cover the entire city, and are complemented by a fleet of environmentally friendly Mitsubishi i-MiEV electric cars that operate on a ride-share program to reduce transport cost.

Electric buses and rails are also planned to complete the City's transportation network in the future.

Masdar Now

Construction is booming in Masdar City, as neighborhoods are growing around the Masdar Institute of Science and Technology (Masdar Institute "MI") that serves as the nucleus of the city. MI—founded with the assistance of MIT in Massachusetts—has become one of the

Middle East's most promising institutes, already responsible for 40 patent-application disclosures. The recently completed expansion of the Institute will enable growth to over 600 students and four centers, now covering 163,000 m².

On the University campus there is a bank, a sushi bar, canteen, organic food shop and a concrete basement where the driverless pods transport passengers from the entrance of the City to the Institute.

Near the operating University is the energy-saving Middle East headquarters tower of Siemens, in which more than 800 staff work. The award winning building has been designed with sustainable materials and energy efficient technologies, with shading on the façade designed to optimize natural light transfer to the interior, while limiting the amount of direct sunlight emitted through the windows, which helps with cooling and reduces the energy-intensive air conditioning burden.

Phase Two of construction will see the completion of a three block building that will be the new permanent headquarters of the International Renewable Energy Agency (IRENA), scheduled to be completed this summer.

More research facilities and energy technology companies are choosing to build their headquarters in Masdar, including General Electric and SK Energy, whose buildings are currently under construction.

By 2015, Masdar City is expected to have 7,000 residents and 12,000 people commuting from Abu Dhabi.

Although the ambitiously green city is at an early stage of its development due to several delays in its schedule, and has yet to reach its original expectations of zero carbon and zero waste, it has come fairly close to achieving a truly sustainable and environmentally friendly setting.

While the high cost of the Masdar City project (almost USD 18 billion), will remain an obstacle for other cities to completely follow suit, by proving that living without fossil fuel is possible and that solar energy can truly replace it, Masdar has undeniably accelerated the employment of renewable power around the world.

Glossary

* Greywater is a wastewater that turns greyish when stagnant and does not include any organic material.

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SMART GRIDS: The Future of Electrical Supply

By: Ahmed Ghoneim

Electricity is at the heart of all modern things. The whole world relies on and uses electricity daily in a multitude of devices that are crucial to everyday living. The problem is that our demand is too high and it is often more than the supply. In Egypt, for instance, power outages are a common issue caused by high loads from consumers. There are generally two ways in which the power problem can be tackled, either by increasing the supply, which is difficult; or attempting to reduce the consumption or demand. Smart grids do the latter.

Electricity does not just “pop up” in our walls; electrical supply is a complex, elaborate process that involves many stages. Electrical supply is composed of what is known as an electrical grid, which is a complex network of connections and devices that provides electricity to homes and institutions. The first step in the grid is the power station.

A recent incident in the Fukushima Plant in Japan, which resulted from the 2011 tsunami, has caused the global community to panic about nuclear energy, with countries such as Germany planning to close all nuclear plants in the near future. The only remaining sources that are being used and further explored are renewable resources.

Hydroelectric energy, as in the Aswan High Dam, is a relatively stable and year-long source in many countries. However, it only produces about 10% of Egypt's electricity. Wind, solar, and geothermal energy are also used with varying success, but the biggest challenge with these sources of energy is that they are intermittent, meaning they do not provide a steady current all the time, being that they depend on environmental factors, and the cost of setup.

Negative Effect of Fossil Fuels

Power plants relying on coal or petrol usually produce polluting gases, which is why they are located far from the residential places they provide electricity for. An exception to that is natural gas, which is the cleanest of the fossil fuels and allows having power stations close to residential areas. However, this is not the only negative environmental effect fossil fuels can have.

The biggest threat to the world and humanity as we know it is due to the massive release of carbon dioxide caused by burning fossil fuels. Carbon dioxide emissions increase its concentration in the air, which leads to the greenhouse effect in which the Sun's energy is trapped more strongly in the Earth than before, increasing the average temperature of the Earth.

This is why it is important to find alternate sources of energy and more importantly, reduce power usage and increase efficiency, because a lot of electricity goes to waste without being properly employed.

