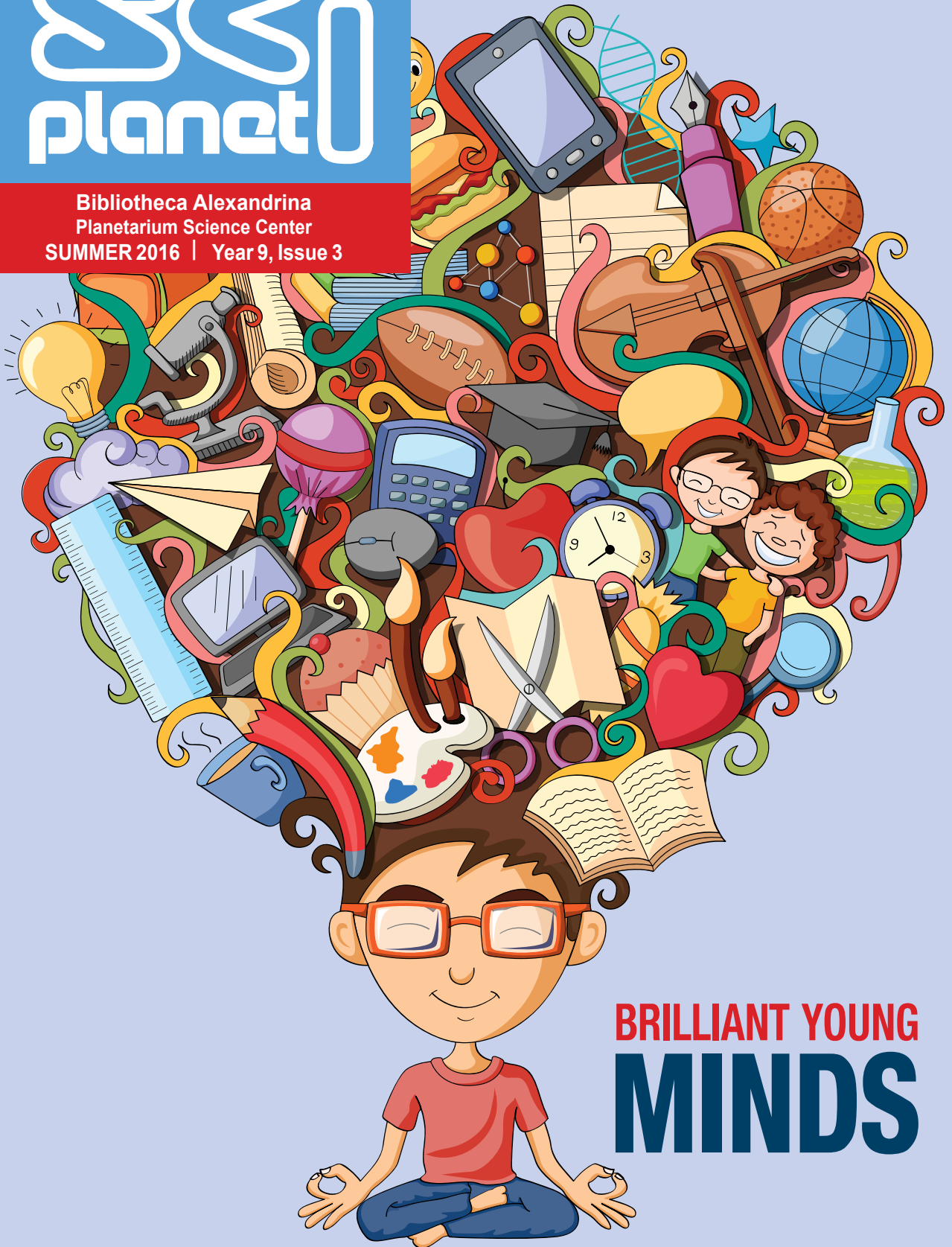


EYE ON SCIENCE

# Sci planet

Bibliotheca Alexandrina  
Planetarium Science Center  
SUMMER 2016 | Year 9, Issue 3



**BRILLIANT YOUNG  
MINDS**

## IN THIS ISSUE...

- 4 Avicenna; the Prince of Physicians
- 5 Pascal; a Literary Scientist
- 6 Q&A: The Founder of Quantum Theory
- 7 Chandra and the Secrets of the Stars
- 8 Frederick Banting: Battling Diabetes
- 9 Frédéric Joliot: A Continuing Scientific Saga
- 10 Top Ten Modern Child Prodigies
- 12 The Early Challenges of Great Minds
- 13 Promising Inventions by Young Inventors of Today
- 14 Curious Inventions by Young Innovators
- 15 A Letter to a Young Scientist
- 16 Young Egyptian Minds Shaping Our Future
- 18 Egyptian Team Wins Again at Intel ISEF 2016
- 19 An Interview With A Young Scientist
- 20 Forty and Under Self-Made Billionaires
- 22 Aristotle and the Legacy of Logic



# YOUTH: Their Science, Innovation, and Entrepreneurship

By: Maissa Azab

I am a firm believer that age is no boundary for accomplishment. Just as it is never too late to learn, discover, or create new things, it is never too soon either. In fact, history brims with child prodigies that have continued to marvel generation after generation for centuries following their departure from our world.

Nevertheless, prodigious performance is not necessarily limited to children with exceptional gifts bestowed upon them; phenomenal intelligence and aptitude have often been demonstrated by teenagers and young adults. Yet, inherent qualities of observation and perception are not the only means by which a young person proves to be a genius. Having the desire and the drive to wonder, analyze, deduce, and innovate can also be the ingredients of a mastermind.

It is, thus, crucial to not undermine or dampen young enthusiasm and ideas; they can be the source of future comfort and wealth. As a matter of fact, investing in exploring and unleashing youth's hidden talents and capabilities can be the most rewarding venture. After all, today's children and teenagers are the rulers of tomorrow; let us then instill in them the seeds of positive thinking and confidence; let us nourish their constructive curiosity and goodwill; let us stand by them and with them.

In this issue, we aim to give youth a boost and give older adults a nudge to do the same. From Aristotle to Mark Zuckerberg, we explore examples of young successes in the world of knowledge, science and technology. We highlight eminent Nobel Laureates who have achieved, or embarked on life-changing discoveries at a young age. We discuss challenges that sometimes face young intellects, curious creations by young inventors, and modern conceptions by young innovators that may shape our tomorrow. Finally, we certainly pay special attention to Egyptian youth, how they think, and where they may lead us someday.

We hope to inspire all our readers of all ages.

"An experiment is a question that science poses to Nature, and a measurement is the recording of Nature's answer." — **Max Planck**; read about him on page 6.

"Everyone is a genius; but, if you judge a fish on its ability to climb a tree, it will live its whole life believing that it is stupid." — **Albert Einstein**

"One, remember to look up at the stars and not down at your feet. Two, never give up work; work gives you meaning and purpose, which life is empty without. Three, if you are lucky enough to find love, remember it is there and do not throw it away." — **Stephen Hawking**

"Progress is made by trial and failure; the failures are generally a hundred times more numerous than the successes; yet, they are usually left unchronicled." — **William Ramsay**

# QUOTES BY YOUNG SCIENTISTS

"An expert is a person who has made all the mistakes that can be made in a very narrow field." — **Niels Bohr**

"Curiosity, the rover and the concept, is what science is all about; the quest to reveal the unknown." — **Ahmed Zewail**

"Science is the acceptance of what works and the rejection of what does not; that needs more courage than we might think." — **Jacob Bronowski**; British mathematician, historian of science, theatre author, poet, and inventor.

"Somewhere, something incredible is waiting to be known." — **Carl Sagan**

"The further the experiment from the theory, the closer it is to the Nobel Prize." — **Frédéric Joliot**; read about him on page 9.

"The black holes of nature are the most perfect macroscopic objects there are in the universe; the only elements in their construction are our concepts of space and time." — **Subrahmanyan Chandrasekhar**; read about him on page 7.

"I am not here just to win an award and go home. I am here to change the world's view of women and girls in a scientific community in developing countries." — **Azza Fayad**; read about her on page 16.

"Archimedes' finding that the crown was of gold was a discovery; but, he invented the method of determining the density of solids. Indeed, discoverers must generally be inventors; though inventors are not necessarily discoverers." — **William Ramsay**



By: Dr. Mohamed Soliman  
Director, Manuscripts Museum

# AVICENNA: THE PRINCE OF PHYSICIANS

the types of minerals. In the Middle Ages, Arabs depended on this book as one of the most important sources at the time; it was also translated into Latin in 1068.

Avicenna's medical journey began at an early age, he studied medicine at the age of sixteen at the hands of Abu Sahl al-Misihi and Abu Mansur al-Hassan. At seventeen, he gained fame when he succeeded in treating Prince Nuh ibn Mansur al-Samani when all other doctors failed to do so. Years later, he wrote his miracle book, *The Canon of Medicine*, which was translated, among other books, into Latin. According to Gustave Le Bon in his book, *Arab Civilization* "These works prevailed as the world's medical reference for around six centuries".

