SCi planet

Bibliotheca Alexandrina
Planetarium Science Center
SUMMER 2015 | Year 8, Issue 3

BIBLIOTHECA ALEXANDRINA
مكتبة الإسكندرية

Planetarium Science Center

SCIplanet
SUMMER 2015

Year 8, Issue 3

Cultural Outreach Sector

Educational & Promotional Publications Unit (COPU)

Maissa Azab
Head of Unit

Editorial Team
Shahenda Ayman
Hend Fathy
Esraa Ali

Lamia Ghoneim
Jailane Salem
Basma Fawzy
Ahmed Khaled

Design Team
Asma Haggag

Maha Sherin
Faten Mahmoud

Publishing Department
Language Revision

Contact Us:
PSCeditors@bibalex.org

SCIplanet

Planetarium Science Center
مركز القبة السماوية العلمي

For additional information and reservation, please contact:
psc@bibalex.org
Tel.: +(203) 4839999
Ext.: 2350, 2351
Fax: +(203) 4820464
www.bibalex.org/psc

IN THIS ISSUE...

LIGHT: The Source & Future of LIFE

By: Maissa Azab

On the most fundamental level through photosynthesis, light is necessary to the existence of life itself. It plays a vital role in our daily lives and is an imperative cross-cutting discipline of science in the 21st century. It has revolutionized medicine, opened up international communication via the Internet, and continues to be central to linking cultural, economic, and political aspects of the global society.

When we think of light and energy, there are two approaches that come to mind. The latter is the use of powerful lasers to create fusion under controlled conditions. The former is, of course, solar energy, which provides a practically-inexhaustible resource that will enhance sustainability, reduce pollution, and lower the cost of mitigating climate change.

Social media, low cost telephone calls, video conferencing with family and friends; these are three examples of how the Internet allows people around the world to feel connected in a way that has never before been possible in history. All of this technology is because of light thanks to optical fibers.

Photonics is the science of light. It is the technology of generating, controlling, and detecting light waves and photons, which are particles of light. The characteristics of the waves and photons can be used to explore the universe, cure diseases, and even solve crimes.

Even if we cannot see the entire electromagnetic spectrum, visible and invisible light waves are a part of our everyday life. Photonics is everywhere; in consumer electronics (barcode scanners, DVD players, remote TV control), telecommunications (Internet), health (eye surgery, medical instruments), manufacturing industry (laser cutting and machining), defense and security (infrared camera, remote sensing), entertainment (holography, laser shows), and more.

All around the world, scientists, engineers, and technicians perform cutting edge research surrounding the field of Photonics, which opens a world of unknown and far-reaching possibilities limited only by lack of imagination.

We dedicate this issue to Light, the source and future of life. Among the topics we approach and the valuable contributions of our regular collaborators, we tackle historical and modern aspects relating to artificial lighting, how light helps cure diseases, the role of light in communication, how special organisms produce their own light, and how different organisms perceive light to see the world around them.

We hope our new issue lights up your life!

LIGHT OR DARK?

By: Craig Dykers
Founding Partner, Snøhetta

Perhaps the study of light is the study of time. Each thing we see actually occurred a moment earlier. Light is not only an ephemeral condition, it is physical. There is no good replacement for direct contact with the Sun. We have seen in recent years the increase of health problems related to some architectural design decisions that ignore this basic relationship between life and light. Everything in this complex relationship with light is tied to our history and our development as people.

One of the earliest structures dedicated to knowledge, the forerunner of our modern libraries, was the stoa. In ancient Greece, the stoa was a temple-like structure, but was different in many ways. It is wider than it is deep, and its axis of movement is generally perpendicular to the direction in which it is entered. Like a porch, one wall of the stoa is colonnaded and open to the exterior, unlike a portico at a temple that is meant primarily to frame a smaller doorway. The temple is dedicated to revering wisdom, the stoa is dedicated to creating wisdom. The Hellenistic stoa was very likely the prototype for the Ancient Library of Alexandria.

Several features of the stoa are relevant to the understanding of physical well-being and the relationship between the body and mind. In a stoa, people move along the long axis, discussing theory or simply reviewing the day's affairs. Walking from one end of the stoa to the other, guests would flow, turn around and repeat the stroll. Each time a return trip was made, the light and the dark sides of the room in relation to the body would switch. There was never a single relation to light in these spaces. These types of spaces became the foundation of the Academia where Aristotle, Socrates and Plato built the philosophical agendas that most of the western world is founded on today. One can imagine the great Alexandrian thinkers, Erastothenes or Hypatia walking and thinking in such a way on a gentle Alexandrian evening.

Physical movement combined with a relationship to light promotes well-being both physically and intellectually. We have used this simple principle in many of our built designs. Such planning is however generally invisible, or at least it does not readily show itself in the way most people think, formally.

Our oldest and our newest projects are two libraries where this thinking is embedded. The Library of Alexandria is framed by a vast roof that holds, spreads and nourishes light in changing directions throughout the day. The Ryerson Early Learning Centre in Toronto captures the shapes of clouds, sunlight interacts with multicolored floors and draws you in and out of the building by reflection.

Human nature has changed little in millennia, and certain core aspects of what it is to be human will likely remain for generations to come. Due to this, it is possible to explore the core aspects of light and how they affect us. In a sunny climate, it may be the tiniest shaft of light through the trees or a tent cover that provides the paradigm for appreciating these relationships with the Sun. The vitality of light is so important to us that it cannot be ignored.

DANCING with the Stars

By: Jailane Salem

Elusive dancing lights in the sky, flickering across the navy–blue blanket that shrouds the world at nightfall. An enchanting sight like no other; anyone would be awestruck at its magnificence. It is none other than the sighting of the *Aurora Borealis* and *Aurora Australis*; these amazing natural light displays that occur at the Earth's Poles, the Arctic and Antarctic, confounding people for a long time.

Many myths and legends were created across the ages to explain this awe-inspiring phenomenon; however, we have only lately come to a better understanding of it. Nevertheless, although the cause of the Aurora is well known now, we have yet to unlock all of its secrets.

Our journey to unfold the mystery of the Northern Lights and Southern Lights begins with our trusty friend, the Sun. Auroras are in fact caused by solar winds, which are charged particles travelling from the Sun, coming into contact with the Earth's magnetic fields. Only when we follow the particles' journey from its inception to its contact with the Earth's magnetic field, we understand how it all takes place, so let our journey begin!

You may have already started feeling warm, maybe a little too uncomfortably warm. Do not worry; we will just have a quick look at the Sun, then head back to Earth soon enough!

The Sun is the closest star to our planet; it provides us with heat and light. Basically, it is a hot ball of gas, mostly hydrogen. As it is very hot, most of the gases exist in the fourth state of matter, plasma. Deep inside, due to the high pressure and the incredibly high temperature of over 14 million degrees at the Sun's core, a reaction where hydrogen atoms merge to form helium takes place, releasing a lot of energy and light that radiates from the inner core of the Sun to its surface.

The heated gas becomes plasma that flows in huge eddies from the core to the surface through convection. When the plasma gets heated from the core, it rises to the surface in a continual cycle; it becomes so hot that it becomes electrically charged, creating powerful magnetic fields as it moves up and down the convection currents. Since the Sun spins on its axis the plasma also flows sideways, which in turn wounds the magnetic field lines, which keep getting stronger until they eventually rise to the surface and penetrate it. This process happens at solar maximum.

You may be wondering now what solar maximum is? Well, the Sun follows an eleven-year solar cycle, where the solar activity varies from minimum activity to maximum activity, depending on its magnetic field. This is of great importance to us because, when the Sun is at solar maximum, Earth experiences more solar storms as more magnetic fields push and break through the surface, causing the eddies of hot gas to cool down, creating sunspots.

Once the magnetic field has pushed its way out of the surface, the plasma keeps dragging it out until it reaches its breaking point, and breaks off from the Sun's surface. This is what is called solar wind; it is several times bigger than the size of the Earth. After a while, the magnetic fields disperse, rearranging themselves back into an orderly arrangement; this is when the Sun is at its solar minimum. The solar wind that is produced at times of solar minimum is fairly light and slow; however, at times of solar maximum, it is very strong. Scientists can tell whether there will be more solar wind or not by keeping track of the presence of sunspots.

So, how does this solar wind act? It is basically a constant stream with varying intensity depending on the solar cycle; it can travel at a speed of 400 km/sec and can take around two to four days to reach Earth. The plasma, which is a key component, is made up of positively charged atoms and electrons that float around one another. Their high energy charge, along with the expansion of the magnetic field, allow them to escape the gravitational field of the Sun and set them on route to us.

Wow! So are we constantly being bombarded by solar wind? Yes, we are! How are we still intact if we stand in the way of such a strong force barreling towards us through space? Well, luckily we have our own magnetic field that shields us from the brunt of the impact. Several billion tons of plasma have come our way; however, all have been deflected by the Earth's magnetic field.

This magnetic field that shields us is invisible; it is created by the hot molten iron found at the center of our planet. The circulation of this liquid metal creates electric currents that produce the magnetic field, which shoots out of the center of the Earth, through the crust, and into space, enveloping us and creating a protective shield. This is what is known as the magnetosphere.

However, a small amount of solar wind does enter our atmosphere, causing the aurora phenomenon; the visible evidence of the solar winds' presence. So how does that occur? While most particles bounce off our magnetosphere, some manage to get through where the magnetosphere is weakest. These weak spots are present at the North Pole and South Pole, where a sort of funnel exists, allowing some of the particles of the solar wind to enter into our atmosphere, and that is where the fun begins!

When the electrons in the solar wind make it through the magnetosphere, they encounter the two main components of our atmosphere: oxygen and nitrogen. When these two elements collide with the highly charged electrons from the Sun, their state is excited. In order to calm down and return to their original energy level, they must let out the extra energy that built up, and they do so in the form of shooting out tiny packets of light called photons. This is what we see in the nighttime sky as the dancing curtains of light at the North Pole and South Pole.

Auroras can be seen in a variety of colors, depending on where in the atmosphere the electrons interact with the oxygen and nitrogen. The most commonly seen color is glowing green; however, colors ranging from red to pink, blue to purple, in lighter and darker combinations have also been observed. The colors of the photons depend on the height where the collision between the oxygen and nitrogen and the incoming electrons takes place.

Oxygen at lower altitudes gives off a different color than oxygen at higher altitudes. The yellow–green color that is most common of the aurora occurs at the lower altitudes in the atmosphere, between 100 km and 300 km; while in the upper atmosphere, above 300 km (ionosphere), oxygen collisions create a beautiful red aurora, which is a rare sight.

Nitrogen can also produce red light, but when the collision occurs at around 100 km; it usually forms the rippled edges of the aurora. Hydrogen and helium are also present in the ionosphere; these lighter gases produce beautiful blues and purples. However, they are not always easily discernible to the naked eye and we sometimes need a good camera to capture them.

The auroras take place at all times; however, during daytime we cannot see them because they are outshined by sunlight. Clear skies are also needed for a proper sighting of the aurora since clouds would hide the light display. There are many people who make it a point to travel to watch these beautiful surreal displays that take place in the vast skies.

To think that these displays are a result of all the activity that take place on the Sun, and that only a small amount of the solar wind is able to venture into our atmosphere to leave us with such a beautiful display, is definitely a reminder of how vast and mysteriously beautiful our universe is.