Alternate Sources of Energy

A growing trend, which forms part of our topic, smart grids, is using sources of energy other than fossil fuels in power plants. Nuclear plants are an expensive choice, but they produce large amounts of energy without polluting the air. However, they pose the risk of radiation exposure if any failure happens in the plant, which could be catastrophic.

1) The Power Station

The power station is where electricity is generated. It depends mainly on a rotating device, called a turbine or generator that generates electricity when turned. This device can be powered in a variety of ways; however, most of the power stations in the world rely on burning fossil fuels such as coal, natural gas, and petrol to provide energy to turn the generators.

Supply and Demand

Since power demand varies, supply must always exceed the demand to prevent blackouts and failures in power plants. This is a difficult task because if too much electricity is generated in any single instant, this electricity is lost because it cannot be feasibly stored on the spot.

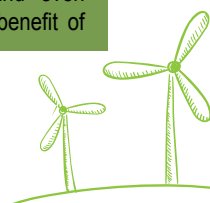
Power stations use very complex control systems that monitor and attempt to foreshadow electrical usage and adjust generation accordingly. Interestingly, weather forecasts play a huge role in power generation. When the weather is too hot or too cold, it means consumers will be turning on their ACs or heaters, and that the demand will be high.

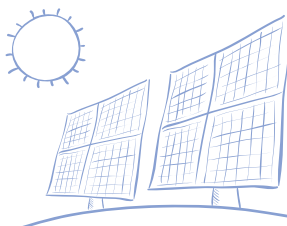


2) Transmission Lines

After exiting the power station, the voltage produced is stepped up (increased) to a very high level and fed to transmission cables, which are usually the overhead cables you see along the road. The voltage is stepped up because this decreases the current. Lower current means lower losses.

Very little energy is lost during transmission. In this world's old electrical grid system, this stage is probably the most optimized. Transmission lines are interconnected in a way that makes them form networks between cities and even countries, and provide the benefit of





load sharing, where a region with higher demand borrows electricity from a region with lower demand.

This system is not without its cons, however, for transmission lines are only one-way, meaning they do not give back any feedback from the users, which makes obtaining detailed information hard.

3) Distribution

Since electricity is transmitted at such high voltages, it has to be stepped down before it reaches houses. It is then branched off and distributed right to your doorstep. This is the third part of the grid, distribution.

Distribution is also a one-way process. There is no way you could monitor each house's individual status and usage statistics. There is no way you can control which devices or parts of the house receive more electricity than others. Enter the smart grid.

The Problem

The current system of electricity does not differ much from what was installed in most countries one-hundred years ago. It is old and impractical, it does not fit the needs of the current digital age and it is not flexible enough to incorporate multiple, small sources of intermittent power at times of need. This calls for the development of a new system, correctly titled the smart grid that relies on computer technology to change the electrical supply system.

The Smart Grid

Instead of solely relying on central, high-power producing stations that do not allow for much flexibility at times of higher and lower than average demand, the smart grid uses distributed supply. Multiple, smaller power stations such as wind and solar-powered stations are situated closer to residential areas where they can give a boost of electricity when needed, or reduce the load off central, bigger stations whenever possible.

How will the people at the central station know if these smaller, intermittent-power stations currently have power hence reduce their production? The smart grid upgrades

the transmission and distribution lines to two-way lines. Instead of just giving power to consumers, each unit—house, apartment, or company—provides feedback about its consumption and production.

For example, if each house has solar panels, data about the power stored or produced currently from these panels is fed back to the central power station where they can reduce their production a bit if there is surplus. Or if the demand is currently high, the power company can remotely activate the solar panels to provide the houses more electricity from them, or even let them share power amongst each other, while even compensating them for the power they provide!

What happens if the demand is still too high and there is not enough power at all to produce it? In the current days, too high a demand could lead to massive blackouts that may go on for days on end. With smart grids, however, a special service could allow power companies to send messages to consumers asking them to turn off some of the more power-consuming devices, or even directly cut off power from these devices!

Imagine if power was low but you, at least, still had the lights on, even though you cannot use your microwave for a while. That would be much more convenient. The Egyptian Government has launched a new app on mobile phones entitled "Khod Balak". The app will detect your location and send you messages about power availability in your area. When demand is too high, it will suggest what devices you can turn off to reduce consumption.

Smart Home

Smart grids can integrate tightly, or even pave way for realizing the dream of smart homes. Have some clothes in your washing machine? Let it run when power demand is lowest. Left a room but forgot to turn off the lights? The lights will turn themselves off after a while, reducing loads on generators and decreasing your power bill! Your house can even be scheduled to charge your hybrid car at optimum times or turn off other devices as it charges your car first.