Briefly, we present Ibn Sina's most significant contributions to medicine, according to numerous medical scholars in Arab history, as listed by Dr. Ragheb El-Sergany: "Ibn Sina was the first to discover the ancylostoma, which he called the round worm... He was also the first to describe meningitis, and the first to identify the difference between paralysis caused by internal reason in the brain and paralysis resulting from an external cause, in addition to describing the stroke caused by abundance of blood..."

Moreover, he was the first to identify the difference between intestinal colic and renal colic... He was also the first to describe the ways of transmission of some infectious diseases; such as, measles and smallpox... Furthermore, he differentiated between primary and secondary meningitis... and he was also the first to discuss tonsillectomy".

Ibn Sina also discussed different types of cancer, such as liver cancer, breast cancer, and tumors of the lymph nodes. He conducted very delicate surgeries, such as the removal of some cancerous tumors in their early stages, tracheotomy, and the removal of abscess from the lung cavity. In addition to the treatment of hemorrhoids through connectivity, he also found an innovative way to treat anal fistula.

Ibn Sina also tackled kidney stones and explained how to extract them, in addition to warnings that must be considered. He mentioned the cases that need catheter, and described some feminine diseases, such as vaginal obstruction, miscarriage, and fibroids; in addition to diseases that can infect women who newly gave birth. Last but not least, Ibn Sina was familiar with dentistry; he was precise and clear in identifying the importance of treating dental cavities.

These were only some of many of Ibn Sina's contributions to humanity. It is peculiar though that Ibn Sina passed away at the relatively young age of fifty-seven because of a disease he was not able to treat.

**T**oday, we introduce you to the Muslim polymath who, in his short life of fifty-seven years, enriched the human civilization with centuries-worth of contribution. According to historical references, this genius started his scientific career when he was only ten years old, reaching the peak of fame in medicine before the age of twenty-two.

This was Abu Ali al-Hussein ibn Abdullah ibn al-Hassan ibn Sina Saharf al-Mulk (980-1036), also known as the Prince of Physicians, al-Shaykh al-Rayeeh (meaning the Leader), the Arab Galen, and the third teacher after Aristotle, the first teacher, and Al-Farabi, the second teacher.

At a very young age, Ibn Sina, known in the West as Avicenna, became immersed in religious studies, devouring the books of jurisprudence (Fiqh and Sharia). It is said that he began divulging religious interpretation and advice according to the Imam Abu Hanifa doctrine when he was just twelve years old, and that he started to debate senior religious scholars when he was sixteen years old. At this very early age, Ibn Sina started to study philosophy and logic, which had a significant impact on his intellectual thoughts. He found his vocation in reasoning, to the extent that he was accused of atheism; his answer to that charge was "My faith in God is unwavering; if I am considered infidel, so there is no one real Muslim on Earth".

It is thought by some that Avicenna's contributions in the field of philosophy exceed his contributions in the field of medicine; it is even said that his books on theology and metaphysics replaced Aristotle's books in philosophy despite their intellectual differences. Avicenna did not excel in philosophy and medicine alone; thanks to his fervent intelligence and talent in retaining science, he excelled in several other disciplines.

Considered a pioneer of geology, Avicenna authored a treatise entitled "Minerals and their Upper Effects" in his book, *Al-Shifa*, where he studied a number of geological phenomena and classified

We have to pause in deep thought and awe when it comes to an exceptional genius who successfully combined science, literature, and religious thinking; a man who had significant scientific contributions, as well as remarkable literary creativity, leaving this world at the young age of thirty-nine. He was the scientist, writer and French intellectual Blaise Pascal (1623–1662).

# PASCAL

## A LITERARY SCIENTIST



By: Dr. Shaymaa Elsharif  
In Charge of Cultural Programs and Activities  
BA Center for Francophone Activities

Pascal lived a short life; albeit full of success. Pascal's father was an eminent judge, who was intellectual and interested in science; he was, thus, keen to offer his children a proper education. Pascal stood out as a mathematical and geometrical prodigy since he was eleven years old; however, his father's priority was to teach him Greek and Latin, so he attempted to discourage him from getting immersed in Mathematics and Geometry. Nevertheless, Pascal challenged his father that he would learn the two languages beside the two fields he loved and excelled at, and he won the challenge.

When Pascal was fifteen years old, he published a research about cones, which amazed everyone who read it because of its accuracy; Renee Descartes, the eminent French philosopher and mathematician, actually thought that Pascal's father was the one who wrote it, not Pascal himself. Pascal's real launch was at the age of nineteen, in 1642, when he produced the first version of the mechanical calculator, deriving its name "the Pascaline" from his family's name.

Despite its genius simplicity when it comes to operating it, this machine was very expensive to manufacture at the time. Pascal, thus, worked throughout the following ten years to develop it, producing about twenty versions of it in attempts to lower its cost and making it available for everyone. The Pascaline is considered

the foundation for the development of the calculator that we know today.

Pascal is also the inventor of "Pascal's Triangle", where each number represents the sum of the two numbers above it; the Triangle is the development of previous researches by scientists who preceded him. He is also the founder of "Pascal's Law" in physics, which states that if you shed additional vertical pressure on a trapped liquid, then this pressure affects all the liquid's particles and in every direction equally; this law led to the invention of the hydraulic pressure machine, drag loads, and weight lifting machines. Moreover, the pressure unit in the international measurement system is called the "Pascal Unit"; there is also a computer programming language called the "Pascal Language".

In 1645, when Pascal was 31 years old, he was in a coma for two whole weeks as a result of an accident; when he regained consciousness, he decided to change his life. Indeed, Pascal dedicated the last eight years of his life to religious devotion, which took a turn to the extreme when he declared his conviction of Jansenism, a Catholic theological movement that originated from the work of the Dutch theologian Cornelius Jansen.

The theological center of the movement was the convent of Port-Royal Abbey, Paris, where Pascal retreated for certain periods every year, being influenced by the ideas circulating within the sanctuary's wall. These

ideas directly affected the intellectual and philosophical content of Pascal's unique literary works: *Pensées* (Thoughts), and *Lettres provinciales* (Provincial Letters). Curiously, these two works were compiled from scattered scraps and published after Pascal's death.

Pascal never witnessed his works' success, nor the infinite number of researches and literary analysis centered on them for four centuries to come. To this day, these two works are taught in French language sections in numerous universities around the world. It is worth mentioning that a distinguished university in Pascal's birthplace, Clermont-Ferrand, is named after him—Université Blaise Pascal.

Pascal suffered for many years from a disease physicians of his time could not identify or cure. He suffered a mixture of severe headache and stomach ache, accompanied with cramps in the extremities, which sometimes went so far as paralysis that crippled his legs, forcing him to use crutches to move since he was just twenty-four years old. In August 1662, Pascal's condition worsened until he was unable to move at all; he continued to suffer until he eventually took his last breath on the morning of 19 August.

Blaise Pascal...defeated by illness then death; yet, celebrated in the realm of science, and thus, immortalized.

# Q&A:



## THE FOUNDER OF QUANTUM THEORY

A brilliant ninth-grade student once visited my office, to ask some questions that intrigued him while reading Carl Sagan's *Romance of Science*. He asked me about the 20<sup>th</sup> century's most momentous scientific theories, to which I answered: "If you are asking me what would be one of the 20<sup>th</sup> century's greatest achievements, even more significant than Einstein's theory of relativity, the answer would be the quantum theory". I explained that: "If you are searching for the basis of all modern physical sciences related to atomic particles, then you are searching for the quantum theory. If you are looking for a model scientist, whose impact has surpassed that of eminent physics' geniuses, then you are looking for the founder of the quantum theory; Max Planck".

The intelligent student pulled out a piece of paper and said: "I have summarized some information about Max Planck that I would like you to correct please; may I?" I welcomed his request with a smile; he started to read: "Max Planck was born on 23 April 1858, in Kiel, Germany. He is the son of German parents; his father was a university law professor. Generally, Planck came from a prominent family, whose members were judges, senior officials, scholars, and clerics.

Planck studied at the Universities of Munich and Berlin, where one of his teachers was the great physicist Gustav Kirchhoff". At this point, I interrupted him to ask: "Do you know who Gustav Kirchhoff is?" He thought a little and said: "I have read his name; I think he is Russian. In fact, I would be grateful if you brief me about him". I, thus, elaborated: "Kirchhoff is a German physicist, not Russian, born in 1824 and passed away in 1887. He has physical laws named after him in Thermodynamics and electrical engineering. Please continue".

My visitor resumed: "Max Planck received his doctorate for an experiment he conducted

"Because of his genius, Max Planck was recognized and applauded for his excellence by the scientific community. He then got promoted rapidly and was awarded the professorship degree in physics from the University of Berlin not past the age of thirty one years"

while studying the diffusion of hydrogen through radium". I interrupted him again, to comment and correct what he said: "His experiment was not conducted on radium, as it had not been discovered yet. It was conducted on palladium; an element of the platinum group, with the lowest melting point, and resembling platinum chemically. Palladium is extracted from copper and nickel, and was named after Pallas, the goddess of wisdom in ancient Greek mythology".

I then asked him something not many people know about Max Planck: "Do you know that this experiment was the only one conducted by Max Planck throughout his life; none before or after, for he was a mathematical, rather than an experimental, scientist". I tried to test the outstanding student's conjecture and asked a question implying its answer: "Do you know, or can you guess, how old Max Planck was when he received that high degree in physics with honors from the University of Munich?"