References
www.webexhibits.org
www.sciencekids.co.nz
http://alaska.gov/kids/learn/northernlights.htm
http://solarscience.msfc.nasa.gov/SolarWind.shtml

AROUND THE WORLD in a SOLAR PLANE

A plane that only uses solar energy to complete a tour around the world, that is Solar Impulse 2 mission; an amazing feat attempted by two pilots, Bertrand Piccard and André Borschberg, who are passionate about making alternative energy aviation options a reality. Their goal is to demonstrate that more environmentally-friendly options are not only available but also technologically possible. By only relying on the Sun, this flight will not cause any polluting emissions.

In every city where the plane will land during its journey, the pilots will try to show the public that new alternatives to fossil fuels and technologies are the way to go for the future. They want to encourage people to re-think renewable energy and to explore those options more fully.

The around-the-world mission will last about five months, March–July 2015. The starting point was Abu Dhabi, United Arab Emirates, which is the hosting city, where the journey begins and ends.

The aircraft has only one seat, so the pilots will fly one after the other; they also have a sixty-people support team helping them on their journey. They plan to complete a 35,000 km journey, with no fuel whatsoever on board. In order to complete their tour in the specified time span, they will have to fly nonstop for some parts of the journey sometimes for 5 or 6 days.

The plane can fly all day long, because it has 17,000 solar cells built into its wings, which can recharge their lithium batteries and store energy to last it during the night. The plane has four electric motors that work with renewable energy; it is made of carbon fiber and the wings are super long, almost 72 meters.

In order to fly the aircraft the pilots have undergone extensive training, not only in the actual operation of the plane, but also on how to survive in such a limited space for days on end.

References
www.cnbc.com
www.solarimpulse.com
www.hindustantimes.com

THE HANDS THAT LIT THE WORLD

By: Hend Fathy

Artificial light has undoubtedly become an indispensable factor to human life. Before ancient Man accidently discovered fire, all human activities were totally dependent on the availability of daylight; fire flames then became the only source of artificial light available. It would have been impossible to predict at that time how lighting would develop to the levels taken for granted in today's high-tech world. The history of lighting devices hardly goes chronologically due to the remarkable overlapping of different technologies across time and place.

The Dawn of Artificial Light

The very early attempts to produce sustainable artificial light date back to 400,000 BCE when early Man used the flaming torch and the campfire, which offered him freedom from the blinding darkness of the night and relative safety from its prowling beasts. One of the earliest developments of the portable torch was tying a bundle of sticks together into a blazing torch that produced a brighter and longer-lasting light.

Then, humans came to develop primitive lamps through using the bodies of fish and oily animals to contain ignited wicks of fibrous bark. These were known as animal lamps and survived until around 5000 BCE.

Advancements came gradually with the discovery of materials that burnt more readily and shone more brightly, as well as finding more suitable containers. Shells, hollow rocks, and similar non-flammable containers were filled with combustible materials soaked in grease and ignited.

The Innovation of Candles

Although candles have been developed independently in many places around the globe, the earliest attempts affiliate to ancient Egypt. The very first form ancient Egyptians innovated was a rushlight made by soaking the pithy core of reeds in melted animal fat. As it had no wick, it was not considered a true candle; by 3000 BCE, they formed true wicked candles made of beeswax. Moreover, ancient Egyptians introduced the earliest candle holders, which date back to 400 BCE.

Evidence was found that in later centuries, many early civilizations developed candles using wax extracted from different organisms. The Chinese created candles from insects and seeds; in Japan, candles were made of wax extracted from tree nuts; while in India, candle wax was made by boiling the fruit of the cinnamon tree. It is worth mentioning that the Romans are credited for the invention of candles as we know and use them today by around 500 BCE.

Greek Pottery and Oil Lamps

Although the saucer lamp—a type of lamp made of pottery or bronze—was found in ancient Egypt and China, major innovations to primitive lamps took place in ancient Greece as of the 7th century BCE. It comes as no surprise then to know that the word "lamp" derives from the Greek "*lampas*" meaning "a light", which refers to the Olympic race in which a lighted torch was handed on from runner to runner.

The Greeks introduced new materials and designs; lamps had feet and curved handles, and carried wicks that controlled the rate of burning. They basically depended on natural oils as fuel, such as olive oil, mainly used around the Mediterranean; sesame oil, mainly in the East; nut oil; fish oil; and castor oil.

Although Athens remained the major manufacturer and exporter of high quality pottery lamps until the 4th century BCE, it was the Romans who took over from the Greeks as mass manufacturers of lamps. Pottery oil lamps were affordable, yet messy to handle, as the oil often oozed from the wick hole; hence, Roman lamps with closed oil reservoirs came about 500 BCE. They consisted of bowls with wicks projecting through openings and a cover to keep the oil from being spilled or drunk by mice.

The Argand Lamp

Traditional oil lamps remained predominant for domestic uses until the 18th century, when large-scale whaling was developed. It was found that whale blubber and spermaceti oil could produce a high-quality fuel, which unfortunately led to overfishing of whales. Whale oil was also used in manufacturing candles instead of the expensive beeswax and the bad-smelling tallow candles.

In 1780, Aime Argand, Swiss physicist and chemist, patented the Argand lamp, one of the most common types of lamps that worked with whale oil. This lamp presented an improvement in light output up to a total of 10 candlepower. It utilized a tall cylindrical glass chimney that kept the flame steady and improved the air flow. The Argand lamp remained among dominant lamps until the development of Gesner's Kerosene lamp mid−19th century.

The Kerosene Lamp

In 9th century Baghdad, Persian scholar Muhammad ibn Zakariya al-Razi mentioned the first description of the Kerosene lamp in his *Book of Secrets*. He referred to it as the "*naffatah*"; this prototype used "white napht"—or kerosene as we know it today—to produce energy.

Al-Razi used two different methods to distill the fuel from petroleum; one using clay and the other ammonium chloride as the absorbent. The lamp flame was surrounded by a heavy glass layer that maintained it and eliminated fire risks.

A much later development of the Kerosene lamp came during the 19th century by Canadian physician and geologist, Abraham Gesner. Gesner distilled a clear thin fluid from coal, which made an excellent lamp fuel. He had his project industrialized to make affordable Kerosene lamps in 1854.

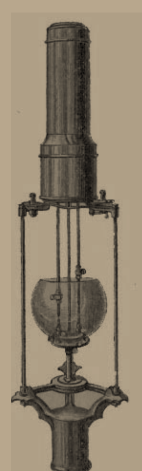
Gas Lighting

During the early 19th century, the technology of gas lighting became popular in street and public places lighting. It is mentioned that the first general use of gas street lighting took place in London in 1814; by 1823, nearly 40,000 lamps had been installed in 350 kilometers of London streets. Gas lighting also became popular in American theaters at that time.

Electric Carbon Arc Lighting

The first decade of the 19th century also witnessed the first demonstration of the carbon arc lighting by Sir Humphrey Davy at the Royal Institution in London. At that time and until mid-19th century, batteries were the only source of electrical power.

Davy's lamp used two charcoal sticks and a 2000-cell battery to create an arc across a100-millimeter gap. The sticks were separated by an insulator, which melted slowly, self-feeding the two carbons. With the introduction of converting chemical energy into electrical energy using batteries, 1830s and 1840s witnessed major experimentations in arc lighting.

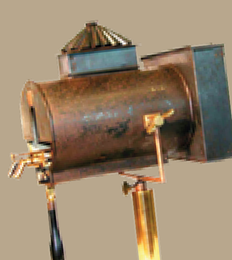


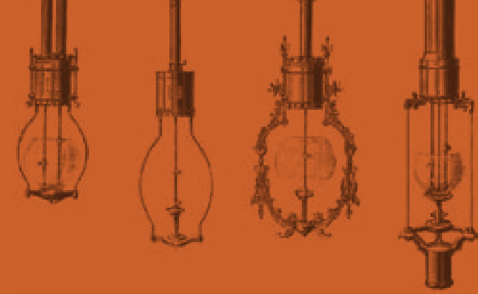
Arc lamps were widely used across Europe and USA throughout the 19th century. During 1840s, they were used for public lighting in Paris; by 1880, there were 90,000 of them burning at night in the USA.

Limelight

In 1826, a new technology of lighting was introduced by Thomas Drummond, who observed that a piece of lime glowed brilliantly when heated by an oxygen and hydrogen flame. Drummond described his lighting technology as 83 times brighter than the Argand Lamp.

Limelight came into use in theaters by mid-19th century, where a lens was placed in front of a limelight to give a spotlight. This technology had an exceptionally long run in theater lighting, and remained in use in London theaters until about 1910.





The Rise of Incandescent Lamps

Although Thomas Edison offered humanity the first practical commercialized version of the incandescent lamps, the basic technology is said to have been introduced by German inventor Heinrich Göbel in 1854. Göbel's model was based on passing an electric current through a carbonized bamboo filament placed inside a glass bulb.

Various models appeared since that date and until the introduction of Edison's lamp twenty-five years later, the most remarkable of which was Joseph Swan in 1879. Although the problem of sustainable electrical supplies was almost solved by that time, other constraints persisted. Swan was aware of the problems of producing a vacuum within a glass envelope, and thus embarked on a collaboration with other scientists to produce a glass-blower.

In 1880, Swan's incandescent lamp was reported in an issue of "Engineering": "Electric lighting by incandescence is just as simple as arc lighting is difficult, all that is required is a material, which is not a very good conductor of electricity, highly infusible, and which can be formed into a wire or lamina, and is neither combustible in air, or if combustible, does not undergo changes in a vacuum".

The idea of the Swan Lamp depended on heating a silk filament until it reached incandescence while pumping air away from the lamp envelope. This procedure eliminated the air, which previously caused lamp blackening. Sir William Armstrong's industrial premises in Northumberland were the first to be lit by Swan's lamps in December 1880, with 45 lamps operating by a water-powered dynamo.

On 31 December 1879 in New Jersey, Edison demonstrated his incandescent lamp that used a cardboard filament

installed in an evacuated glass bulb. The demonstration involved 100 lamps; each rated at 16 candlepower and consumed about 100 watts, with an average lifespan of 100 hours.

The following year, Edison experimented with over 6,000 specimens for producing the filaments, of which bamboo became commonly used; during the same year, he received a patent for the T.A. Edison Electric Lamp. Within another two years, there were over 300 electric power stations around feeding over 70,000 lamps.

Gas Discharge Lamps

In 1894, American electrical engineer and inventor Daniel Moore introduced the very first commercially viable model of gas discharge lamps, known as the “Moore Tube”; a predecessor to both neon and fluorescent lighting. Moore’s model was based on evacuating phosphor-coated glass tubes and inserting low-pressure gases into them, which glowed when a current was passed through them. The gases Moore used were nitrogen and carbon dioxide, respectively emitting pink and white light.

In early 20th century, French inventor Georges Claude discovered how to create neon gas through liquefying air, which he found glowed bright orange when an electric current is passed through it. He then embarked on creating a “Moore Tube” with neon gas and demonstrated modern neon lighting in 1910.

Claude’s invention did not find its way as an indoor lighting device, as homeowners rejected neon lamps due to their color. However, in 1912, they became popular as advertising signs, as they were successful eye catchers thanks to their glowing and arresting red color. In 1915, Claude received a patent for his invention, which became the basis for his company, Claude Neon Lights. In the 1930s, a new range of neon lamps colors became available thanks to the introduction of fluorescent power coating of neon and mercury discharge tubes. However, in 1917, Moore returned to make

a new mark on lamp history by inventing the negative glow neon lamp. He created two-electrode small bulbs, which allowed neon to glow immediately around the electrodes. These lamps were used as indicator lights on many electronic devices, such as early TVs until the 1960s, and are still in use as decorative lighting devices until now.