With the current state of energy sources, the eventual depletion of fossil fuels and their negative effect on the environment, the inefficiency of turning on more power plants that typically waste lots of energy at times of high demand, the world needs smart grids.

Unfortunately, it is still not a reality in any part of the world. Developed countries have intensified research and development in this area as their governments lay out promises of rolling out smart grids gradually. The future of electricity is coming, and hopefully we—the developing countries—will be a part of its realization.



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I was checking my power bill when the light went out for a couple of hours, which was ironic. At the moment, I suffered a brain freeze, not just because the electricity went out again, but rather because of what I saw in my bill; a number that almost made me cry.

When the electricity came back, I read what the Minister of Electricity said about the daily blackouts; he talked about appliances that consume too much power. Then, I realized why I had to pay that large amount of money, so I asked my dearest friend, Google, to learn more about these appliances, and to know what scientists could offer to solve this problem.

First of all, when I searched the largest energy contributor, I found that Heating, Ventilating, and Air-Conditioning (HVAC) demand a lot of energy. As electricity for air-conditioning can be shifted easily, thermal energy storage is becoming a more popular air-conditioning choice for high-performance commercial properties. Therefore, scientists have tried to figure out something that could help us save energy, money, and to stop relying on few sources of energy.

Moreover, I found a couple of companies that figured out a solution for this growing problem; both of them rely on what is called the “Ice Battery”. Portland General Electric (PGE) in Oregon will soon start a pilot program using icy slush to store energy from wind turbines when they overproduce, tapping into it when the turbines fall still.

The Applied Exergy Company developed PGE’s icy solution: a Thermal Approach to Grid Energy Storage (TAGES). It uses a heat pump, driven by excess energy from wind turbines or solar panels, to cool water into a pumpable icy slush, which is then stored. The slush is run through the heat pump the other way to retrieve the energy, powering a turbine as it melts. Using waste heat from a coal plant to power the heat pump can mean 80% of the energy put into the slush can be retrieved.

Moreover, Energy Storage Systems (ESS), in Portland, Oregon, is using a flow battery containing a solution of iron and water. Electricity is stored in the system by seeding iron ions with excess electrons. When that electricity is acquired, the iron is pulled between two electrodes, which strip it of the excess electrons. The Company is planning to fit an iron ion battery at a local vineyard to help the growers balance their energy more effectively and obtain more out of their solar panels and wind turbines.



ICE BATTERIES

By: Omar Raafat

Furthermore, we can even use more familiar material such as glass for energy storage. According to this Halotechnics of Emeryville, California, (PGE) developed a phosphate-based glass with a melting point low enough for it to become a storage medium. As they developed a glass that you can pump like a liquid, which has a viscosity order of magnitude below traditional window glass and at 400°C is about the viscosity of honey, the glass could be pumped to where energy is needed. As it cools and solidifies, it releases heat that drives a steam turbine to make electricity.

Chris Dieterle, a power analyst at (PGE), says that these new batteries hold a lot of promise for handling the energy from

renewable sources. California’s legislation has been a game changer; it sends a message out to everyone else that this is a very serious matter and there need to be some breakthroughs.

Moreover, Calmac, the world leader in the product design and manufacture of thermal energy storage, figured out hybrid cooling system, which uses an ice bank thermal energy storage tank to make and store ice for use in air conditioning systems when the wind is not blowing or the sun is not shining, like in after dark hours. These “IceBank” tanks are made of heavily insulated polyethylene and contain a spiral-wound, polyethylene-tube heat exchanger surrounded with water.

Thus, buildings without on-site renewable energy power generation can use ice batteries. Ice can be made at night during off-peak times, when electricity rates are cheaper and when a cleaner baseload generation is used. They can control electricity consumption, by making a lot of ice at night and then, during the day, use that ice to cool the building. They have essentially shifted energy usage of a major portion of the building from day to night. Nighttime electricity is less expensive, more efficient to generate and less polluting. Moreover, it happens to correspond with when wind is mainly blowing.

Being smarter about generating and storing energy in buildings will allow us to lower our dependence on fossil fuels, while providing more reliable and efficient sources of energy to repower our world.