The student responded: "Your question indicates that he was young at the time, maybe in his twenties or thirties, for example?" I praised his guesswork, saying: "Actually, you are right! He was only twenty years old"; I then added: "Because of his genius, Max Planck was recognized and applauded for his excellence by the scientific community. He then got promoted rapidly and was awarded the professorship degree in physics from the University of Berlin not past the age of thirty-one years".

The student was unsatisfied by all this information about Max Planck; he started

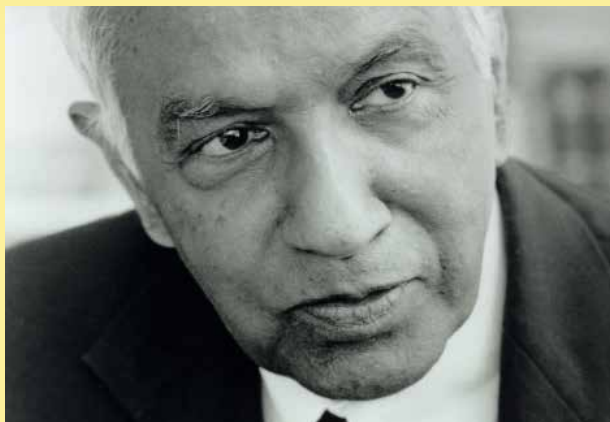
to ask about the quantum theory itself. I replied: "The quantum theory is one of the most momentous scientific theories in human thought. Max Planck founded the theory in 1901, but could not even ratify the concepts included in his theory till Albert Einstein highlighted and put them into practice in 1905. Einstein developed the theory and was awarded the Nobel Prize in Physics 1921 for one of the theory's applications; not for his theory of relativity as many thought".

The student looked surprised, but I continued: "In fact, the quantum theory can be described as an alarming theory. It includes a range of exotic ideas applied to everything in the universe, from atoms to galaxies. The quantum theory dives into the depth of atoms, using high and very smooth mathematics, dealing with its components; basic, secondary, or even hypothetical particles that are difficult to be directly quantified, but their impact could be measured. The quantum theory determines the path of these particles; how they unite, disconnect, and even how they originated since the Big Bang".

I concluded: "Max Planck's quantum theory is based on three main principles known as the Principles of Quantum Theory; namely: Quanta, Uncertainty, and the mutual transformation between matter and energy". I then asked my student to research deeply the concept of these principles, and to come back to visit me if he could not understand any of them.

# CHANDRA

## AND THE SECRETS OF THE STARS



Our current understanding of the evolutionary stages of massive stars, including black holes, is the result of an extensive theoretical work of an Indian–American scientist, Subrahmanyan Chandrasekhar, better known as Chandra. In honor of this prodigy discoverer of the universe, Chandra’s name was bestowed upon NASA’s premier X-ray observatory: the Chandra X-ray Observatory.

In 1983, Chandrasekhar was awarded the Nobel Prize in Physics for the mathematical theory he formulated to explain the physical processes of the birth, structure, development, and evolution of stars. It is believed that he carried out this work when he was just 19 years old, on a ship traveling from India to Britain to begin working on a PhD in Physics. This is the youngest age at which Nobel Prize winning work was awarded.

Subrahmanyan Chandrasekhar was born on 19 October 1910, in the city of Lahore. He was the nephew of Sir Chandrasekhara Venkata Raman, who won the Nobel Prize in Physics in 1930 after carrying out groundbreaking work in the field of light scattering.

Born to a well-educated family, as a child, Chandra was home-schooled by private tutors until 1921, when he enrolled in a Hindu High School, where he excelled. Later on, Chandra studied at Presidency College in Madras; upon graduating with a Master’s degree in 1930, he set off for Trinity College, Cambridge. Although he won the Nobel Prize for the work he did at an early age, Chandrasekhar performed throughout his scientific life extensive research that covered many other areas within theoretical physics and astrophysics.

To form an idea about the significance of the contribution Chandrasekhar made in the field of astronomy, one needs to learn about the common understanding of the stars evolution at that time. By the early 1930s, scientists had concluded that, after converting all of their hydrogen to helium, stars lose energy and contract under the influence of their own gravity. These stars, known as white dwarf stars, contract to about the size of Earth, and the electrons and nuclei of their constituent atoms are compressed to a state of extremely high density.

Chandrasekhar determined what is known as the Chandrasekhar limit. He proved that a star having a mass more than 1.44 times that of the Sun does not form a white dwarf, but instead continues to collapse, blowing off its gaseous envelope in a supernova explosion, and becoming a neutron star; an even more massive star continues to collapse and becomes a black hole. These calculations contributed to the eventual understanding of supernovas, neutron stars, and black holes.

A supernova is an explosion of a massive supergiant star; it may shine with the brightness of ten billion Suns. The total energy output may be as much as the total output of the Sun during its ten-billion year lifetime. A neutron star, on the other hand, is a type of compact star; neutron stars are the smallest and densest stars known to exist in the Universe. With a radius of only about 11–11.5 km, they can have a mass of about twice that of the Sun; they can result from the gravitational collapse of a massive star after a supernova. Finally, a black hole is a region of space and time exhibiting such strong gravitational effects that nothing, including particles and electromagnetic radiation such as light, can escape it.

Chandrasekhar proved that, as stars evolve, they release energy generated by their conversion of hydrogen into helium and even heavier elements. As they reach the end of their life, stars have less hydrogen left to convert so they release less energy in the form of radiation. They eventually reach a stage when they are no longer able to generate the pressure needed to maintain their size against their own gravitational pull, and they begin to shrink, eventually collapsing into themselves. Their electrons become so tightly packed that their normal activity is shut down and they become white dwarfs, or tiny objects of enormous density.

Chandrasekhar became an American citizen in 1953. He retired from the University of Chicago in 1980, but remained on as a post-retirement researcher. In 1983, he published a classic work on the mathematical theory of black holes. Chandra passed away in Chicago on 21 August 1995, at the age of 82. Throughout his life, Chandrasekhar strove to acquire knowledge and understanding; according to an autobiographical essay published with his Nobel lecture, he was motivated “principally by a quest after perspectives”.

### References

[www.britannica.com](http://www.britannica.com)  
[www.notablebiographies.com](http://www.notablebiographies.com)  
[www.physicsoftheuniverse.com](http://www.physicsoftheuniverse.com)

By: Shahenda Ayman

# FREDERICK BANTING: Battling Diabetes

Diabetes is the fastest growing long-term disease affecting millions of people worldwide; it happens when the body fails to utilize ingested glucose properly. This could happen due to lack of the hormone insulin or because the available insulin is not working effectively. Lack or insufficiency of insulin causes high levels of glucose in the blood that can damage blood vessels, leading to several serious, sometimes deadly, complications.

Normally, insulin is made by the beta cells of the pancreas to regulate glucose levels in the blood. When there is excess glucose in the blood, insulin stimulates cells to absorb enough glucose from the blood for the energy they need, while stimulating the liver to absorb and store any extra glucose. Insulin release is triggered after a meal, when there is rise in blood glucose; when blood glucose levels fall, during exercise for example, insulin levels fall too.

Frederick Banting, born 14 November 1891 in Canada, is the youngest recipient of the Nobel Prize in Medicine and Physiology at the young age of 32. Before Banting, no one had ever heard of insulin or knew where it came from or what it did.

During the 19<sup>th</sup> century, observations of patients who died of diabetes, a killer disease at the time, often showed that the pancreas was damaged. In 1869, German medical student, Paul Langerhans, found that, within the pancreatic tissue that produces digestive juices, there were clusters of cells, later named the islets of Langerhans, whose function was unknown.

In 1889, physiologist Oskar Minkowski and physician Joseph von Mering showed that if the pancreas was removed from a dog, the animal got diabetes. However, if the duct



through which the pancreatic juices flow to the intestine was ligated, the dog developed minor digestive problems but no diabetes. It seemed that the pancreas must have at least two functions; to produce digestive juices, and to produce a substance that regulates glucose.

In 1920, Banting had the idea that pancreatic digestive juices could be harmful to the secretions produced by the islets of Langerhans. He, therefore, wanted to ligate the pancreatic ducts in order to stop the flow of nourishment to the pancreas. This would cause the pancreas to degenerate, making it shrink and lose its ability to secrete digestive juices. The cells thought to produce an antidiabetic secretion could then be extracted from the pancreas without being harmed.

Banting worked at the University of Toronto, in the laboratory of J.J.R. Macleod, who allowed him to use the laboratory despite his skepticism. In spite of everyone's lack of belief, Banting, along with fellow student, Dr. Charles Best, set out to test his idea.

After his Nobel Prize, Banting won a series of honorary degrees; two of them were the Reeve Prize of the University of Toronto, and the Life Annuity achievement from the Canadian Parliament. After finally discovering the “wonder drug”

They operated on dogs; once they extracted the secretions from the dogs with altered pancreases, they were ready to test the theory, by injecting the extract into a collie. The results were stunning, though temporary; Banting and Best coined the term “isletin” for their extract. They then added a chemist to their team and began producing more “isletin”, so they could perform larger trials; the University at that point renamed it “insulin”.