Florescent Lamps

Fluorescent lamps are gas-discharge lamps that employed a more sophisticated technology. They used electricity to excite mercury vapor in argon or neon gas, producing short-wave ultraviolet light that causes a phosphor to fluoresce, producing visible light.

American electrical engineer and inventor Peter Hewitt was the first to demonstrate the mercury-vapor principle in lamp design in 1901. However, his model emitted a blue−green light, and thus was deemed unpractical. It was, however, very close to the modern design, and had much higher efficiency than incandescent lamps.

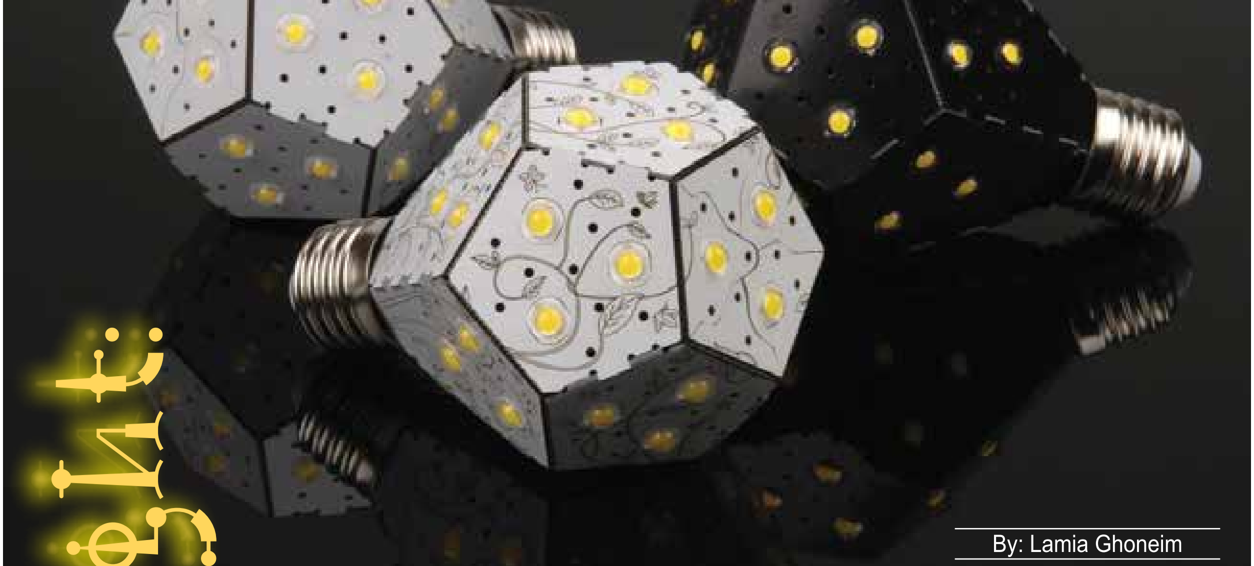
German inventor Edmund Germer came very close to developing the modern fluorescent lamp in 1926. However, his lamp had a short life due to defects in the arc tube that corroded the electrodes and destroyed the lamp. Also, the lamp produced an unpleasant greenish color due to his phosphors, which did not help him persuade investors.

It was not until 1934 that the first actual fluorescent lamp came to existence thanks to four American inventors: George Inman, Richard Thayer, Eugene Lemmers, and Willard Roberts. Their lamp had real white phosphors, and was stable and reliable; it is worth mentioning that their design remained almost not changed for over 70 years.

The journey of artificial lighting does not end here, of course; later decades had milliard of more glowing development points. Nowadways, there are much advanced forms of incandescent and florescent lamps. We all know about IED and Halogen lamps, as well as many other less familiar names. However, we wanted to shed light on earlier forms, and also to ignite your enthusiasm with the latest innovation of the NanoLight.

References

http://www.ies.org/lighting/history/
www.college-optometrists.org
http://www.mts.net/~william5/history/hol.htm
http://www.naturesgardencandles.com/candlemaking-soap-supplies/item/history/-history-of-candle-making.html
http://candles.org/history/
http://academic.eb.com/EBchecked/topic/328821/lamp
http://myhayah.com/?p=1353
https://cornellbiochem.wikispaces.com/Kerosene
http://www.edisontechcenter.org
http://www.newworldencyclopedia.org/entry/Fluorescent_lamp



NanoLight: World's Most Efficient Light Bulb

By: Lamia Ghoneim

For years now, LEDs[1] have been heralded as the heir to old-school incandescent[2] lightbulbs and the better option than compact fluorescents[3]. Yet, despite some serious advantages, such as much improved energy efficiency and a decade-long lifespan, the technology has not quite lived up to expectations as the ultimate lighting source.

While the high upfront cost of LED bulbs relative to traditional ones is often cited as a hindrance for some folks—though proponents have long argued it ends up being cost-effective in the long run—the most glaring issue, as lighting experts have pointed out, is a phenomenon referred to as "efficiency droop". Whereby efforts to increase a bulb's electrical output to where it can adequately brighten large spaces as living rooms have also caused it to be less and less energy-efficient, sometimes to the point where it cancels out much of the purported financial benefits.

Three friends from the University of Toronto who share an enthusiasm for sustainable products are out to offer a solution, namely "NanoLight". Gimmy Chu, Tom Rodinger, and Christian Yan have come up with a bulb design that apparently fixes the efficiency droop issue.

The trio's "breakthrough" invention not only offers an output of 1,600 lumens, equivalent to a 100 W incandescent lightbulb, it does so while operating at incredibly low power-sipping rating of 12 W. In fact, they claim that the NanoLight is the world's most efficient lightbulb.

NanoLight products claim to have addressed the LED heat issues, and are also billed as omnidirectional; meaning it is specifically engineered to shine light in all directions, as opposed to just in the middle of the bulb as other LED lights. This is a common goal for household lighting. Other bullet points include instant-on (a standard benefit for LEDs over CFLs) and completely eliminating the need for a heat sink.

NanoLight claims to be 87% more efficient than a standard incandescent and it uses 50% less energy than a compact fluorescent. NanoLight LEDs are directly attached to a printed circuit board that

is folded to resemble the stereotypical lightbulb shape, albeit in a "funky" abstract design. The funky geometric form is necessary for the printed circuit board to be folded into a bulb-like shape and mounted with electrical components. The product testing has shown that the LEDs withstand the heat issues within this format.

NanoLight was originally launched through a campaign with Kickstarter, a global crowd-funding company aiming to bring funding to creative ideas through crowd contribution. The campaign was very successful, and the product received immense backup from thousands of backers.

Currently on the market, NanoLight is being sold under the name "Nanoleaf", and has gained much popularity due to its efficiency and sustainable design. The company's goal is nothing short of changing the world—one lightbulb at a time.

"We center every aspect of our work at the NanoLight on creating higher energy efficiency, reducing carbon footprints, and creating ecological value in all of our products", the Company says in its mission statement "At the most fundamental level, our purpose is to create energy-efficient LED lighting that is innovative and economical, so that our planet can have a brighter future".

Nanoleaf comes in three models, in addition to the 12-W Nanoleaf, a 10-W Nanoleaf (75-W equivalent), and a 12-W NanoLight (1800+ Lumens). These three models are available in 120V AC and 220–240V AC versions to cater to different geographic regions. A dimmable model is also available now on the Company's website. With a price range of USD 20–40, the Company assures its customers that the price will pay itself in energy savings over its 25–30 years lifespan.

Glossary

(1) **LED** is a Light-Emitting Diode (LED) product that is assembled into a lamp or a lightbulb for use in lighting fixtures.

(2) **Incandescent lightbulb** is an electric light, which produces light with a wire filament heated to a high temperature by an electric current passing through it until it glows. The hot filament is protected from oxidation with a glass or quartz bulb that is filled with inert gas or evacuated.

(3) **Compact Fluorescent Lamp (CFL)** is a fluorescent lamp designed to replace an incandescent lamp; some types fit into light fixtures formerly used for incandescent lamps. The lamps use a tube which is curved or folded to fit into the space of an incandescent bulb, and a compact electronic ballast in the base of the lamp.

References

www.zdnet.com
www.gizmag.com
http://shop.nanoleaf.me/
http://mashable.com/2013/02/24/nanolight/

DAYLIGHTING OUR LIVES

By: Jailane Salem

Homes are our safety fort, the sanctuary that allows us to escape daily life tensions. However, with the increasing rise of building heights, getting enough natural light is becoming more and more difficult. In many areas, where tall buildings are crowded together, the Sun plays a short game of peek-a-boo with those who live in these buildings; instead of relying during the day on natural light, they have to turn on electric lights. By using more electricity, people end up with bigger bills, in addition to the negative effect it has on people's wellbeing. This, of course, requires close attention from urban planners to allocate appropriate plots for buildings that would allow them enough natural light.

While people are increasingly spending more time cooped up inside, architects have been trying to find appropriate solutions to provide us with the natural light we need. Daylighting—a method applied by architects nowadays—is the controlled admission of natural light into the space within a building.

This design technique is important to provide good illumination during the day, and if natural light is used to its maximum potential, it can reduce the dependence on artificial light, making buildings more sustainable and energy-efficient. In commercial buildings, electric lighting accounts for 35–50% of the total electrical energy consumption; strategic use of daylight can reduce this energy demand, in addition to improving people's comfort and productivity.

Though getting sunlight into one's space is great, it can cause glare and rooms can become too bright that it can lead to discomfort. This is why there are certain systems designed to harvest the maximum sunlight in a controlled manner that avoids unwanted glare and increase in temperature.

One way to avoid glare is through installing light shelves, which perform two jobs: bouncing light upward into the space for better light distribution and penetration, and shading windows from excessive glare. Light shelves can be installed inside or outside the building and can be made from various materials; they are most effective when installed on walls facing the Sun.

Another daylighting design is the use of skylights. You guessed it; these are installed in the roof and are often made from a clear or diffusing material that allows natural light to enter the building. Since they are placed in a crucial spot, they are usually made from double layers for added protection, as well as better insulation. They do not always have to depend on direct sunlight to illuminate the interior, since diffuse light from overcast skies can also light up an interior.

While architects try to create designs that use daylight to create a visually appealing space, they have reason to do so because researchers have found that natural light is key to our wellbeing. A research that has been conducted on the daylight effect in hospitals indicates that it is greatly beneficial for patients, as it is better to recover in a room with a window that not only lets natural light in, but also has a view of nature.

An article published in 1984 reported that surgery patients in rooms with windows facing trees recovered 8.5% faster and took fewer analgesics than those whose view was a brick wall. Daylighting also helps in post-operative recovery, reducing the average length of a hospital stay, and lessens the period needed for pain relief.

Not only is daylighting important in hospitals, but in schools and education facilities as well. A connection between better daylighting and student outcome has been found; a 1999 study entitled "Daylighting in Schools: An Investigation into the Relationship between Daylighting and Human Performance", commissioned by the Pacific Gas and Electric Company, found a high correlation between schools that reported improvements in student test scores—upwards of 10%—and those that reported increased daylight in the classroom.

Working in a space that is well-lit by natural light increases productivity and helps promote a feeling of well-being; that is why it is important for architects to bear that in mind while designing buildings.