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On 4 October 1957, the first artificial satellite, Sputnik I, was launched, carrying equipment to measure the density of the atmosphere; 96 days later, Sputnik I re-entered the Earth's atmosphere. On 12 April 1961, a Soviet test pilot, Yuri Gagarin, became the first human being in space. These two events marked the beginning of a new form of exploration and the beginning of a new and unfamiliar type of pollution at the same time. Space junk has made such a mess of Earth's orbit that experts say we may need to finally think about cleaning it up.

Satellites, solar panels, rocket bodies, and fragments from space shuttles that are floating in space and are no longer functional are considered space debris. This type of debris has the speed to collide with meteorites and make further opportunity for damage to other objects in space. Even very small objects can do considerable damage; for example, a paint chip could puncture the space suit of an astronaut. This debris can also float to Earth and re-enter the Earth's atmosphere; over 14,000 objects have fallen to the Earth over the past 30 years.

In 1978, the Soviet Union Kosmos 954, which contained a nuclear power source, re-entered over Canada and left debris over an area the size of Austria. In 1969, five Japanese sailors were injured by pieces of space debris that hit their ship. The largest piece, weighing 453.592 kg, landed in Australia in 1979. Although no life-threatening damage has resulted from collisions thus far, the potential threat remains.

There are 22,000 objects in orbit that are big enough for officials on the ground

to track and countless more smaller ones that could do damage to human-carrying spaceships and valuable satellites. "We have lost control of the environment," said retired NASA senior scientist Donald Kessler, who headed the National Academy of Sciences report.

Since the space age began 54 years ago, civilization has littered the area just above Earth's atmosphere with leftover boosters and other parts that come off during launches, as well as old satellites. When scientists noticed that this could be a problem, they came up with agreements to limit new space. Those agreements are intended to make sure that what is sent into orbit eventually falls back to Earth and burns up.

Two events in the past seven years—a 2007 Chinese anti-satellite weapon test, and a 2009 crash-in-orbit of two satellites—put so much new junk in space that everything changed, the report said. The widely criticized Chinese test used a missile to smash an aging weather satellite into 150,000 pieces of debris larger than 0.01016 m and 3,118 pieces can be tracked by radar on the ground, the report said.

"Those two single events doubled the amount of fragments in Earth orbit and completely wiped out what we had done in the last 25 years," Kessler said.

The report briefly mentions the cleanup possibility, raising technical, legal and diplomatic hurdles. It refers to a report issued earlier by a US Department of Defense that outlines all sorts of unusual techniques. The report by the Defense Advanced Research Projects Agency is

entitled "Catcher's Mitt" and it mentions harpoons, nets, tethers, magnets, and even a giant dish or umbrella-shaped device that would sweep up tiny pieces of debris.

While the new report does not recommend applying the technology, Kessler said it is needed. He likes one company's idea of a satellite that is armed with nets that could be sprung on wayward junk. Attached to the net is an electromagnetic tether that could either pull the junk down to a point where it would burn up harmlessly or boost it to safer orbit. NASA officials said they are examining the study.

Many solutions are being considered by scientists and engineers, however, the challenge to finding a solution lies within all of the nations who have helped to pollute our space. If the nations do not put these solutions now into action, we will face another crisis in addition to the already existing problems.

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Air & Water

By: Dr. Mohamed Soliman
Director, Manuscripts Museum

“Although Arab and Muslim physicians had no knowledge of bacteriology, their writings about the causes of diseases and their transfer, as well as their indications to environmental pollution and healthy living highlight their profound accuracy of observation, experimentation, and understanding. Any fair researcher can validate this claim by reading the texts they wrote about the causes of diseases.”

That is how Dr. Mahmoud Alhag Kassem Mohamed from Iraq began his brilliant article on environmental health in Islamic Arab heritage; the article was divided in two parts. The first part is about the environment's safety and the causes of its pollution, while the second part is about precautionary medicinal surveillance to protect the environment from pollution. In these two parts, he demonstrates the most significant texts from heritage books with respect to the environment and its preservation, as well as its role in transferring diseases and epidemics when contaminated by Man. In this article, we shall tackle the aspects of air and water.

Most significant Arab scientists discussed in their works the role of air in transferring diseases and epidemics, stressing the importance of air purity to prevent them. Avicenna (428 AH) defines good pure air in his famous book, *The Canon of Medicine*, stating that: “The air of good essence is the air that is not mixed with any strange vapors or fumes; it is open to the skies, not captured by walls and ceilings/in closed rooms”.