In January 1922, they tested their solution on their first human patient, who showed immediate improvement and further testing confirmed its effectiveness; diabetes finally had a life-saving treatment. Building on this success, Banting switched his studies to cattle, which were readily available in great quantities. This allowed for mass production of insulin, resulting in millions of lives saved and countless lives enhanced.

After his Nobel Prize, Banting won a series of honorary degrees; after finally discovering the “wonder drug”, he went on to study and research varied subjects at the Banting and Best Institute. When World War II broke out, Banting was killed in February 1941, in an air disaster in Newfoundland.

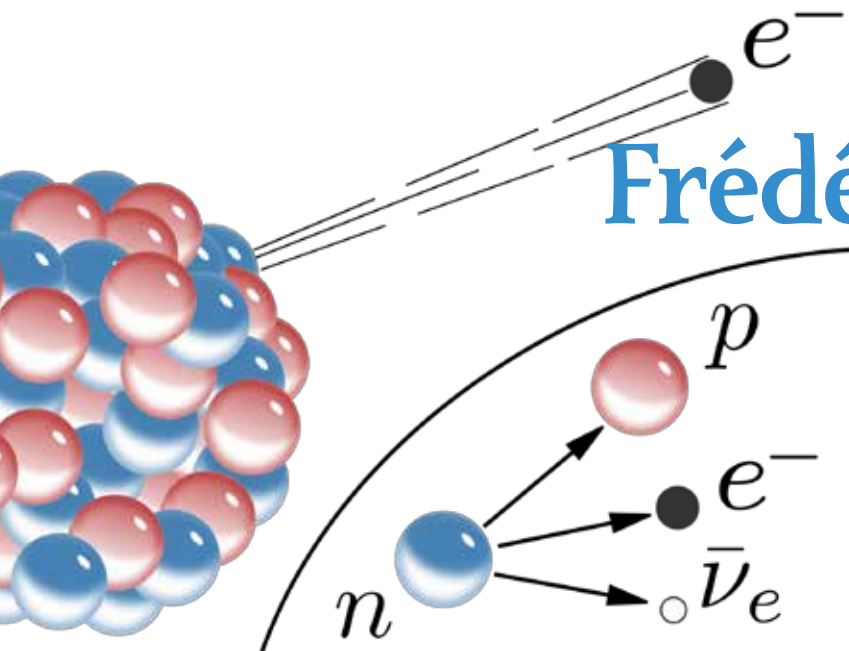
Diabetes remains a disease that is all encompassing of a patient's life. It still needs attention multiple times per day, whether to check glycaemia—the presence of glucose in the blood—or to calculate each meal and snack. Patients must remain attentive at all times to feelings that might indicate hypoglycemia—deficiency of glucose in the bloodstream—few other conditions require this level of diligence. Until now, we have not been able to substantially reduce the diligence necessary and inherent burden of managing diabetes.

## References

nobelprize.org  
news-medical.net  
britannica.com

encyclopedia.com  
scienceheroes.com  
thefamouspeople.com  
spectrum.diabetesjournals.org





# Frédéric Joliot: A Continuing Scientific Saga



**F**rédéric Joliot was a member of the French Academy of Sciences and of the Academy of Medicine; he was named a Commander of the Legion of Honor.

By: Moataz Abdelmegid

An esteemed French physicist, Frédéric Joliot was the husband of Irène Curie, daughter of Marie and Pierre Curie, the well-renowned 1903 Nobel Prize winners in Physics. Repeating history, Frédéric Joliot and Irène Curie were jointly awarded the Nobel Prize in Chemistry, in 1935, for their discovery of Artificial Radioactivity. Joliot was only 35 years old when he received the Nobel Prize, which makes him the youngest Nobel laureate in Chemistry to this day.

Frédéric Joliot was born in Paris, on 19 March 1900. In 1925, he became assistant to Marie Curie at the Radium Institute of the University of Paris, where he met Marie's daughter, Irène. By that time, Irène Curie had prepared for her baccalaureate at the Collège Sévigné. In 1918, she became her mother's assistant at the Radium Institute; and in 1925, she presented her doctoral thesis on the alpha rays of polonium. Irène and Frédéric got married in 1926, becoming life-time partners in their personal, as well as scientific, paths.

In the course of their researches, they bombarded boron, aluminum, and magnesium with alpha particles, and they obtained radioactive isotopes of elements not ordinarily radioactive; namely, nitrogen, phosphorus, and aluminum. These

discoveries revealed the possibility of using artificially-produced radioactive isotopes to follow chemical changes and physiological processes; the absorption of radioiodine by the thyroid gland was detected, and the course of radiophosphorus, in the form of phosphates, was traced in the metabolism of the organism. The production of these unstable atomic nuclei afforded further means for the observation of changes in the atom as these nuclei broke down.

The Joliot-Curies observed also the production of neutrons and positive electrons in the changes they studied. Their discovery of artificial radioactive isotopes constituted an important step toward the solution of the problem of releasing the energy of the atom. They used neutrons instead of alpha particles for the bombardments, causing fission of uranium; this was the groundbreaking method they developed for producing radioelements artificially.

This method was undoubtedly the greatest discovery of Irène and Frédéric. By using the bombardment of boron, aluminum, and magnesium with alpha particles, they successfully produced the isotope 13 of nitrogen, the isotope 30 of phosphorus; and simultaneously the isotopes 27 of silicon and 28 of aluminum. These elements, not found

naturally, decompose spontaneously, with a more or less long period, by emission of positive or negative electrons. For this very important discovery they received the Nobel Prize.

Frédéric Joliot served as the director of the French National Center for Scientific Research; in 1945, he became France's first High Commissioner for Atomic Energy; and in 1948, he oversaw the construction of the first French atomic reactor. A devoted communist, he was purged in 1950 and relieved of most of his duties, but retained his professorship at the Collège de France. Joliot-Curie was one of the eleven signatories to the Russell-Einstein Manifesto in 1955. Upon the death of his wife in 1956, he took over her position as Chair of Nuclear Physics at the Sorbonne.

Frédéric Joliot was a member of the French Academy of Sciences and of the Academy of Medicine; he was named a Commander of the Legion of Honor. The lunar crater Joliot is named after Frédéric Joliot, who together with Irène Curie parented a boy and a girl, Pierre and Helene, both of whom became scientists; thus, continuing a legendary scientific saga.

## References

nobelprize.org  
 britannica.com  
 chemheritage.org  
 encyclopedia.com

# TOP 10

## MODERN

Psychologists define a “prodigy” as somebody who is on the extreme end of giftedness; someone who is very advanced in one area, usually not all areas, and years ahead of his/her peers. Typically, child prodigies emerge in math, language, art, or music; some might include chess or even sports.

Signs of prodigy-hood can be seen as young as two or three years of age; for example, Mozart was writing and playing symphonies when he was only five years old. On the other hand, Picasso enjoyed a fruitful childhood period of painting brilliant pictures; his interest in art was apparent as soon as he could talk. His father was an art professor who discovered young Pablo painting when he was thirteen.

In some cases, prodigies are both born and made; they can be born with retentive memories and a quality of mind that enables them to relate and organize experiences, and they can be made in the sense that they receive opportunities and rewards of special practice, instruction, or training.

Historically, there have been many attempts to classify people into intelligence categories, according to their performance on a standardized intelligence test relative to the average performance of others of the same age. This is called Intelligence Quotient (IQ). Lewis Terman, who developed the original notion of IQ in 1916, proposed this scale for classifying IQ scores points to be: normal or average intelligence (90–109 points), superior intelligence (110–119), very superior intelligence (120–140), genius or near genius (over 140).

Here, we introduce you to our selection of Top Ten modern science child prodigies from around the world today in no specific order.

### Mahmoud Wael



An Egyptian prodigy, Mahmoud was born in January 1999. He memorized the multiplication table when he was three years old and his IQ reached 155 points when he was just six years old. At the age of eleven, Mahmoud won the title “World’s Smartest Kid” in the *Guinness World Records*, having the highest absolute indicator of IQ among his peers and being mentally capable of performing complex arithmetic operations with multi-digits with the same speed as a computer.

Mahmoud was the youngest person in the world to take courses of computer network programming. He met Egyptian scientist and Nobel Laureate Ahmed Zewail, and is hoping to become the youngest scientist to win the Nobel Prize

### Akrit Jaswal



Jaswal was born on 23 April 1993. He began walking at an early age, talked before the age of one, and was said to have been reading Shakespeare when he was five. While most seven-year-olds were playing around pretending they were doctors, Akrit Jaswal was performing actual surgery. His love for science and anatomy was noticed by doctors who let him observe surgeries; he was inspired and soon learned all he could about surgery. At age twelve, he joined the Faculty of Medicine, and by the age of seventeen, he was working on his Master’s degree in Applied Chemistry.

### Tanishq Abraham

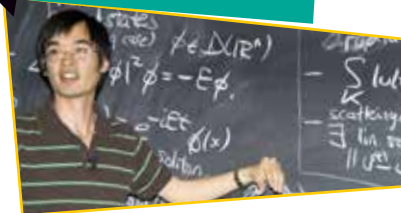


Tanishq Abraham is among the youngest members of Mensa genius society, which he joined when he was four years old. He started to show his genius at four months, when he began browsing children’s books and correctly answering questions about them. Upon entering Mensa, he scored a high 99.9 percentile on the standardized IQ test of Mensa.