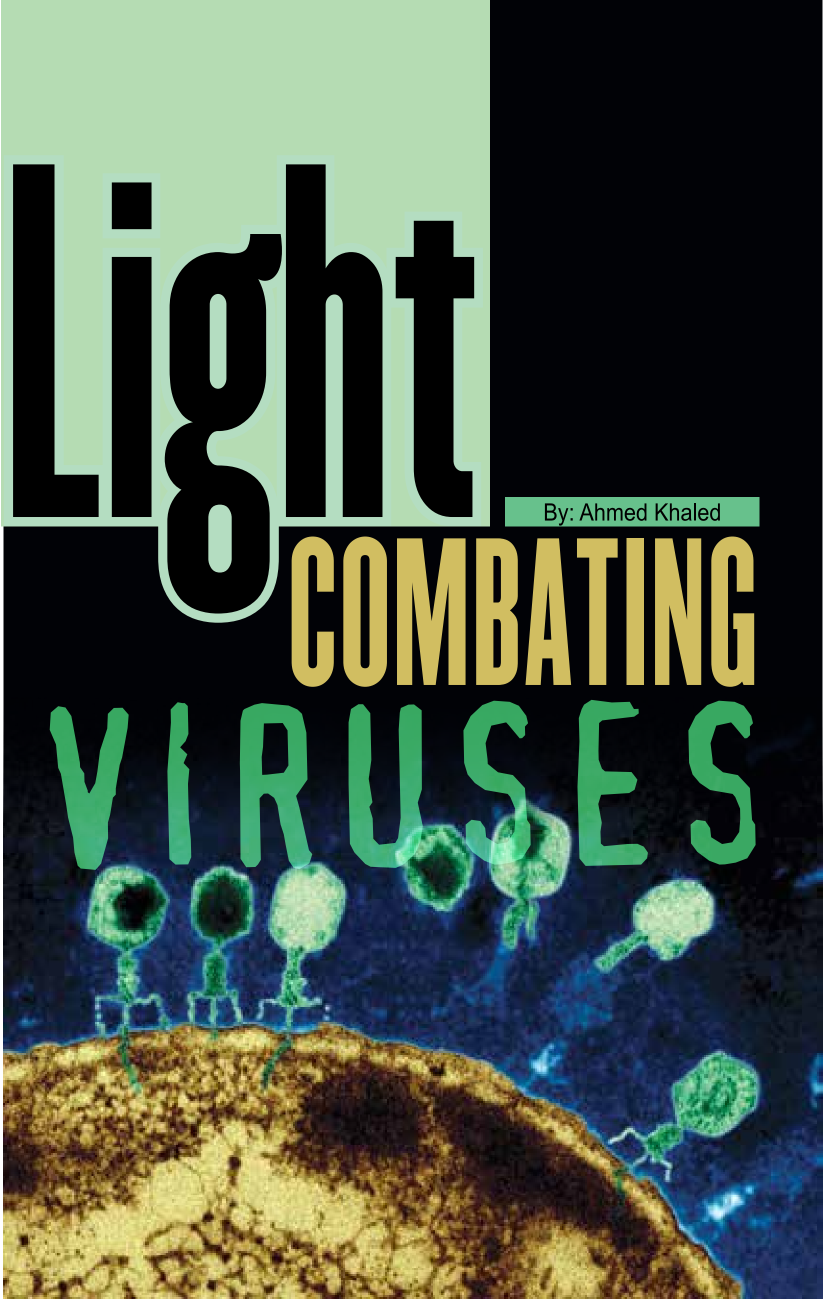
References

http://sustainablecitiescollective.com/david-thorpe/1028301/we-must-maximize-use-daylight-buildings-reduce-energy-use

http://lightlouver.com/lightlouver-description/why-daylighting/

http://sustainabilityworkshop.autodesk.com/buildings/redirecting-light

Light COMBATING VIRUSES



By: Ahmed Khaled

Nobody likes viruses; yet, we are surrounded by them. The best we can do is to coexist with them, developing certain protective mechanisms against their aggressive nature.

Washing our hands, using sanitizers regularly, being careful while sneezing, not rubbing our eyes with our bare hands or eating food without washing them; all of these are precautions that we take to prevent our bodies from being infected by viruses. However, even if we do these things, we are not fully protected from infections as once they enter the body it is quite tough to kill them.

In most cases, our immune system does a pretty good job in defending us against viruses, such as with the common cold or flu. There are, however, viruses that our immune system has a hard time dealing with, such as Ebola or Hepatitis C. These types can be very deadly, so it might be surprising that, when some viruses are exposed to visible light, they can be killed by time.

Is it possible to shine a light on infected tissue, and only kill the viruses, leaving healthy tissue intact? If a vaccine is not available for a viral illness, treatment options are extremely limited. As a result, a combined team of physicists and biologists thought of the case where when we increase the laser volume on a glass at a particular frequency, it vibrates violently enough to shatter; similarly, by putting more energy into the laser, the virus could shake itself apart.

Laser is like a hose pouring out water concentrated in one place with a higher intensity, while ordinary light is like the sprayer we use to water our plants that covers a wide area. It starts off with weak light and keeps adding more energy, so the light waves become ever more concentrated, making all light rays coherent and with a higher concentration of energy levels.

The Ultra-Short Pulse (USP) laser releases energy in pulses just one femtosecond long. Forced resonance is a technique that could be used to kill viruses using the USP laser as every virus has a unique molecular structure and a unique frequency that will cause it to vibrate. It is identical to the way a fine crystal glass will resonate, or vibrate at a particular frequency.

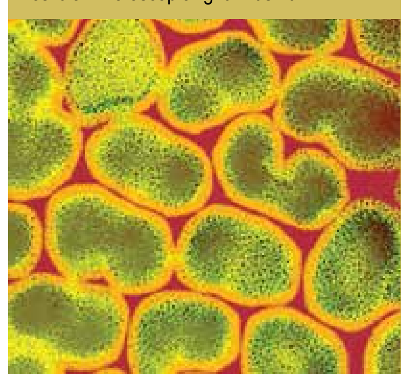
Many more technologies are currently being studied in the world, in which the laser impulses can kill viruses contained in blood without killing the healthy tissues. The most well-known type is the semiconductor laser therapy of the blood, which works on the principle of normalization of blood conditions and immunity, increasing this way the resistance of live tissues to bacteria, viruses, and infections.

A study shows the effectiveness of laser therapy in HIV/AIDS treatment; researchers have irradiated human blood and patients have shown some improvement after the first application. The normalization of blood was proven, as well as the immunity improvement; this indicates the positive effect of laser on both blood and the immunity system in most cases diagnosed with HIV/AIDS.

One of the first things low-level laser blood irradiation triggers is the activation of microcirculation, taking into consideration that blood is a kind of reporter of everything that takes place in our body as it circulates through blood vessels to all of our organs. The laser works on the tissue level and its performance is universal for all organs, where it helps with restructuring by means of intensifying certain functions of cell parts.

Could anyone have ever fathomed that light, not only sustains life, but can save it as well? Thanks to new technologies and unstoppable research that amaze us every day with discoveries and achievements, we can fight things we thought could only be deadly.

Reference
http://science.howstuffworks.com/life/cellular-microscopic/light-virus.htm



Healing Light

By: Lamia Ghoneim

In the beginning, the Sun was worshipped by many ancient civilizations; presumably for its perceived power and strength, but also for its healing properties. Many ancient cultures practiced various forms of healing with light, including the people of Ancient Greece, Ancient Egypt, and Ancient Rome.

Heliotherapy—using sunlight for healing—dates back to Hippocrates, who was a great advocate of the Sun's healing properties. Indian medical literature, dating back to 1500 BCE, describes a treatment combining herbs with natural sunlight to treat non-pigmented skin areas. Buddhist literature from about 200 CE, as well as 10th-century Chinese documents, make similar references.

With the demise of ancient cultures, not only did the worship of the Sun diminish, but also the knowledge of its healing powers. As a result, since the Middle Ages and up to the beginning of the 20th century, people turned away from the Sun, preferring pale skin, which they viewed as a sign of wealth, over the darker skin associated with hard working labor.

In modern times, instead of Sun worship, scientists have gone completely the other way, issuing warnings about the dangers of exposure to the Sun. Dermatologists warned that, by going outside and spending too much time in the Sun, we risk melanoma—the deadliest version of skin cancer. They also warned that sunlight damages our skin, causing wrinkles and premature aging.

Nevertheless, in more recent years, many studies have emerged to challenge the anti-Sun dogma of the dermatology world. While the dangers still exist, the benefits of a sensible amount of sunlight might just turn out to outweigh the risk.

Not only can sunlight help heal certain diseases, but a growing body of evidence now suggests that getting adequate Sun and adequate amounts of vitamin D (the sunshine vitamin) not only protect us against the risk of osteoporosis and depression that people have known for some time, but also against colon cancer, breast cancer, heart disease, rheumatoid arthritis, diabetes, multiple sclerosis and a host of other awful maladies.

Widespread advice to avoid direct Sun exposure is now heavily under question; more and more doctors and patients are turning towards new, and old, light therapy methods to treat a wide variety of ailments.

Light Therapy for Skin Conditions

While different wavelengths work for different conditions, treatment is most often done with narrow band Ultraviolet B radiation (UVB), which is the safest and most successful wavelength. Phototherapy eliminates the need of using corticosteroids[1] ointments or other systemic medications that can have a negative effect on the body.

Chronic skin conditions such as psoriasis[2] can be life debilitating for many patients. Aside from being unsightly, and thus disparaging to a person's self-esteem, they also often cause inflammation, itchiness, and pain. Exposing the affected areas to sunlight has been known to help in the treatment of these diseases, but it is difficult to monitor the improvement as it occurs outside the doctor's office.

In office phototherapy treatments using artificial UV sources are gaining more popularity as they have been proven successful in treating many skin conditions; including psoriasis, eczema[3], vitiligo[4], and scleroderma[5].

Since many of these diseases are caused by an autoimmune response, UV light therapy works through reducing the inflammatory response of the immune system, by penetrating the skin and slowing down cell production that causes lesions in diseases such as psoriasis and eczema, directly reducing itch, and by re-pigmenting areas of the skin that lost pigmentation in the case of vitiligo.

Two forms of phototherapy exist: non-targeted phototherapy and targeted phototherapy, in which light is administered to a specific, localized area of the skin. Current targeted phototherapy is administered via excimer laser, elemental gas lamp, or via LED light; it is administered in a doctor's office and only to the affected skin, not the entire body, thus sparing healthy skin from UV rays health risks.

Light Therapy for Depression

Whether we suffer from depression or not, everyone feels better when the Sun comes out. What most people have known instinctively has come to be understood scientifically in the past two decades.

Studies have shown that the brain produces more of the mood-lifting chemical "serotonin" on sunny days than on darker days. Serotonin is the same neurotransmitter that is boosted by well-known antidepressant medications; it relieves stress and produces a general sense of well-being.

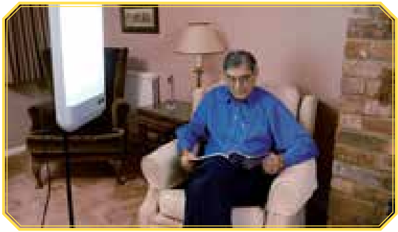
However, sunlight—or bright light, to be more exact—is more abundant, safer, and easier to absorb than any other antidepressant. Bright light has been used as a treatment for winter depression for over two decades now. Its efficacy in treating winter depression, also known as Seasonal Affective Disorder (SAD), has been supported by dozens of studies.

As the days get shorter, cloudier, and colder during winter, people with SAD frequently suffer from fatigue, irritability, depression, carbohydrate craving, sleep problems, and weight gain. Exposure to the Sun's bright light or a high intensity light fixture for 30–60 minutes a day is remarkably effective in alleviating the symptoms of SAD.