In his treatise *The Art of Avoiding Body Illnesses in the Land of Egypt*, Ibn Radwan (460 AH) explains how the state of the air changes, stating that: “The air's state changes in two ways, one of which is regular change,

which does not cause new diseases and I, therefore, do not call it an infectious change. The other way is irregular change, which results in new diseases. The irregularity in air change results from too much heating, too much cooling, humidity, dryness, or getting mixed with a decaying matter, which can be near or far”.

As for Almajusi (before 384 AH), he explains the reasons of air change in his book the *Complete Book of the Medical Art* as follows: “The change of the air's essence due to location can be due to the vapors that result from decaying fruit and legumes, the bad vapors of which rise to mix with the air, or the vapors that rise from ditches, glades, or city wastes. As for the murdered and the dead, they can be in a city or near to it due to a war in which many people and cattle are killed; if there is an epidemic, bad vapors rise from the carcasses to mix with the air, which becomes the essence of the vapor and, when people breathe it, they get infested with deadly diseases, similar to what happened to the people of Athens”.

Almajusi continues: “The air divergence from its normal essence means that it changes—in essence and condition—to

corruption and decay, causing people to suffer bad diseases and symptoms... These diseases are described as new-coming diseases and one-time disease because they are attributed to one common factor, namely the air surrounding us”.

As for water pollution and its negative impacts on human health, a brilliant extraction from Ibn Radwan's treatise *On the Prevention of Bodily Ills in Egypt*, quoted in Dr. Mahmoud Kassem's article is: “It has been detected that heat and humidity are the dominant state in many parts of Egypt, and that its air and water are of low quality. The Nile in Egypt becomes worst during times of flooding and inactivity. Hence, water must be boiled and repeatedly filtered...”

The low quality of Nile water is due to its stagnation in Summer time, and its restless flow that brings along dirt and decay. Hence, Nile water should be obtained from areas with strong flow and less decay... As for water wells, their waters are not fit to drink due to closeness of Cairo's water and districts to the fragile earth surface, which makes it inevitable for toilets' moldiness to reach it. Also, low lands get filled once the Nile floods”.

Renewable water gives the best benefit; the deeper the wells are the farther we get from the Man-made pollution to the environment. Otherwise, we will have to purify and distillate drinking water as advised in Avicenna's *The Canon of Medicine*: “Evaporation and distillation enhance the quality of water. Otherwise, it should be boiled”. He continues: “Water of wells is of low quality because it is entrapped and in contact with grounds... The worst of it is what came into contact with lead and gained power from it, causing many intestinal ulcers”.

In this quote, Avicenna refers to the mixture of water and lead and its impacts on the stomach. “Sluggish water, exposed in particular, is of low quality... Sluggish water in all cases is not good for stomach... Water mixed with mineral essences and similar material, and leech-contaminated water are all of worse quality. However, some of these are beneficial”.

This was a brief showcasing of what some Arab scientists advised regarding the significance of environment protection. Preserving the environment is, in fact, preserving Man's health.



MAN,

By: Gamal Hosni
Director, Art Exhibitions and Collections

AN ELEMENT OF NATURE

Ever since the beginning of time, Man has been responding to the environment he lives in, in various aspects of his life. In addition to essential vital activity related to nourishment and habitations, Man's adaptation and use of environment has gone beyond mere survival.

Meticulous observation of natural phenomena and verities brought men to become accomplished astronomers and mathematicians. Skills that led early builders to excel in using these phenomena to the extent of aligning edifices with stellar systems creating a bond between earthly and heavenly bodies in an attempt to reflect and emphasize universal unity.

Today too, artists continue to explore human connection to the environment through contemporary creativity. New York based Japanese artist Nobuho Nagasawa has created a wave of light that she calls "water weaving light cycle". It is woven out of fiber-optic cables that the artist has toiled to weave herself after studying looming techniques and building a special loom to proportionally accommodate the thickness and nature of the fiber-optic cables used instead of thread.

The woven sheet hangs sinuously above the staircase of City Hall in Seattle. The wave emits blue light pulses

which intensity fluctuates according to weather conditions in the Seattle area. Weather news are fed to a specifically modified regulator that transforms weather input to a programmed set of instructions resulting in the change of lighting of the fiber optic cables. Sound extracts from nature of the Seattle area form an integral part of the artwork. They are introduced to boost the effect of the wave and complete the desired feeling relating the visitor to nature.