At five years old, Abraham finished the mathematics courses offered by Stanford University’s Education Program for Gifted Youth on five levels—kindergarten to 5<sup>th</sup> grade—in just six months. His prodigious talent became even more evident at the age of six, as he was already taking high school and college courses.

Abraham has maintained a grade point average of 4.0 in all of his college courses and was one of the youngest to be inducted in the Phi Theta Kappa Honor Society. He also publishes essays on NASA’s Lunar Science website. At the age of eleven, he was the youngest person to graduate from his university in California.

### Kim Ung-Young



Korean Kim Ung-Young’s IQ is 210; born in 1962, Kim just may be the smartest man alive today. At three years old, Kim was a guest student of physics at the Hanyang University. At four, he was already able to read in several languages. At five years old, he was already able to solve complex calculus problems; before he was ten, he was already speaking eight languages. When Kim was seven, he was invited by NASA and was able to obtain his PhD in Physics at the Colorado State University before he turned fifteen.

# CHILD PRODIGES

## Priyanshi Somani



Somani is a mental calculator from India. She started mental calculation at the age of six; by age eleven, she was the youngest participant at the Mental Calculation World Cup of 2010, which she won. She bested 36 other competitors from 16 countries, winning first place by solving the square root of ten six-digit numbers in a record-breaking 6 minutes 51 seconds. To top it off, she was the only participant to have 100% accuracy in addition, multiplication, and square roots in the history of the competition.

## Jacob Barnett



When he was two years old, Barnett was diagnosed with moderate to severe autism. Doctors said that he might not be able to talk, read, or become independent in basic daily activities. Jacob proved the doctors wrong when he was able to recite the alphabet forwards and backwards at three years old.

At the same age, while visiting a planetarium, Jacob answered the presenter's question of why the moons of Mars are oddly shaped. He enrolled at Indiana University–Purdue University, Indianapolis, at age ten. While working on his degrees, he asserted that he might one day disprove Einstein's Theory of Relativity. He is currently working on his PhD in Quantum Physics.

## Elise Tan Roberts



Einstein's IQ was 160; Elise Roberts' IQ was 156 when she was just two years old! Professor Joan Freeman, a specialist education psychologist, put Roberts through a complex 45-minute IQ test just to silence skeptics before concluding that she was indeed gifted. She, thus, became the youngest member of Mensa, beating the record previously held by a three-year-old boy Oscar Wrigley. When Roberts was just five months old, she started speaking; when she was eight months old, she started walking, and was running by the time she was ten months.

## March Tian Boedihardjo



March Tian Boedihardjo was born in Hong Kong and is the youngest person to enroll at Hong Kong University at nine years old. He finished his A-levels, maintaining A's in advanced mathematics courses and a B in Statistics. He participated in a specially-designed, double-degree program, Bachelor of Science in Mathematical Science and Master of Philosophy in Mathematics, which he completed in 2011; one year earlier than the designed curriculum. He is currently studying for a PhD in Mathematics in the USA.

## Ainan Cawley



Sometimes, the right ingredients just come together to create a chemistry genius. Ainan Cawley of Kuala Lumpur, Malaysia, now fifteen years old, was just six years old when he gave a science lecture about acid and alkaloids at a Singapore school. He was only seven years old when he passed the chemistry O-level exam, a test meant for teens aged sixteen and up. The following year, he enrolled in the Singapore Polytechnic, becoming the world's youngest student ever to take up a third-year tertiary module.

## Gregory Smith



Born in 1990, Gregory R. Smith was memorizing and reciting books at fourteen months; he enrolled in university at ten years of age. When he graduated, Gregory was the youngest person ever to receive a Master's degree from the University of Virginia. This young man travels the globe as a peace and children's rights activist, he was nominated for the Nobel Peace Prize at the age of twelve. He is the founder of International Youth Advocates, an organization that promotes principles of peace and understanding among young people throughout the world.

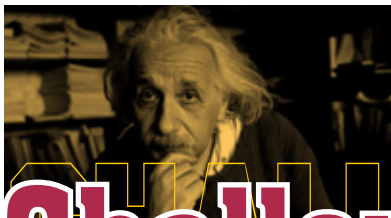
Being a child prodigy means having an enormous talent; one that is simply there, and does not take decades to master. A child prodigy evokes awe, amazement, and wonder; they might make you feel inadequate, but keep in mind that they can also give you hope with the amazing, wonderful things they can do.

## References

listverse.com  
www.britannica.com  
www.cracked.com  
thecairopost.youm7.com

www.the richest.com  
bashny.net  
www.the richest.com  
www.oddee.com

# THE EARLY



# Challenges of Great Minds

By: Basma Fawzy



Some of the greatest minds of all time had not been considered great in their youth; their bright mentalities were not apparent at an early age and their abilities were underestimated. Yet, those who were once considered ordinary or even less, outsmarted everyone, creating fame for themselves with ideas that stood the test of time. Let us delve deep into the story of famous scientists who proved everyone wrong about their abilities when they were young.

***"I have not failed. I have just found 10,000 ways that will not work."***

Thomas Edison

Thomas Edison is the man who lit our world. He invented the light bulb, the phonograph, and had another 1000 patents under his name; because of his ingenuity, and perseverance, the world is not the same anymore. Although he suffered from a hearing impairment, Edison was a man with undefeated spirit, who had the courage to try 10,000 ways and still never gave up.

At school, Edison was a hyperactive child and easily distracted; his teacher found him "difficult" to teach. It was his mother who believed in him. He left school and his mother, a school teacher, became responsible for his education. Edison was lucky because his mother cared about his education. He was difficult to teach, but he was not unintelligent, and it is because of his mother that he became the Edison we

***"Logic will get you from A to B. Imagination will take you everywhere."*** Albert Einstein

***"I have not failed. I have just found 10,000 ways that will not work."*** Thomas Edison



theory proved correct, ensuring that he was definitely ahead of his time.

***"I must have been born with a strong attraction toward, and possibly even an aptitude for, doing things on a small scale."***

John Gurdon

John Gurdon, an English biologist who won the 2012 Nobel Prize in Medicine for his work in the field of genetics, was told by his schoolmasters that he was not smart enough to study the subjects that he won the prize for later on. He persevered, believed in himself, and eventually won the Nobel Prize. He did not feel discouraged by the negative comments; he went about his life, imagining and inventing, and proved them wrong. Sir John Gurdon is known for nuclear transplantation and cloning.

Assumptions about children often turn out to be wrong. Einstein's speech problem did not stop him from great achievement; John Gurdon reprogrammed mature cells, and Edison lit the world. No one ever knows which child can be the next Einstein or Edison; all children deserve a fair chance and a huge amount of patience. Never judge a book by its cover, and never judge a child that early; patience will reveal a child's hidden potential. Some bright scientists are born with problems, and thus, need encouragement to fulfill their true potential; all they need is faith.

## References

www.biography.com  
www.ligo.caltech.edu  
www.telegraph.co.uk  
www.brainyquote.com  
www.nobelprize.org

# PROMISING INVENTIONS

BY YOUNG

## INVENTORS

OF TODAY



Nowadays, scientists are occupied with searching for solutions for environmental issues, diseases, and lack of energy resources that our planet needs. We need not worry, as the future generation of young innovators may change the world.

### Early-stage Cancer Detector

The death of a family friend as a result of pancreatic cancer pushed Jack Andraka to find a way to contribute to the fight against this deadly disease. Andraka noticed that one of the reasons behind low survival rates from pancreatic cancer is the lack of early detection and an effective screening method.



At the age of fifteen, he invented a new, potentially life-saving method for early detection of pancreatic cancer. This test is performed using a dip-stick type sensor, similar to diabetic test strips, in addition to filter paper, and a basic instrument for measuring electrical resistance. This method detects the increase of mesothelin, the protein that indicates the presence of cancer during its early stages.

From around 1500 contestants, Andraka won the grand prize at the 2012 Intel International Science and Engineering Fair. Now, he holds an international patent on the device and hopes to bring it to market within ten years. He also aims at developing this method to be able to detect any disease.

### PolluCell

Determined to help people in developing countries lacking access to clean energy and electricity, Sahil Doshi, the fourteen-year-old boy from Pittsburg, came up with a battery that can generate electricity using



By: Sara Khattab

carbon dioxide and waste materials. Doshi hopes that his battery, PolluCell, will help reduce greenhouse gases in the atmosphere and work as a low-cost alternative for electricity in developing countries.

The PolluCell contains two half-cells: an anode and a cathode. Doshi used aluminum from beverage cans for the anode, which easily loses electrons; and silver from silver-plated copper guitar strings for the cathode, which is more prone to gain electrons. He added carbonated water in the two half-cells and added salt to each half to catalyze the reaction. To speed up the reaction, he attached two copper wires to the terminals of a 9-volt battery and put the end of each wire into the water. This created a cell that converted the carbon dioxide in the water into approximately 800 millivolts of electricity.