More recently, light therapy was found successful in treating other conditions, including sleep disorders and other types of depression not associated with change of seasons, as research showed that the rate of serotonin production in the brain was directly related to the duration of bright sunlight, regardless of the season.

Since sunlight shuts off the body's production of melatonin, a hormone produced at night that makes you feel drowsy, exposure to bright light can help the body maintain its circadian rhythm. The circadian rhythm is a 24-hour cycle that regulates biochemical, physiological, and behavioral processes; it makes a person feel tired when it is dark outside. By adjusting this cardiac rhythm, patients who suffer from sleep disorders generally improve.

The patient sits near a machine called a lightbox, which emits strong light; the light usually mimics natural sunlight though there are variations. A unit of measure called a lux gauges the amount of light used in a treatment; the standard output of a lightbox is between 2,500 lux and 10,000 lux.



Light Therapy for Pain and Wound Healing

When there is an injury, pain is the message the brain sends to the body to signal that it is hurt. While painkillers offer some temporary relief from the feeling of pain, they only help mask the symptoms rather than actually healing the source of the pain.

Phototherapy, particularly Low Level Light Therapy (LLLT), has gained attention in recent years as a new scientific approach with therapeutic applications in accelerating wound healing and alleviating pain. LLLT refers to the use of a red-beam or near-infrared laser with a 600–1000 nanometers wavelength and 5–500 milliwatts power.

Often dubbed cold lasers, these devices do not produce heat; in contrast, lasers used in surgery typically use 300 watts, burning the tissues they encounter. Cold lasers are handheld devices used by the clinician and are often the size of a flashlight. The laser is placed directly over the injured area for 30 seconds to several minutes, depending on the size of the area being treated and the dose provided by the cold laser unit.

During this time, the non-thermal photons of light that are emitted from the laser pass through the skins layers; the dermis, epidermis, and the subcutaneous tissue or tissue fat under the skin. This light has the ability to penetrate 2–5 cm below the skin at 90 mw and 830 nm.

It has been shown in clinical trials and laboratory studies that LLLT has tissue regenerative effects for the skin, tendon, muscle, bone, nerves, spinal cord and cerebral cortex. It has very good anti-inflammatory and analgesic effects; it also improves the function of healthy organs such as the brain and muscles, having cytoprotective effects on them.

While light therapy is considered safe and non-invasive, there are some side effects to the therapy, including headache and sunburn, but they are generally not serious. Most can be dealt with by adjusting the duration and intensity of the sessions.

Glossary

(1) Corticosteroids are a class of chemicals that are involved in a wide range of physiological processes, including stress response, immune response, and regulation of inflammation, carbohydrate metabolism, protein catabolism, blood electrolyte levels, and behavior.

(2) Psoriasis is a common, chronic, relapsing/remitting, immune-mediated systemic disease characterized by skin lesions including red, scaly patches, papules, and plaques, which usually itch.

(3) Eczema is a term for a group of medical conditions that cause the skin to become inflamed or irritated.

(4) Vitiligo is a chronic skin disease characterized by portions of the skin losing their pigment; it occurs when skin pigment cells die or are unable to function.

(5) Scleroderma, also known as systemic sclerosis, is a chronic systemic autoimmune disease characterized by hardening (sclero) of the skin (derma). In the more severe form, it also affects internal organs.

References

www.osa.org
www.webmd.com
www.healthline.com
www.livestrong.com
www.ncbi.nlm.nih.gov
www.womenshealthmag.com
http://nationaleczema.org/eczema/treatment/phototherapy/

By: Basma Fawzy

Light:

The Unspoken Language

The early rays of the Sun that mark the beginning of a day, the stars that guide travelers to the North, the burning fires of ancient lighthouses…all unspoken messages of light, changing the way we communicate.

Since ancient times, light has always been used as a guide for wandering ships. Whether in the form of wood fire, torches, or oil lamps, lighthouses stood by the seaside, proudly fulfilling their role by helping ships reach their destination safely. The signal of a lighthouse is clear; it is either take heed or simply you arrived safely. That was just the beginning of communication through light.

With the invention of telegraph, developing a coding system became a necessity; the purpose of the coding system was to translate language into pulses that will be sent through wires. In 1838, Samuel Morse, an American painter and inventor, created the Morse code; signals that transform into electric pulses, which move through a wire. Those pulses can deflect a magnet which subsequently moves a marker that produces written codes.

Morse transformed the alphabetical letters to codes consisting of dots and dashes; the most famous of these codes is SOS, the distress signal. The Morse code was not limited to transmitting signals through electric pulses; it developed from just dots and dashes into many other signals like sounds and flashes of light such as turning on and off a source of light to send pieces of information.

Light was used in the past to guide ships, and through the use of the Morse code it was also used to send different signals of help or guidance. Optical communication is a way of carrying information through light. This way of transferring information is very useful especially to ships at sea when no other form of communication is available.

One of the famous forms of transferring information through light is signal lamps, known as Aldis lamps. Those lamps are named after their inventor, and sometimes use Morse code; they are mainly used on naval vessels and airport control towers. Nowadays, they are used in airports just as backup devices, and they do not transfer complex messages; just basic messages like stop or land.

Officially, Morse code is no longer in use, whether in its written form (dots and dashes) or the flashes of light (signals), but it has been replaced by advanced and faster ways of communication.

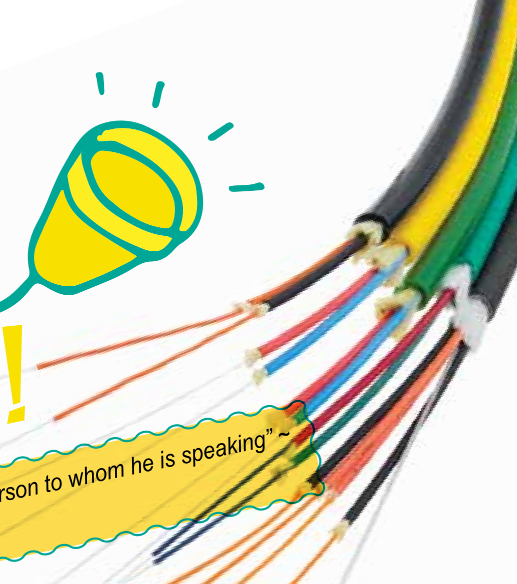
Since Ancient Times, light was used for communication; traffic light is an example of how light is used for that purpose. Red light means stop, green light means go, and yellow light means caution. As light plays an important role and helps in organizing traffic, it is also important at sea. All ships abide by the rules of the International Regulations for Preventing Collisions at Sea.

The lights on a ship do not just indicate its size; they also show its direction. Lights on any ship are not haphazard; the left side is called the "port side", while the right side is called the "starboard side". The lights of the port side are red, and on the starboard side are green; thanks to these lights, you can easily tell which way a ship is heading.

Communication by light is not restricted to human beings only; other creatures also use light to communicate. Unlike human beings, they have not invented anything; however, they are gifted with powers to produce and emit light. The process of producing and emitting light is known as bioluminescence; it is used to find mates, for defense, for communication, and for camouflage. Some types of fish produce light to lure other types to attack.

References

www.omniglot.com
www.britannica.com
www.universetoday.com
www.todayifoundout.com
www.brighthubengineering.com
http://ns1763.ca/tele/morse01.html
http://inventors.about.com/od/tstartinventions/a/telegraph.htm
http://earthsky.org/brightest-stars/polaris-the-present-day-north-star



Communication at the Speed of Light!

By: Esraa Ali

"The day will come when the man at the telephone will be able to see the distant person to whom he is speaking" ~ Alexander Graham Bell (c. 1906)

During the first half of the nineties of the past century, the notion of communication was restricted to chatting over the telephone or watching television. A country thus became connected together with two different wire communication networks: one for telephones and the other for cable television. Later on, with the emergence of the Internet, people realized that communication could mean something more, even easier, and faster as the speed of light!

In 1880, Alexander Graham Bell and his assistant Charles Sumner Tainter jointly invented the photophone, later given the alternate name radiophone. Bell described the photophone briefly as an apparatus that produces and reproduces sound on a beam of light. The photophone functioned similarly to the telephone; except for using light as a means of projecting the information, while the telephone relied on electricity.

The photophone worked by projecting voice through an instrument toward a mirror; the vibrations in the voice caused similar vibrations in the mirror. By directing sunlight into the mirror, the vibrations were transformed back into sound at the receiving end of the projection. The device was able to transmit a voice signal over a distance of 2,000 meters, but was not able to protect transmissions from outside interferences, such as clouds.

Four years earlier before Bell's invention of the photophone, he invented the conventional telephone, but he referred to the photophone as his greatest invention. His plea for extending scientific favor, which was so readily extended to the telephone, to this new claimant was ignored throughout the 19th century. The photophone was an extremely important invention, but that was many years before the significance of Bell's work was fully recognized.

The discovery of optical fibers as a telecommunication medium belongs to Charles K. Kao, also known as the "Father of Fiber Optics", in the 1960s. Before his pioneering work, glass fibers were widely believed to be unsuitable as a conductor of information. Through his research efforts, Kao and his team discovered that silica glass of high purity is an ideal material for long-range optical communication.

Optical fibers, also known as fiber optics, are flexible and transparent fibers made of silica or plastic, and measure about the same thickness in diameter as a strand of human hair. These fibers are arranged in bundles—known as optical cables—that transmit data carried by light signals, over long distances, from one end to the other.

Each optical fiber consists of three main parts: a core, or the central part of the fiber that carries light; a cladding, or the layer of glass or other transparent material surrounding the core; and a buffer coating, or the material that surrounds the core to protect the optical fiber from damage from moisture and physical damage, and does not govern the transmission capability of the fiber.

Today, modern optical fibers are capable of transporting information at data rates exceeding several gigabits per second. The speed of data transmission does not depend on the thickness of the strand, but rather on the speed at which the lasers and the signal boosters can flicker. The higher the speed of the lasers and boosters, the more expensive they are; as a result, the speed of lines is determined by engineering as well as economics.

Fiber's capacity brought fundamental changes in the way people communicate. The high capacity of fiber turned the Internet into a means of communication for people around the world; for example, use of social media, low cost telephone calls, texting, and video-conferencing with family and friends scattered around the world, and so many other forms of modern communication.

"In scientific researches, there are no unsuccessful experiments; every experiment contains a lesson. If we do not get the results anticipated and stop right there, it is the man that is unsuccessful, not the experiment."

~ Alexander Graham Bell

Bell's photophone demonstrated the basic principle of optical communications as it is practiced today. The two requirements for commercial success, a powerful reliable light source, and a reliable low-cost medium for transmission, were almost a hundred years away. Nowadays, in the 21st century, the use of light in optical fibers has revolutionized the way humans interact, and communication means have reached a way that has never before been possible in history.