This site specific artwork was especially designed with the aim to reconnect people with their environment. Ironically, we spend more time inside acclimatized buildings that isolate us from natural and environmental elements that we ourselves are part of.

This is one simple trial to awaken us to relate more the natural world that we have done a lot to unduly distance ourselves from.

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Nobuho Nagasawa, Water Weaving Light Cycle, 2005, woven optical fiber, stainless steel cable wire, illuminators, sound, located at Seattle City Hall, Photo by Nobuho Nagasawa.

Exploring the Human Civilization Enigma

EPISODE
3

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

Having stopped because the very tall, the very short, and the very fat are all staring at the window, you attempt to draw their attention to continue the conversation, but to no avail. They are fixated at the window although it is shut from the inside and the outside and the blinds are drawn. You ask yourself: What are they looking at? Are they fascinated with the tiny strawberry and grape patterns on the blinds? Maybe; after all, we have just been discussing human health and healthy eating.

No... They are listening to something important; a voice from the outside getting persistently louder, and as it gets louder, you become more curious. You open the window to encounter a cloud of thick white smoke that persistently rises from the right, the left, and the front. When you look back, you cannot find the three; you look at the window, but you cannot see anything. The sound gets louder and louder; the smoke threatens to enter the room. The people in the house wake up because of the loud noise; they shout: They are destroying the palace at the street's corner... close the windows tight; the smoke will suffocate us.

You hear the neighbors exclaiming: How can they destroy the palace? It is more than 300 years old... It is built in the Greek style...It is an artistic and architectural gem... It can be a touristic sight... What is happening? Who allowed this? It is a city landmark... This is chaos... You interject, objecting: How can they destroy the palace? In this way? At this hour? The smoke threatens to suffocate us as the dust bombards us!

Closing the window depressed and defeated, you return to bed to find the three ghosts under it looking up at you from underneath the bed in sadness and misery. What is this? Do they feel fear and sadness? Do they have feelings like ours and are affected by what affects us? The three sneak out, their facial expression changing from sadness to surprise to puzzlement, so you ask them: Do you feel fear and sadness as we do? Aren't you advanced creatures with supernatural powers? Why did you hide under the bed? Will the bed protect you from what is happening outside?

The very tall one asks you: What is happening outside? You answer him surprisingly: Have not you heard? They are destroying a house on the street. The fat

one screams: This is a crime; if you have the right to build on this planet these ugly buildings that pollute the sight with their stupid designs and horrible material with which they are built, then you do not have the right to destroy, polluting the air with this suffocating dust, and polluting the ears with these disturbing noises.

The very short one interrupts, repeating the same sentence: I want to leave this planet... I want to leave this planet. The very tall one pats him on the shoulder: Calm down my friend, we will leave very soon; but we have not completed our mission yet. The short one continues repeating the same sentence: I want to leave this planet... You intervene conversing with them as you did before: I cannot but apologize to you for what you have seen on our planet; we are good creatures, but what you have seen is the behavior of some people, not all people, who want to...

The very tall one interrupts: Calm down our friend; we know very well that what we have seen is none of your fault. Since we landed on your beautiful planet... excuse me, your once beautiful planet; since we landed on it, we have seen very grave images. He then moves towards his



VISITORS INFO

Planetarium

Available Shows

Stars Show

45 min. Live Show by the PSC
Resident Astronomer

Oasis in Space

25 min. Full-dome Show

Stars of the Pharaohs

35 min. Full-dome Show

Seven Wonders

30 min. Full-dome Show

The Life of Trees

33 min. Full-dome Show

Kaluoka'hina

35 min. Full-dome Show

Mystery of the Nile

45 min. IMAX Show

Cosmic Voyage

35 min. IMAX Show

Visitors INFO

- For the Planetarium daily schedule and fees, please consult the Center's official website: www.bibalex.org/psc
- Kindly note that, for technical reasons, the Planetarium maintains the right to cancel or change shows at any time without prior notification.