In 2014, Doshi presented his innovative eco-friendly battery design in the 16<sup>th</sup> annual Discovery Education 3M Young Scientist Challenge; a youth science and engineering competition for middle school students in the United States of America. Doshi was awarded the grand prize of USD 25,000 and was entitled "America's Top Young Scientist". Winning the competition gave Doshi the opportunity to work directly with 3M scientists who mentored him to develop his idea into an actual prototype.

### Algae Mobile

At the age of thirteen, Param Jaggi started working with environmental and energy technologies. When he was learning to drive, he got the idea of making use of cars in decreasing air pollution. Param built an algae-based bio-reactor called the "Algae Mobile", which is inserted into the exhaust pipe on the back side of a car. This device uses algae to turn carbon dioxide emissions into oxygen while driving the car. Since 2009, he built different models of the "Algae Mobile".



Param introduced his device in many science fairs and competitions, where he won an award from the Environmental Protection Agency for his environmentally-friendly invention. He also won an award at the Intel International Science and Engineering Fair for "Algae Mobile 3". Only 20 years old, Jaggi is already the Chief Environmental Officer and founder of his own company Ecoviate, which is a research and development company focusing on green technologies.

### Ocean Energy Probe

After receiving a letter from her friend in Ethiopia talking about how there is no access to light and other basic necessities in her country, Hannah Herbst was determined to find a solution to the global energy crisis. At the age of fourteen, she started to work on her low-cost ocean renewable energy probe. This probe works through ocean tidal



Continued p. 23

# Innovations by Young Scientists

By: Nourane Khaled

Since the dawn of time, humans have been inventing and developing new tools and products to facilitate life tasks. The major part in innovations and inventions was by adults; however, some young innovators have made significant contribution to this world and their work cannot be denied.

Some of these innovations were very simple. Have you ever thought, for example, that the earmuffs you wear in cold days were one day considered an invention? In 1873, the fifteen-year-old Chester Greenwood came up with this idea after having suffered from the cold. He tied a scarf around his head, but it did not help, so he made a frame out of a wire and added pads of heavy fabric. Chester worked on perfecting his invention, using steel bands instead of wires. In 1877, he obtained a patent for his invention and created the Greenwood's Ear Protectors Factory. Chester's creativity did not stop there; he obtained around a hundred more patents during his lifetime.

Another invention that proves a creative mind can do miracles, even in case of disability, is French Louis Braille. Braille was in an accident at three years of age, leading to loss of his sight. Despite his blindness, he was very intelligent; he was accepted in the National Institute for Blind Youth in Paris. There, he was taught to read from heavy paper with raised letters. Later, a French soldier taught him a complex system of dots and dashes used in war, so Braille got the idea of creating a new simple system. He achieved that in 1824, when he was fifteen years old. Nowadays, the Braille system is used by blind people all over the world and is available in several languages.

Have you ever seen a field of wheat or rice and questioned how they harvested all that in the past? Farmers spent days and weeks harvesting their crops; then, the American Cyrus McCormick invented the mechanical grain reaper. McCormick had received limited school education, but he spent much time in his father's workshop. In 1831, the 22-year-old completed his father's project within six weeks, making the world's first mechanical reaper that cuts, thresh, and bind grains.

In 1642, the eighteen-year-old Blaise Pascal invented the first mechanical calculator. His device was designed to replace extensive arithmetic calculations. This idea came to him after seeing his father, a tax supervisor, spending much time on them. Pascal actually named his invention after him "La Pascaline", the feminine noun of his own name.

At the age of sixteen, the American inventor Samuel Colt carved out a wooden prototype that led to his invention of a rotation-type firearm with a six-barrel cylinder, later called the Colt revolver. While sailing as a seaman, he was inspired by how the ship's wheel worked and followed its mechanism in building his prototype. Colt was always interested in mechanics, and would often disassemble items to see how they worked. In 1836, Samuel Colt received a U.S. patent for a revolver mechanism that enabled a gun to be fired multiple times without reloading.

A really fun and enjoyable invention is the trampoline. Do you know that it is an Olympic

sport since 2000? American gymnast George Nissen created it when he was 22 years old; the idea came to him after watching circus players perform tricks on safety nets. He worked on his invention until it became the actual trampoline we see nowadays.

Some youth, however, are not really hoping for world peace! In 2011, the 19-year-old Eric Jacqmain created a powerful device named the Solar Death Ray. He glued 5,800 tiny mirror pieces on a satellite dish, creating an extremely intense light ray that can burn or melt almost everything. Eric is hoping for more; he is willing to make a larger version of his device using 32,000 mirror pieces!

From these people, we have to learn that age is just a number and it can never be a barrier to make a contribution in this world. Youth are the source of creativity; working on their skills will be the first step towards development. Motivate your children, develop them, challenge them, and let them use their creative minds for the good of this world.

## References

inventors.about.com  
www.britannica.com  
www.dailymail.co.uk  
www.youtube.com/watch?v=TzRAjW6K00  
www.google.com/patents/US8409851  
www.youngscientistchallenge.com  
www.techinsider.io

# A Letter to a Young Scientist

By: Sherine Ramadan

*Dear Young Scientist,*

I am writing to you today because I was informed that you have chosen science for a career. Well, congratulations my dear!

As you know, science is very important for our everyday lives, because it is the most reliable way of learning about the universe. The knowledge that scientists gather can then be used by engineers, doctors, and others. Most of the technology we use and enjoy would not exist had scientific discoveries not preceded them; who knows what can you contribute to science in the future?

I am sure you are full of ambitions and beautiful dreams about changing the world to a better place. As Edward O. Wilson said "On this path you have chosen, go as far as you can. The world needs you, badly. Humanity is now fully into the technological age. There is going to be no turning back", so keep it up and keep going.

However, being a scientist is not an easy task; being a successful scientist is even harder and rare. It takes a lot of effort in studying, working, experimenting, publishing, defending, and hopefully graduating. As for the qualities of a good scientist, it may vary to some extent with different specialties; however, every scientist needs to have a good foundation in science classes throughout high school and

college, along with a good understanding of mathematics. These basic classes give you a good start toward a career in science.

One of the most common characteristics of scientists is curiosity. Scientists are always curious about the world around them, and they yearn to learn what makes everything work. You also must be patient in climbing the career ladder and to undergo the years of work that might be required to make a discovery in a scientific field. Furthermore, a sense of optimism keeps you performing experiment after experiment, even if most of them fail.

Do your best to be a detail-oriented person; notice even tiny observations, remember, and record them. Alexander Fleming provides a famous example of this attribute; his great sense of observation led to the great discovery of penicillin.

Being open-minded is crucial for successful people in science careers. A good scientist will accept whatever outcome his/her work has and not try to force the results into a preformed opinion. He/she also has to have good ethics and will never give false results or shade an experiment just to fulfill the expected outcome. Always accept the solutions of others, even when they conflict with your own.

Most people think of science as an uncreative field; in reality, scientists must be very creative. They ask why something happens or what happens, then devise experiments to answer the question. Their creativity allows them to think outside the box and envision things that cannot be seen. They must be ready to give up old ideas when new ones come along.

Analytical and critical thinking skills enable scientists to posit hypotheses to be tested, and to interpret experimental results that might not be exactly what was expected, but are significant in that they point to another possibility to be investigated.

Moreover, you need to learn from other successful scientists, as Isaac Newton said "If I have seen further than others, it is by standing upon the shoulders of giants". On the other hand, do not aim to be a version of someone else, create the opportunity for yourself to be unique according to your capabilities, as Neil deGrasse Tyson advised "Do what you do best".

Scientists must be able to work as part of a team or to work independently, depending on the need of the project. They must be able to communicate effectively, both in writing and in speaking. In fact, not every smart person has these qualities; there are plenty of smart people who are not geniuses who make great scientists.

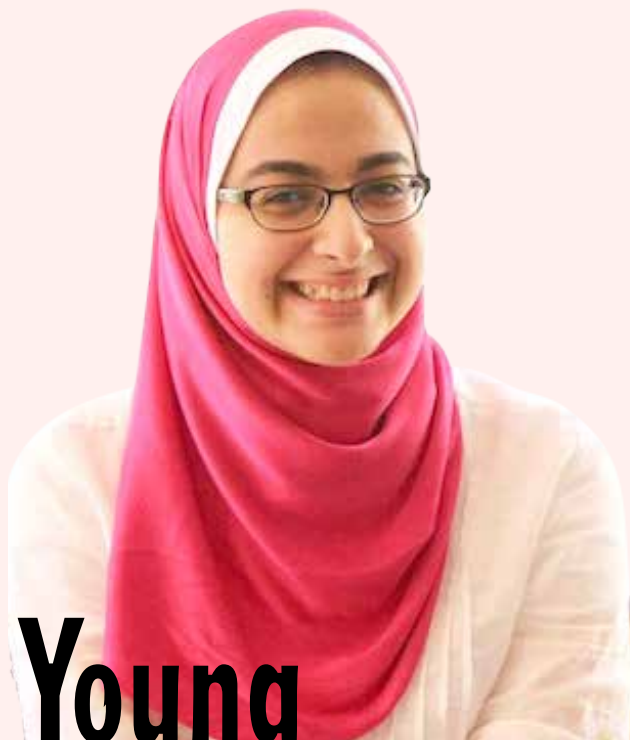
Nobel Prize winner Elizabeth Blackburn summed it all when she said "Go deep; find a good mentor; ask for advice; collaborate; focus on the science and do good research; give a great talk; consider all careers; set your (family) boundaries and use your time wisely; explore creative ideas, but know when to stop".