References

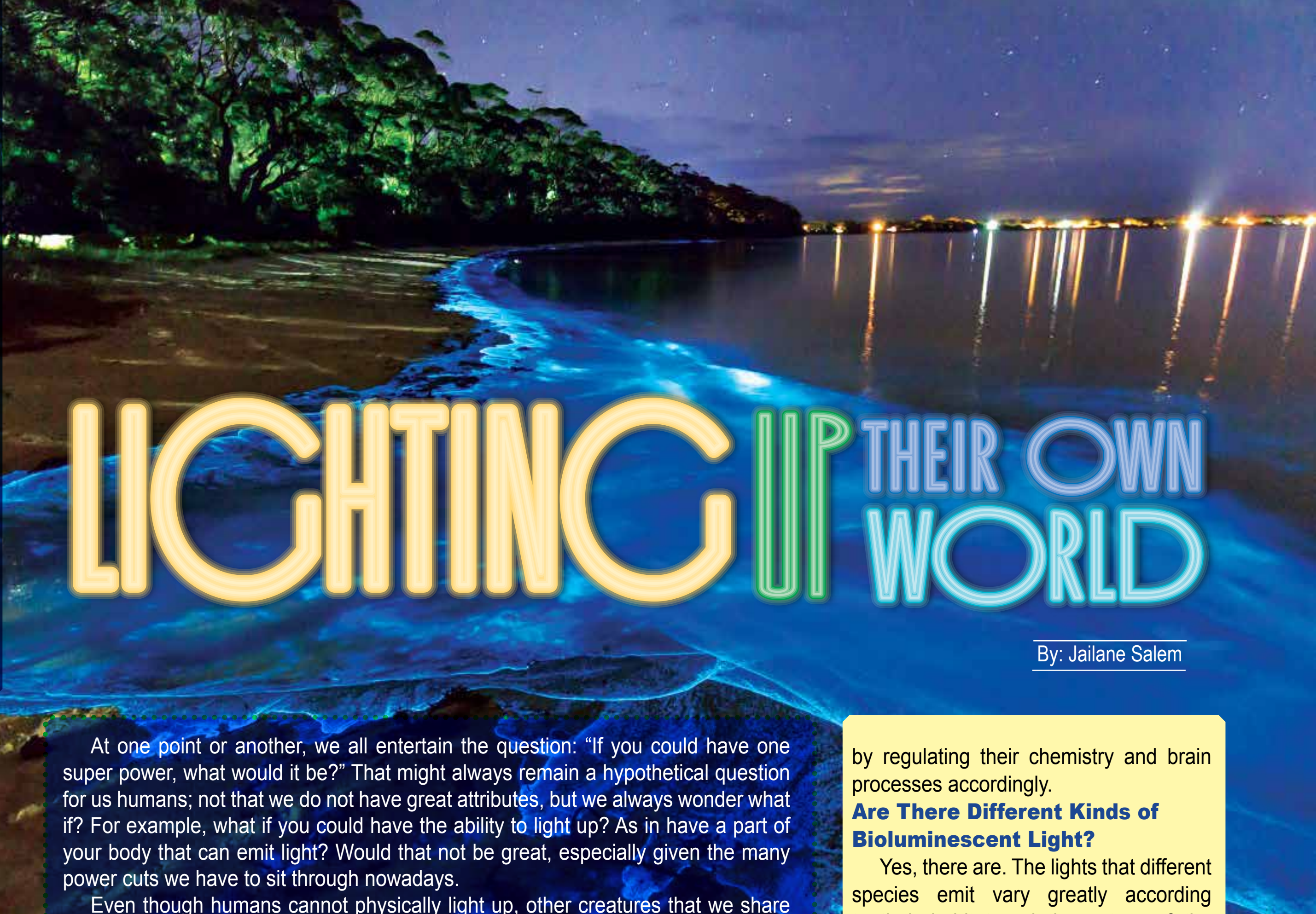
James H. Johnston, "Internet with the Speed of Light Technology", *Legal Times*, Vol. XXV, No. 45, NLP IP Company, D.C., November 2002.

www.light2015.org

http://daveyalba.com/fiber-optics/

https://technet.microsoft.com/en-us/library/bb962026.aspx

http://inventors.about.com/od/pstartinventions/a/photophone.htm



LIGHTING UP THEIR OWN WORLD

By: Jailane Salem

At one point or another, we all entertain the question: "If you could have one super power, what would it be?" That might always remain a hypothetical question for us humans; not that we do not have great attributes, but we always wonder what if? For example, what if you could have the ability to light up? As in have a part of your body that can emit light? Would that not be great, especially given the many power cuts we have to sit through nowadays.

Even though humans cannot physically light up, other creatures that we share this Earth with can! While we cannot see in the dark, and therefore rely heavily on artificial light to help us see when night falls, some creatures have eyes that are built to help them see at night, while others have the ability to create their own light.

The fascinating ability to create one's own light is known as bioluminescence. The light emitted from light bulbs is usually generated by an electrical current that passes through the filament; the increase of heat in the filament causes it to emit light. However, in bioluminescent creatures, it is a chemical reaction that occurs within their bodies; the process neither needs nor gives off heat, and hence, the outcome is known as "cold light".

Bioluminescent organisms live in different environments across the Earth, ranging from deep seas to land. If you have watched the movie Finding Nemo, you might very well remember the scene where Dory and Nemo's dad encounter an anglerfish, lured by the lit-up dorsal fin that protrudes above its mouth.

The anglerfish can glow thanks to bioluminescent bacteria that inhabits its dorsal fin, allowing it to lure prey within easy reach of its humongous mouth, making for an easy lunch! However, not all bioluminescent life forms look as threatening; many of them are insects, such as centipedes, millipedes, and the better known fireflies.

How Do They Glow?

Bioluminescent organisms produce light through a chemical reaction known as chemiluminescence, which takes place between two types of substances: a luciferin and a luciferase. Luciferin is the light-producing substance, whereas luciferase is the enzyme that catalyzes the reaction; different chemicals can take on the role of these two. The luciferin is a photoprotein that needs a charged ion in order to activate the reaction that produces light, while the catalyst luciferase helps in speeding up the reaction.

The reaction usually needs other substances in order to take place, such as oxygen; the high energy molecule that is created by the reaction is what releases the energy in the form of light. Different species use variations of this process, and use their ability to light up by regulating their chemistry and brain processes accordingly.

Are There Different Kinds of Bioluminescent Light?

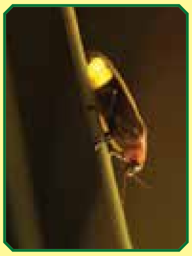
Yes, there are. The lights that different species emit vary greatly according to their habitat and the nature of the chemical reaction that takes place. In deep sea waters, only green and blue wavelengths of sunlight reach that depth, since they are the shorter wavelengths and therefore have more energy to penetrate the water at a longer distance. As a result, bioluminescent sea organisms usually emit light that is in the blue–green part of the visible light spectrum; they cannot process yellow, red, or violet colors.

Land organisms, on the other hand, can emit a wider variety of colors. While some organisms can flash lights on and off; others have a constant glow, like some species of fungi that grow on decaying wood, creating what is known as foxfire.

Why Do They Light Up?

Even though it is a wonderful ability to possess, but why do some organisms actually light up? There are many reasons: some use it to attract possible mates; others as a defensive mechanism that allows them to escape, or as a warning to predators that they are toxic; some actually use it to lure their prey, while some light up for reasons as yet undiscovered by researchers.

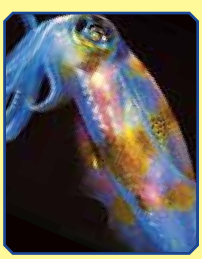
What Are They?



Let us have a look at some of these wonderful bioluminescent creatures, starting off with the wonderful firefly, which adds a certain mystical touch to wherever it is found. Male fireflies are the ones that usually flash on and off to attract mates; they have various lighting signals and patterns to communicate their type and that they are looking for a mate. While not all adult fireflies can glow, they can all glow as larvae in order to fend off predators and warn them that they are toxic.

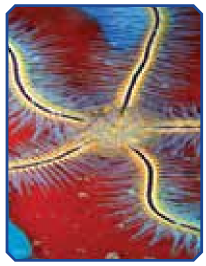
Another bioluminescent organism that can be found growing on rotting trees is fungi. Not all fungi is bioluminescent but some are, and can emit green and blue light that is visible in the dark. Some speculations as to why this occurs is that the light attracts insects that then help distribute the spores of the fungi to other areas, allowing it to increase its colonies.

Bioluminescent plankton, on the other hand, lights up when disturbed, which causes a phenomenon known as the milky sea, creating a beautifully eerie sight. The plankton can light up due to waves made by passing ships, or disturbances caused by water-borne objects. They can sometimes be so strong that they can show up in satellite images of seas and oceans. Moreover, they have been known to interfere with marine navigation systems in some cases.



We all know that squids can eject dark ink in order to envelop their predators in the dark, allowing them to escape. However, some deep sea squids lack this feature of having ink sacs; instead, some squids such as the vampire squid can eject bioluminescent mucus.

This cloud of bioluminescent mucus is ejected from the tips of its arms when it senses danger; this in effect startles the predator, allowing the squid to escape unscathed. The vampire squid also has photophores covering most of its body, which allows it to basically light up whenever it wants; this helps it attract its prey, and swim undetected in the deep dark sea when it is off.



Some marine animals have the amazing ability of detaching parts of their body to help them escape from their predators. Some species of brittle stars and sea cucumbers can detach body parts that are bioluminescent to trick their predators into going after the glowing limbs while they escape to a safer place. Sea cucumbers can detach a bioluminescent body part on a passing fish, which causes their predator to follow the fish instead of the sea cucumber; a great act of subterfuge. Many species of the brittle stars, on the other hand, are bioluminescent and even though they sometimes detach their arms they can re-grow them.

Some fish use their bioluminescent light in order to camouflage themselves and hide in plain sight; this is known as counter-illumination, and is used when fish are swimming near the surface. Near the surface, there is more light around, so fish swimming there tend to have a silhouette that is visible at greater depth. So, how do fish use bioluminescence to camouflage themselves near the surface? One example is that of the hatchetfish, which has a bioluminescent underside; by emitting light pointing downwards, mimicking the same light in its vicinity, its outline is no longer distinguishable from the surroundings, therefore becoming invisible to predators looking up.

While the hatchetfish uses counter-illumination to seem invisible, the cookie-cutter shark has a slightly different approach. It too can emit light from its underside to blend in with the light at the surface of the sea. However, it has a small part of its underside that does not light up, causing those looking up to see a small silhouette. Lured by the promise of an easy catch, they approach the shark, which then launches its attack. This trickery allows the cookie-cutter shark to prey on much bigger fish than itself.

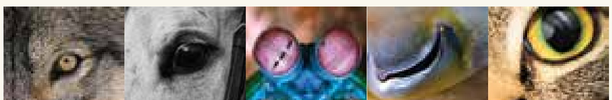
How wonderful it would be to acquire such a fabulously practical and beneficial trait. That is why many researchers are still studying this trait in organisms and some are even working on adapting the process of bioluminescence in order to create light that is as energy efficient as that produced by these animals and organisms. With so many advancements in energy studies and technologies, and with a desperately growing need for energy efficiency, let us all hope to be able soon to bioluminate!

References

http://www.livescience.com/19318-bioluminescent-light-organisms.html
http://animals.howstuffworks.com/animal-facts/bioluminescence1.htm
http://docmo.hubpages.com/hub/Animals-that-Glow-The-Science-of-Bioluminescence
http://education.nationalgeographic.com/education/encyclopedia/bioluminescence/?ar_a=1

By: Shahenda Ayman

THE WORLD THROUGH THEIR



EYES

If you think that all creatures on this planet see objects the same way we do, then you are wrong. Living creatures' visual perception of the surroundings depends on how their eyes process light.

Humans are trichromats; our eyes have three types of photoreceptors known as cone cells, which are sensitive to red, green, and blue. A different type of photoreceptors called rods detect small amounts of light; this allows us to see in the dark. Some animals, on the other hand, have only two types of photoreceptors, which renders them partially colorblind. Others, however, have four types of photoreceptors, which enables them to see ultraviolet light, while some can detect polarized light, meaning light waves that are oscillating in the same plane.