History of Science Museum

Visitors INFO

Opening Hours

Saturday to Thursday:
[10:00–15:00]

Guided Tours Schedule

Saturday to Thursday:
[10:30, 11:30, 12:30, 13:30, 14:30]

- Museum entry fees are included in all Planetarium shows tickets.
- For non-audience of the Planetarium, Museum entry fees are EGP 2.-
- Museum Tours are free for ticket holders.

colleagues, continuing his speech: Do you remember the beautiful river in that far away continent where they were dumping animal carcasses? Do you remember that green ethyl factories in the northern continent dumping their wastes in the farms?

The very fat adds: We remember very well those lunatics burying radioactive wastes near beet and plum farms; they are condemning their own selves with their own hands. The short one continues repeating his sentence: I want to leave this planet... The very tall one continues directing his speech at you, still patting the short one's shoulder to soothe him: The environment is not just a beautiful calm sea to look at, or a spacious house overlooking a blue lake surrounded with vegetation and lemon trees from all sides; the environment of all this planet you are living on, and as we told you before when we were talking about civilization and what it means...

The fat one intervenes repeating his earlier speech: You have inhabited a paradise full of God's wealth; who ruined it like that? You cannot help laughing in misery and sadness, responding: You have all the right, and I agree with you; the environment is not just the destruction of this house. The talk about the environment and planet Earth is endless; we, the inhabitants of this planet, have held numerous conferences and endless debates on protecting the environment; but, as you can see, it is Man's unawareness and greed...

The very short one explodes: I want to leave this planet... I want to leave this planet... The tall one speaks with focus: My friend, slackness and negligence in protecting your environment have their indirect negative consequences, which are much bigger and much more dangerous than their known ones. Environmental pollution and lack of environmental balance maintenance will lead to the gradual disintegration of the feasible limit that allows you to live on this Earth healthily and safely... Environment, my friend, is... The very short one interrupts in a voice that is louder than the sound of the demolition in the street: I want to leave this planet... I want to leave this planet...



ALEXploatorium

Visitors INFO

Discovery Zone

Opening Hours

Saturday, Sunday, Monday, Wednesday
and Thursday: [9:30–15:30]
Tuesday: [9:30–12:30]

Guided Tours Schedule

Saturday, Sunday, Monday, Wednesday
and Thursday:
[9:30, 11:00, 12:30, 14:30]
Tuesday: [9:30–11:00]

Entry Fees

Students: EGP 5.-
Non-students: EGP 10.-

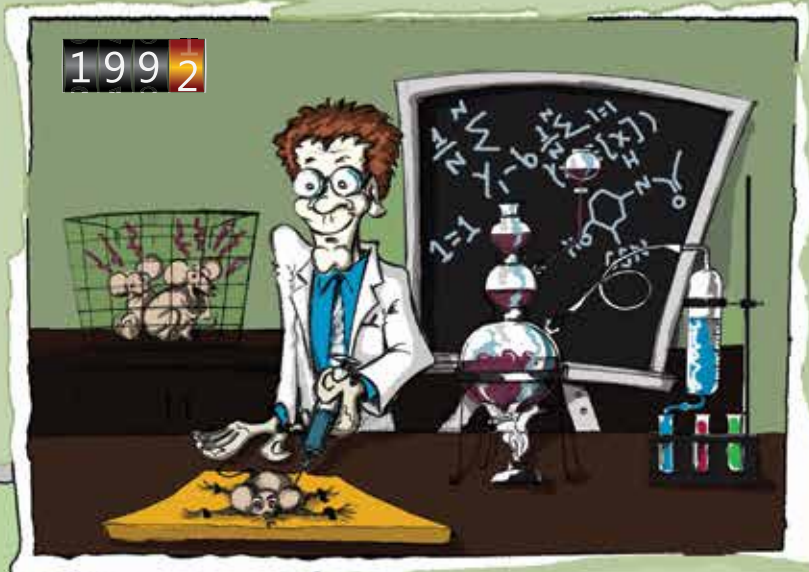
Listen and Discover

- For the list of shows available at the "Listen and Discover" and the schedule, please consult the Center's official website: www.bibalex.org/psc.
- For reservation, please contact the PSC Administrator, at least one week before the desired date.

Show fees

DVD shows:
Students: EGP 2.-
Non-students: EGP 4.-
3D shows:
Students: EGP 5.-
Non-students: EGP 10.-
4D shows:
Students: EGP 10.-
Non-students: EGP 15.-

1992



1999



2014



2051



Illustrated by: Mohamed Khamis

Check out the "Animal Testing" article, page 13