Finally, I would like to express my sincere wishes for a successful career.

*Yours,  
Senior Scientist*

## References

[www.universetoday.com](http://www.universetoday.com)  
[www.mikebrotherton.com](http://www.mikebrotherton.com)  
[www.sciencecareersnow.com](http://www.sciencecareersnow.com)  
[woman.thenest.com](http://woman.thenest.com)



# Young Egyptian Minds Shaping Our Future

By: Jailane Salem

Success in science does not necessarily mean that you have to have already studied at university level, or have taken advanced courses, which is the beauty of it. Science is there for all those who have an inclination to delve into it, and it does not discriminate by age. If you grasp scientific ideas, understand the ins and outs of processes, and have an intelligent curious mind, there are no limits for scientific discovery.

We do not have to go too far to find such young innovators. A few years back, right here in Alexandria, an aspiring high school student had a breakthrough regarding the recycling process of plastic. Living in Egypt, where we consume a vast amount of plastic, encountering mounds of it on almost every street, she was inspired to find an environmentally-friendly solution to this imposing problem. Since we live in a world threatened by climate change and its fast approaching effects, any new idea that can lessen our negative impact on Mother Earth should be welcomed with open arms.

In 2012, Egypt's plastic consumption per capita was 25 kg, which is higher than the Middle-Eastern average that stands at 16 kg per

capita. It is estimated that plastic consumption surpasses one million tons per year; however, the biggest issue with this use of plastic is its manufacturing and its life after its initial use. If Egypt were to recycle its plastic, it could be a significant source of revenue.

This is what Azza Abdel Hamid Fayad, the then 16-year-old student, dreamt of accomplishing. In 2012, she was one of 130 competitors at the 23<sup>rd</sup> European Union Contest for Young Scientists, where she won the European Fusion Development Agreement Award. This gave her the opportunity to spend one week at the Joint European Torus facility at the Culham Centre for Fusion Energy in the United Kingdom. There, she presented her project and idea to scientists who helped her by providing assistance and guidance on making her project a reality.

What Azza Fayad discovered was a catalyst that can break down the plastic polymers, and turn them into biofuel feedstock; the starting materials that are used in making biofuels. What is innovative about Fayad's project is not the concept itself, but the catalyst that she used. She proposed the use of aluminosilicate; a catalyst that can break down plastic waste and produce gases, such as methane, propane, and ethane, which can be used as raw stock to produce a high yield of ethanol. What is great about this method is that it is low in cost, and environmentally-friendly.

Just as Azza Fayad came up with a way to help reuse plastic, another great young innovator, Mostafa Magdy Al-Sawy, is also working on a project that is green and beneficial to Egypt. He has come up with an idea for a smart dam that is an amalgamation of various purposes.

Egypt has long been relying on the water from the Nile for life sustenance; this is why it is crucial to preserve this precious and life giving source. Dubbing his invention the "Arab Smart Dam", what Mostafa Al-Sawy proposes is building a dam that is highly efficient in energy consumption, earthquake-proof, as well as a great energy generator.

In 2015, Mostafa competed in London with many hopefuls in the "Talented Arabs Championship", an annual competition that aims to acknowledge great achievements and innovations made by Arabs in their field of expertise. Thirty countries participated in 2015 when 16-year-old Mostafa Al-Sawy's innovative design won an award.

His award-winning design is exemplary in its implementation of renewable energy usage; solar panels and wind turbines will be used to power the turbines that in turn will produce hydroelectric energy. The dam is proposed to be built in Al-Salloum, and would produce an estimated 33.1 megawatts of electricity per hour. While the estimated cost of building the dam stands at around EGP 28 billion, Al-Sawy believes that this cost will be returned in just a few months after the dam starts operation. While he is the scientist behind the project, there is a team helping him on working out the finances of the project.

If this project sees the light, it will have a great impact on helping Egypt rely more and more on renewable energy, which is quite abundant in Egypt, but not put to use as it should. The way of the future most definitely lies there; however, the reliance on fossil fuels is still quite prevalent. One can only hope that more projects like those of Azza Fayad and Mostafa Al-Sawy will keep making the headlines and eventually become a reality on the ground.

While these are valiant individual efforts, there has been a move to create a place that encourages young scientists; in 2014, the Egyptian Young Academy of Sciences was launched. It is part of the Egyptian Academy of Scientific Research and Technology (ASRT) and is aimed at targeting youngsters who wish to make their way into scientific fields.





The (EYAS) includes members from the Global Young Academy (GYA), which is comprised of leading young scientists from 58 countries. GYA has a mission to become the voice of young scientists from all over the world, and to provide them with the platform needed to connect to each other and have interdisciplinary dialogues that will only lead to great innovation.

What EYAS aims to do is to create an environment where young scientists can communicate and learn from Science, Technology, and Innovation (STI) communities, in both Egypt and abroad. It also aims to help those interested in participating in conferences, competitions, and workshops, and to enable them to pursue their scientific goals. Its members are offered the opportunity to have easier access to research teams, so that collaborations can come about easier. EYAS also works on implementing an institutional framework that will allow young scientists to participate in Egypt's development.

Another place where young aspiring scientists can go to share their projects and ideas, as well as learn from one another is the Annual Competition in Science and Research held by Intel Corporation for students in the Arab world. In 2015, it took place at the Library of Alexandria and was met with great success, it gathered 130 students

from 11 Arab countries, and the financial awards combined came to a total of USD 20,000.

The competition encompassed many interesting projects, such as the top prize winner, Mohamed Ayman Abdel Latif, a 17-year-old student, who invented a way to isolate lung cancer cells in order to stop them from growing and spreading to other organs.

The Regional General Manager of Intel in the MENA region, Taha Khalifa, said "It is our priority at Intel to continue fostering development and investing in the power of young Arab scientists, innovators, and leaders. We consider it our duty to support our youth through mentorship, investment in research, innovation and education, in order to allow them to explore all opportunities with innovative approaches". To the finalists, he had this to say "The Intel Science Competition is a crucial event for the future of young scientists in the Arab world. These finalists represent the best and the brightest innovators and leaders from our region ... judging by the caliber of the projects presented this week, I am confident that these young innovators will make our world a better place".

It is clear that many great minds are amongst us in Egypt; their success can only mean great things, not only for our country, but also for humanity. The younger generations have much to offer and have current know-how. If only the facilities and opportunities are easily accessible to them, it is obvious that amazing achievements are within their grasp. With the need for sustainable, green scientific solutions, it seems that young scientists might just know the answers the world needs.

#### References

- inhabitat.com
- www.scidev.net
- egyptianstreets.com
- weekly.ahram.org.eg
- globalyoungacademy.net

**"The Intel Science Competition is a crucial event for the future of young scientists in the Arab world. These finalists represent the best and the brightest innovators and leaders from our region ... judging by the caliber of the projects presented this week, I am confident that these young innovators will make our world a better place"**



# Egyptian Team Wins Again at Intel ISEF 2016

For the fourth consecutive year, Intel Bibliotheca Alexandrina Science and Engineering Fair (Intel BASEF) teams won top places in the 2016 International Science and Engineering Fair (Intel ISEF), held 8-13 May in Phoenix, Arizona, USA.

In a continuing annual tradition, ten qualified Egyptian projects participated in Intel ISEF 2016. The 17 Egyptian students competed honorably in the international fair, winning several awards and acquiring the international recognition of scientists from all over the world. Their participation was organized by the BA Planetarium Science Center (PSC), in collaboration with Intel Egypt and the Ministry of Education, and was sponsored by the Academy of Scientific Research and Technology (ASRT) and the U.S. Consulate General.

Winning students from Egypt include Maria Hany Naguib and Samah Ayman, who won 4<sup>th</sup> place in the Earth and Environmental Sciences category for their project “Superconductive Hybrid Desalination”. The idea for the project stemmed from the scarcity of water resources, which is one of the most pressing challenges in Egypt. Superconductive Hybrid Desalination aims to overcome these challenges through using nano-magnetite. The project’s results, after conducting several experiments, were astounding, and its total cost is quite low, further proving the project’s exceptional success.

Two other winning Egyptian students are Haya Ahmed Mohamed and Madouna Atef, who won 4<sup>th</sup> place in the Environmental Engineering category for their project “Desalination by Pervaporation System”. The idea for the desalination of seawater arose from the fact that water is the most essential element in sustaining life, having vital and economic roles, and that the freshwater crisis has become one of the biggest challenges facing Egypt and other countries nowadays. As such, this innovative, low-cost project, which is easy to manufacture, is of high efficiency, has a high flow rate, is mechanically and thermally stable and safe, and operates using a simple scientific method (pervaporation) has come to light. The project can thus become a reliable solution for our community.