Scientists assert that good color vision helps animals find food on land or in water; for instance, good color vision helps land animals differentiate between ripe red fruit and unripe green fruit. Moreover, colors can make animals more attractive to each other. The ability to see colors also helps animals identify predators or any other thing that might attack them.

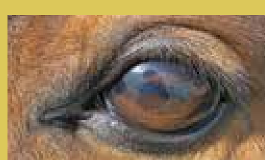
So, how do animals see the world?

ON LAND

Cats and Dogs

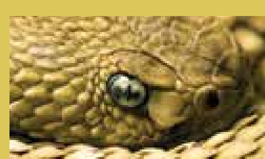
Cats and dogs are color blind; they only see very pale shades of color. Many of them have vision similar to humans who have red−green color blindness. According to Dan-Eric Nilsson, Professor of Zoology at the University of Lund, Sweden; and coauthor of the *Animal Eyes* book; cats vision is six times blurrier than ours in daylight, but is better at night, with sensitivity to movements. This is because they have more rods than humans; this ability enables them to hunt at night.

Horses



Like zebras, horses eyes are pointing sideways to give them outstanding peripheral vision; this also helps them avoid predators and escape when possible. However, these animals have a blind spot directly in front of their noses, they also lack binocular vision; that is, a horse will always see two images and cannot merge them together like a human. Although horses have better night vision than humans, their color vision is rather poor; they can distinguish green and blue, but a horse's sight is mostly in shades of grey.

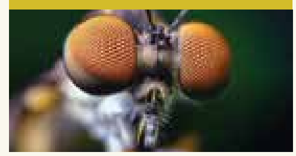
Rattlesnakes



Rattlesnakes have low resolution color vision during daylight and their vision is very dependent on movement, but very good color vision at night. They pick up infrared heat signals from warm objects around them because they have special sensory tools called pit organs.

Pit organs are a pair of holes on either side of the snout between the eye and the nostril; in each pit, a thin membrane is suspended to detect heat. According to David Julius, Professor of Physiology at the University of California, San Francisco; a neural receptor, TRPA1, is found in the snake's nerve cells and connected to this membrane; this receptor is responsible for the snake's ability to transform infrared light into nerve signals.

IN THE AIR



Bees

Like humans, bees are trichromats; however, their three photoreceptors are sensitive to yellow, blue, and ultraviolet light. Their ability to see ultraviolet light allows them to spot patterns on flower petals that guide them to nectar; they perceive so much of the ultraviolet range that enables them to see more than one color of ultraviolet.

In addition to the ability to see ultraviolet light, bees have compound eyes, which consist of thousands of lenses, unlike humans who have only one lens. Each lens in the bee's eyes produces one pixel; as a result, they have extremely low-resolution vision that makes everything look blurry.

Birds

Birds are tetrachromats; their four-type con cells enable them to see red, green, blue, and ultraviolet. Hunting birds such as eagles have sharper vision than humans; they can easily spot their prey from great distances away.

Owls have eyes as big as ours with huge pupils that capture lots of light; however, they are nighttime animals, which means that they see clearly at night when the world is dark for us.

Bats

People assume that bats are blind, but this is totally wrong. All bat species can see pretty well, although their vision is not as good as most night-hunting animals. They are sensitive to changing light levels and this is the main cue that they use to sense when it is nighttime.

To avoid predators, find their way home, and hunt their prey, bats depend on echolocation. They broadcast high-pitched sonar signals and listen for the echoes of sound waves bouncing off objects they are looking for or obstacles in their path. Bats' brains then process the auditory information within those echoes as visual maps.

Bats tailor their signal to get the information they want; such as targeting prey, locating a predator, or finding their roost. Since bats also have perfectly good vision, what they see can sometimes interfere with what they hear. For example, a captive bat in a darkened room might fly into a window as it sees light coming through pane as an escape route, although echolocation sonar tells it there is an obstacle in the way.

UNDER THE SEA

Cuttlefish

Seeing through the eyes of a cephalopod, such as a cuttlefish, squid or an octopus, needs imagination. Cephalopod eyes have no blind spot, and its pupil is a W-shape, making it look especially alien as it pursues prey in the ocean.

Cuttlefish are among the most remarkable of cephalopods. However, nobody expected them to have this particular trick up their sleeve. Cuttlefish can actually see information in the angle of intense polarized light that we can barely comprehend.

In spite of their hunting prowess, cuttlefish have blurrier vision than us. Even though they have incredible color-changing skills—going from beige to blood-red or striped in the blink of an eye—cuttlefish are totally colorblind.

Cuttlefish eyes have one photoreceptor that lets them see in shades of grey; another pair of photoreceptors detects polarization. Unlike cephalopods, we do not have photoreceptors to detect whether the light is polarized or not. Humans only experience polarized light when wearing sunglasses that reduce the Sun's glare by filtering out one orientation of light waves.

Cuttlefish produce polarization patterns on their skin that they may use to communicate. Looking at one another, cuttlefish would see shades of grey with the polarization information overlaid, not unlike the rattlesnake's infrared sense.

Sharks

Though sharks' eyes are similar to ours—made up of retina, iris, lens, cornea, and pupil—our visual abilities are distinct. Sharks have no retina cons; therefore, they cannot detect colors. Sharks' eyes are designed to catch as much light as possible, in addition to seeing in murky water; however, despite seeing objects up to more than 18 m away, their vision is not as sharp as ours.

Mantis Shrimps

Shrimps and crabs have compound eyes similar to insects made up of tens of thousands of ommatidia: elements containing a cluster of photoreceptor cells, support cells, and pigment cells. In this species of spectacular vision—such as Gonodactylids and Lysiosquillids—the middle of the eye has six rows of modified ommatidia known as the mid-band, which is where the magic happens.

Each ommatidia row is specialized to detect either certain wavelengths of light or polarized light; the first four rows detect human visible light and UV light. In other words, each row contains a different receptor in the UV, giving mantis shrimp extremely good UV vision. The ommatidia of the last two rows contain very precisely positioned, tiny hairs; this arrangement is responsible for their polarization vision.

The overall structure of the eye is intriguing too; three parts of each eye look at the same point in space. This results in about 70% of the eye focusing on a narrow strip in space, but also gives them the ability to perceive depth with just one eye.

Mantis shrimps constantly move their eyes, scanning the environment. The ability to move each eye independently comes in useful here, allowing the mantis shrimp to have a large field of view.

What we know about color perception in the animal kingdom pales in comparison to that which is yet to be discovered. Seeing the world through other species eyes is for sure an exciting and highly educational experience.

References

http://nautil.us/
http://www.eyes-and-vision.com/
http://www.iflscience.com/
http://www.colormatters.com/
http://phys.org/
http://io9.com/
http://news.discovery.com/

Art: The Offspring of Light

By: Maissa Azab

Art, a major aspect of culture, was, is, and will always be born from light. Light is made of colors, and colors are projected by absorbing certain wavelengths of light while reflecting others. Yet, that is not just it; light in itself has been employed to illuminate artwork, such as stained glass that has adorned architectural landmarks since the 4th century to this day.

From the caveman to modern day artists, all have used light, shade, and color to illustrate mood and create atmosphere. The word Chiaroscuro is Italian, roughly meaning “light and dark”; it was first used to describe a type of drawing on medium-dark paper where the artist created both darker areas with ink and lighter areas with white paint.

Later on, the term was used for woodcut prints which essentially did the same thing, using white and black together. When it comes to painting, however, Chiaroscuro truly came to life in the paintings of Caravaggio during the late 16th century. Caravaggio began to use deep, dark backgrounds for many of his paintings, and seemed to almost turn a spotlight on his figures; the high contrast in those paintings made for intensely powerful and dramatic works of art.

Throughout history, light has also played the key role in arts such as photography, holography, and cinematography. However, with the invention of artificial light, many artists began using light as the main form of expression, instead of just as a vehicle for other forms of art. László Moholy-Nagy (1895–1946), was a member of the Bauhaus who was influenced by Constructivism. Light sculpture and moving sculpture are components of his Light-Space Modulator (1922–30), which is one of the first light art pieces, also incorporating kinetic art.

Not only that, even the blocking of light, aka shadow, has been employed to create art, such as in shadow puppetry. Shadow play is an old tradition that is still popular in various cultures; it is a popular form of entertainment for both children and adults in many countries around the world.

In modern-day live performances, effective lighting is so important that it typically warrants a working crew. Stage lighting in performance arts pieces not only allows the audience to see what is happening on stage, but can also be used to set the tone, direct focus, or alter one’s position in time and space.

Lighting design is a highly technical field and involves manipulating luminaires to find the appropriate intensity, color, direction, focus, and position. In both theater and dance, light plays a tremendous role in developing the plot of performances and evoking emotion within the audience.

From concerts to theme parks, laser light shows entertain audiences of all ages. The precision and strength of lasers allow for light to illuminate crowds, create designs on infrastructures, and can even be seen in the night sky.

Laser light is useful in entertainment because the coherent nature of laser light allows a narrow beam to be produced, which allows the use of optical scanning to draw patterns or images on walls, ceilings, or other surfaces including theatrical smoke and fog without refocusing for the differences in distance, as is common with video projection. This inherently more focused beam is also extremely visible, and is often used as an effect; sometimes the beams are “bounced” to different positions with mirrors to create laser sculptures.

Light is the most important factor in the appreciation and understanding of architecture. The relationship between light and architecture is not just about energy and matter; it also implies an emotional effect on people. The human eye perceives its form through the incidence and reflection of light, acquiring information about the ambiance in a given place. Visual impressions are interpreted in our brains and put in context to create emotions that move us in a particular way.

Lighting in a living room should be warm and dimmed; the distribution of light should reveal texture and color, balancing the dark and clear areas. This atmosphere, when read by our visual system, creates a comfortable impression that helps us relax.

In opposition, lighting in a workplace should be cool in appearance, brilliant and focused on the specific places of work. All the room should be evenly lit to be perceived as wide and clean; this impression creates a dynamic mood in which different tasks are developed with more energy, mental and physical.

Light defines the architectural space; it contributes to its perception and understanding while adding value to its function and bringing an emotional component for its users.

This has been a very brief overview that merely touches the surface of what light means in art, not to mention in our entire life. Light is indeed indispensable for life in all and every aspect of it; studying and unveiling its secrets is far from over, but is rather just beginning.

The prince of shadow and light, the father of modern physics, the leader of modern scientific approach, the founder of experimental physics, and the first scientist; all are titles referring to Ibn al-Haytham (354–430 AH/965–1040 CE).

Abu Ali al-Hasan ibn al-Hasan ibn al-Haytham, known in the West as Alhazen, is one of the most significant Arab scientists, who changed the world with his theories and researches, especially in light.

By: Dr. Mohamed Soliman
Director, Manuscript Museum

THE PRINCE OF Shadow and Light

As for Western scientists, Belgian historian Alfred Sarton, founder of the science of history, said: "He is the greatest Arab physicist; he is even the greatest Medieval physicist, and one of the few optics scientists known worldwide". Ibn al-Haytham's books and researches remain to this day a primary and an important source for everyone who has worked in the fields of physics and optics; not to mention his major contributions in astronomy, mathematics, geometry, medicine, and especially ophthalmology and eye autopsy.

Ibn al-Haytham is one of the polymath scientists. His works were translated into many foreign languages and formed the foundation of modern theories, especially in the science of light. He is regarded as the pioneer of light sciences or the founder of modern light science. It is not easy to write about Ibn al-Haytham and his work in these few lines; they just shed some light on his contributions to the science of light, and his "Book of Optics" (*Kitab al-Manazir*), though they are not enough.

The "Book of Optics" consists of seven volumes tackling seven main topics, namely: optical perception as a whole; the meanings perceived by vision, their causes, and how they are perceived; errors in optical perception of what perceived as straight and their causes; recognition of sight by reflection from heavy objects; illusions, which are images seen in heavy objects; errors related to reflection and their causes; and finally, optical perception by refraction from behind transparent objects against the transparency of air.

Ibn al-Haytham divided these topics into chapters, in which he followed an experimental scientific approach, supporting his light and optics theories by scientific geometrical experiments. Thus, he was one of the first scientists to follow a proper scientific approach in research.

The first three volumes discuss the theory of vision, functions of the eye, and cognitive psychology; the other volumes tackle the physics of classical optics, so the "Book of Optics" gathers optics, physics, mathematics, and psychology. We can say that his book is divided into two sections: the first deals with the glow of lights, and the vision of straight lines; while the second deals with light reflection and refraction, and what results from them as image-formation in different shaped mirrors and transparent bodies, as described by Ibn al-Haytham.

His most famous and wonderwork "Book of Optics" changed the theories of optics and light that had been instilled for more than a thousand years; it turned the scales of this science as evidenced by the proximal and distal. Its applications, still used to date, contradict all that was believed before it, including what Euclid and Ptolemy had concluded to.

The "Book of Optics" was categorized, as well as Isaac Newton's "Mathematical Principles of Natural Philosophy", as the most important and influential books in physics. It is also regarded as the most contributory book in the development of optics, especially the theory of vision, which Ibn al-Haytham included in his book. The theory was a breakthrough against everything previously known in sciences at that time, proven by experiment and proof, and thus considered a true addition to science.

The common and prevailing explanation of vision before Ibn al-Haytham was based on two theories, namely: extramission and intromission. The extramission theory stated that sight happened by the emission of light rays from the eye; the intromission theory, on the other hand, assumed that light entered the eye in a physical form. Both theories were supported by previous scientists such as Euclid, Ptolemy, Aristotle, and Galen.

Ibn al-Haytham opposed the two theories in his first article in his "Book of Optics"; in the following two articles, he presented his theory of the psychology of visual perception. He presented an alternative for the two theories, explaining the process of sight, which is the most accurate by experiment, stating that sight occurs when the rays of light are emitted from each point of the object to the eye.

Ibn al-Haytham's philosophy and approach is reflected in his quote: "The seeker of the truth is not the one who studies the writings of the ancients as received and puts his trust in them, but rather the one who has his faith in them, yet questions what he gathered from them; the one who submits to argument and not to the sayings of others. Thus, the duty of the one who investigates the writings of scientists, if learning the truth is his goal, is to question all that he reads, applying his mind to the core and margins of its content, tackling it from every side. He should also question himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency."

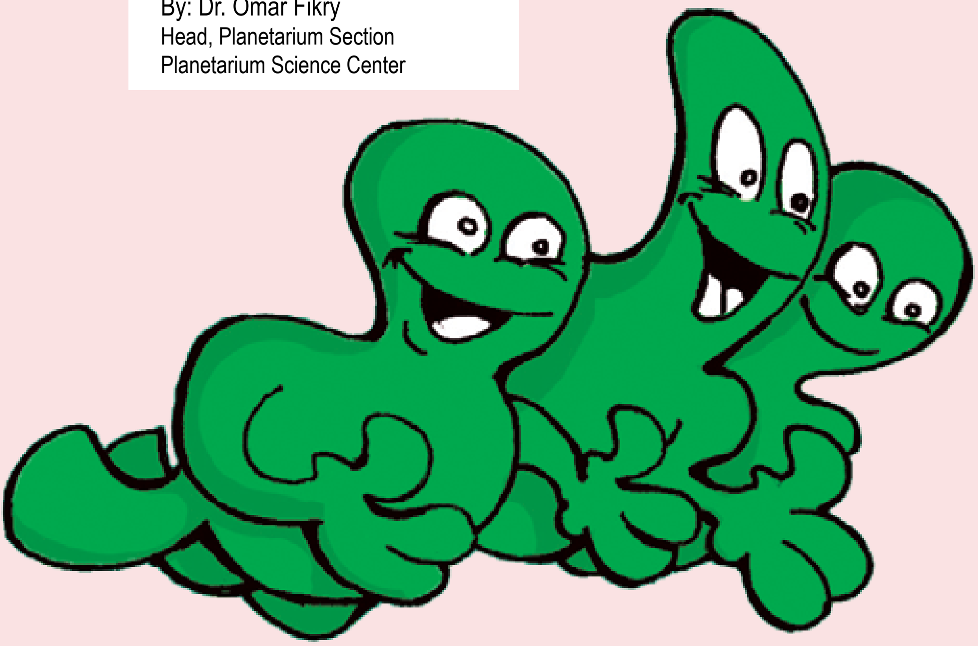
The prince of shadow and light is still alive among us through his knowledge and applications that resulted from his studies to this day. Dear reader, I would urge you to remember Ibn al-Haytham when you use a camera. When you look at the Moon, remember that one of its craters is named after him; remember his saying: "Often enough the dead remains alive through knowledge, whereas the living dies through ignorance and malaise. Therefore, acquire knowledge to gain immortality, and give no value whatsoever to an ignorant life".

So ponder, O men of understanding.

Exploring the Human Civilization Enigma

EPISODE PRE-FINAL

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



You are fed up, dear reader, with the visit of these weird creatures on this strange night. Now, in the pre-final episode, we—you and I—have to put an end to this whole thing. What we know is that these three creatures know a lot about what happens here on Earth; secondly, they are very friendly and are not to be feared; and thirdly, you have become accustomed to their presence and talking to them, which is obvious from the previous episodes. Now, how will this end? The morning is about to break and there will soon be light.

These creatures are rational, intelligent, developed, and liberated; they come from a faraway planet they promised to tell you its name and location. After you stop the alarm bell, which drew their attention, you look at them in astonishment, especially when the sunlight enters the room and passes through their bodies. You ask yourself again: What is that? Is that really happening? Or is it all just a dream? Light should have caused their bodies to cast shadows on the wall; but this is not the case here.

You ask the tallest: "Excuse me" … However, he asks you first: "Please let me ask you first: What is that noise that came from this small thing beside you?" You answer spontaneously: "It is the alarm clock that helps me wake up on time every morning".

"Please tell me, why is there no shadow for you on the wall as a result of the sunlight? Or on the floor as a result of the lamp light?" The fattest answers: "What do you mean by shadow?" The tallest answers him on your behalf: "Shadows my friend are those dark shapes formed when light falls on an object". The fattest replies: "Oh, I see". Then, he continues while looking at you: "Shadows form due to many factors; the most important factor is when light falls on a solid body. However, and as we told you before, we have a special nature that you consider supernatural on your planet".

The shortest tries to interrupt, but you stop him, saying: "Please, there is no need to continue; I want to put an end to what is happening here. I have to go to my work, and you did not tell me yet the reason behind your visit, or the planet you came from". The shortest answers quickly: "We asked you to show us a place where we can talk to all the planet's inhabitants, but our talk was deviated many times to other topics. Come on, tell us about the appropriate place where we can unveil our identity and deliver our message to the largest number of people living on this planet".

A brilliant idea pops into your mind; you think of recording a video of them and uploading it to the Internet, so that as many people as possible can see it as these creatures want. However, when you ask them to get ready for shooting, the shortest asks: "Excuse me my friend; this idea is not as good as you think. If you try to shoot us, we will not appear in the video as our bodies resist shooting, just as they do not form shadows.

You reply with more confusion: "How shall I help you talk to the planet's inhabitants then?" The tallest answers: "Write about us buddy; write about us somewhere popular, or you can send to news agencies our news and description". The shortest comments on this idea saying: "Yes, send to news agencies and to Internet websites after translating this info into all languages. Then tell your friends and acquaintances to spread the word, so that our followers will increase". You rub your forehead in amazement.

Is this idea rational? Who would believe me? Of course, people would assume that I have gone insane; suddenly, you continue: "You do not know my friends and acquaintances well. People here only believe physical things that they can see with their naked eyes and hear with their ears; the age of prophecies and unseen things has ended. Please, excuse me, I ran out of time; why do you need to talk to the planet's inhabitants anyway? Is not one person enough? I am here, you know me and I know you; I am not afraid of you and you spent a whole night in my room. What do you want to tell people? What is the secret behind this request? Tell me… tell me.

Goodbye for now until we meet again in the next and final episode.

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

Alexandria, The Cradle of Astronomy
22 min. Full-dome 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.

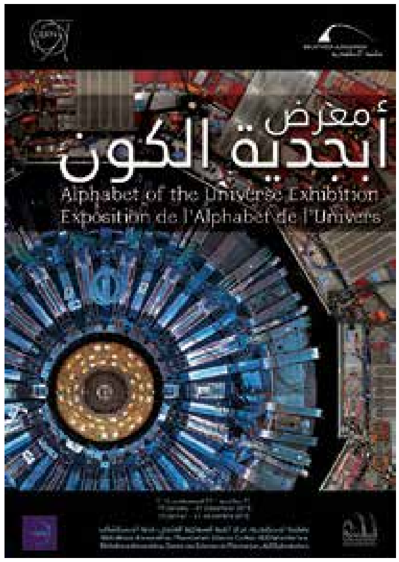
History of Science Museum

Visitors INFO

Opening Hours
Sunday–Thursday: [9:30-16:00]
Saturday: [12:00-16:00]

Guided Tours Schedule
Sunday–Thursday:
[10:30, 11:30, 12:30, 13:30, 14:30, 15:30]

- 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.



ALEXploratorium

Visitors INFO

Discovery Zone

Opening Hours
Sunday–Thursday: [9:30-16:00]
Tuesday: [9:30- 12:30]
Saturday: [12:00-16:00]

Guided Tours Schedule
Sunday, Monday, Wednesday,
Thursday: [9:30, 11:00, 12:30, 14:30]
Saturday: [12:00, 14:00]
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.-

Countries of the Euro-Mediterranean and Middle East share the same history and tackle today the same concerns for the development of the region. Moreover, with the events unfolding in this area in the recent years, there is a need to reinforce a stronger partnership with people and to support democratic transformation and institution-building, with the aim to deliver sustainable and inclusive growth and job creation.

The main objectives of the EMME Summer School are: (a) to consolidate existing science centres in the Euro-Mediterranean and Middle East, their activities and programs; (b) to support the development of new science centers and communication projects in the region; (c) to enhance science centers' advocacy in society including but not limited to institutions at the national and regional levels; (d) to exchange expertise, practices and activities among professionals in the field; (e) to stimulate the development of cooperative projects among the members of the two networks.

The EMME Summer School is addressing future leaders in the field of science centers and museums. This is applied by providing professional development programs, in both general management and field specialty skills. Beneficiaries are middle profile staff of existing science centers/museums and newcomers with projects of new science centers/ museums and activities in the field of science communication from the Euro–Mediterranean and Middle East regions. EMME 2015 will be held at the Planetarium Science Center in the Bibliotheca Alexandrina, Alexandria, Egypt, during the period 5-10 September 2015.

For more information, please visit the following link:

http://www.bibalex.org/EMME2015/

BIBLIOTHECA ALEXANDRINA
مكتبة الإسكندرية

Seeing is Not Always Believing

Illustrated by: Mohamed Khamis

Check out the "The World through their Eyes" feature , page 18