It is worth mentioning that, in 2015, Yasmine Yehia won the first place award in the Environmental Sciences category for her project “Making Use of Gray Water”. Yasmine developed a device that can evaporate water, using the heat from burning rice straw, which can reach 1200 degrees, and then passing rice straw gases on certain algae that produces biodiesel and oil. As such, we can

get rid of the black cloud that leads to many diseases that affect the respiratory system.

The device, which is approved by experts in the Faculty of Science in Damietta, uses rice straw ashes in manufacturing cement and organic fertilizers. It has two turbines: one for generating hydroelectric power, and the other for producing energy through the compression of gases.

In 2014, Sarah Ezzat, Mona Elsayed, and Hoda Mamdouh, who were Intel BASEF 2014 finalists won the 3<sup>rd</sup> Grand Award at Intel ISEF. They also earned the Medal of Distinction from Egyptian President, Abdel Fattah El-Sisi, at the Science Festival organized by the Ministry of Education held at Nasr City Conference Center on 8 September 2014.

Intel ISEF is the biggest science fair for pre-university students. It offers over 1,750 students worldwide the opportunity to gather and share their ideas and present advanced scientific projects. It also provides students with the opportunity to compete for the chance to win educational grants and scholarships, as well as scientific trips worth millions of dollars; in addition to the opportunity to meet scientists from all over the world, including Nobel Laureates in various fields of science.

Intel BASEF aims to help 12–18 years old youths develop 21<sup>st</sup> century skills through focusing on knowledge, research, innovation, critical thinking, problem solving,



# An Interview With A Young Scientist

By: Sherine Ramadan



and teamwork. The students' projects are assessed by university professors, specialized scientists and engineers, as well as professional volunteers. Grand prizes are determined by using a scale of one-hundred points, where points are awarded for innovative abilities, scientific thinking, engineering goals, precision, skills, and clarity. The Committee of Judges follows the necessary international standards in assessing the students' projects.

It is worth mentioning that the fruitful cooperation between BA PSC, Intel Egypt, and the Ministry of Education has resulted in the geographical expansion of Intel BASEF, as it now covers all Governorates in Egypt. Alex Fair was the third and last final exhibition in 2016 event. Four winners were from the Cairo Fair, which included projects from all over Greater Cairo; two other winners were from the Luxor Fair, which included projects from Upper Egypt and the Red Sea Governorate. Consequently, the total number of winners from across Egypt amounted to ten projects.

The BA prepares and trains the winning teams in order to guarantee that they will attain international rankings. This is achieved through providing research skills development programs; having eminent professors from Egyptian universities and specialized institutions who care about young inventors and researchers, to practically and linguistically review the scientific projects; as well as providing the winning projects with financial and technical support, thus preparing them to win in the international competition.

At the age of seventeen, Sarah Hagra and her team were the first Egyptians to win a prize in the world's largest international pre-college science competition Intel International Science and Engineering Fair (Intel ISEF) that was held in 2013, in the United States of America. *SC/planet* magazine has interviewed her to know more about her experience.

**Could you please introduce yourself to our readers?**

Well, I am 21 years old, studying Psychology at the Middle East Technical University in Turkey. I am very proud to be the first Egyptian girl to win a prize in Intel ISEF contest.

We would like to know how you chose your team? And what was your project about?

Actually, Omar Khaled, Abdel-Rahman Mohamed, and I have had the common passion for computer science and the great desire to help children suffering from cancer. So, after hard work and a lot of brainstorming, we came up with the idea of designing a computer program that can identify handwriting features of both healthy and cancer-diagnosed children, in order to build a classification model, through which we can diagnose kids with cancer. We called our project "New Screening Method for Early Pediatric Cancer Detection through Automated Handwriting Analysis".

**Well, that is interesting! What are the procedures you followed to apply for the contest?**

The procedures are very simple and clear; anyone can apply online through [www.isef-eg.com](http://www.isef-eg.com). My team and I first participated in the national competition

Intel Bibliotheca Alexandrina Science and Engineering Fair (Intel BASEF), where we won first place in both our category and the whole competition, which qualified us to participate in the international competition "Intel ISEF" in the United States. There, the competition with the teams from all over the world was on fire; that is why we were thrilled to win the fourth place in the Computer Science category.

**What did you learn from the Intel ISEF experience?**

I have learnt to follow my dreams and never lose hope; to open up to new ideas, work hard, and cooperate with others.

**What do you think are the challenges and problems facing young scientists in Egypt?**

Sadly, there are a lot of problems, such as crowded classrooms, lack of laboratory facilities availability, funds, and governmental support.

**Who is your scientist role model that you look up to in your life?**

Well, I have many; but my favorite is Elizabeth Loftus, the American cognitive psychologist and expert in human memory.

**What do you enjoy most about studying science?**

I enjoy every single detail about it; it is just like exploring everything around you in order to know how to utilize it.

**Finally, what is your advice to young people who are interested in a science career?**

I would like to tell them to believe in their dreams and they will take the lead. Through patience and hard work, they are capable of making the world a brighter and better place.

Thanks Sarah for your time. Good luck in your life.

# YOUNG

## ENTREPRENEURIAL GENIUSES

By: Esraa Ali

Becoming a billionaire so young has never been so easy; not that these young billionaires were born with a silver spoon in their mouths though. The Hurun Forty and Under Self-Made Billionaires 2016 has ranked 39 contemporary self-made USD billionaires, whose average age is 35; 28 of which in the technology sector.

Since it would be difficult to go through the story behind each of the 39 billionaires, let us discover the story behind the list's Top Ten that led to their fame and fortunes at young ages.

### Fast Facts

The list is dominated by five Facebook shareholders; led by Mark Zuckerberg with USD 47 billion (earned his first billion by the age of 23); followed by Dustin Moskovitz with USD 10 billion (earned his first billion by the age of 26); Jan Koum, originally of WhatsApp bought by Facebook, with USD 7.5 billion (made his first billion at the age of 37); Eduardo Saverin with USD 5.6 billion (earned his first billion by the age of 28), and in the eighth place Sean Parker with USD 3.8 billion (earned his first billion by the age of 31).

The fifth and sixth places, each with USD 5.5 billion, go to the founders of Uber Technologies Travis Kalanick and Garrett Camp (earned their first billion by the ages of 38 and 36, respectively). The only female in the list is in the seventh place with USD 4.3 billion, Elizabeth Holmes of blood-testing Theranos (earned her first billion by the age of 30). Last but not least, the ninth and tenth places, each with USD 3.6 billion, go to Airbnb founders Joe Gebbia and Nathan Blecharczyk (earned their first billion by the age of 33 and 31, respectively).

### Accidental Billionaires: Facebook



The story of the social-networking website Facebook began when Mark Zuckerberg, Co-founder and CEO, enrolled at Harvard in 2002 to study psychology. Zuckerberg soon gained a reputation

as a website genius, especially after inventing the "Face Mash" program, which became wildly popular, but was later shut down by Harvard after it was deemed inappropriate.

By late 2003, Harvard had been planning to put its own student directory online, which students referred to as "The Facebook", to link its students together. Zuckerberg, thus, decided to take the task, as he thought he could do it better than they could, and in a week's time.

Zuckerberg wrote a computer code for his own social networking site "The Facebook", working on it together with his friends Dustin Moskovitz, Chris Hughes, and Eduardo Saverin; they launched it on 4 February 2004. Out of a dorm room in Harvard, the group ran the site, extending it to reach students in Columbia, Yale, and Stanford Universities.

Facebook maintained an intimacy that is regarded the secret of its success. By end-2004, the site had one million users of students who created a profile, could look up others' profiles using a search box, and made contact using a poking button.

Later, Zuckerberg met Facebook's first investor, Sean Parker, who joined the company as its president; he is regarded as the first to see potential in the company. In June 2004, Zuckerberg moved his company to California, where he met local venture capitalists and attracted millions of dollars of investment.

By December 2005, the site started to attract the interest of other companies to advertise with. However, Zuckerberg focused on expanding the site and adding more features instead of selling it. Later on, Zuckerberg and his co-founders looked at funding options that could help their website grow after realizing its potential as a social connection tool that allows billions of people worldwide to connect quickly and easily.

To date, Facebook has created tens of billionaires and hundreds of millionaires, and continues to succeed. You may consider its history as simple, yet Facebook's success is remarkable, and a great example of the Internet's potential for rapid growth, success, and real change.

### Simple, Personal, Real Time Messaging: WhatsApp



With one billion users, WhatsApp is now the world's biggest mobile messaging service. WhatsApp was co-founded by Jan Koum and Brian Acton, who both became billionaires after Facebook bought their company in 2014.

Jan Koum, who had a knack for computers, met Brian Acton at Yahoo, where they worked before leaving it in 2007. In 2009, Koum started an idea for a mobile application when he realized that the App Store of iPhone was about to spawn a whole new industry. He chose the name WhatsApp because it sounded like "what's up"; in February 2009, he incorporated WhatsApp Inc. in California.

In just a small amount of time, WhatsApp became popular, thus, gaining Facebook's attention. In 2014, Facebook proposed Koum a deal to join the Facebook board; ten days later, Facebook announced it was acquiring WhatsApp for USD 19 billion. Like Facebook, WhatsApp became more than a messaging app, improving SMS technology in a few years.

### Your Day Belongs to You: Uber



The story of Uber takes us back to a snowy evening in Paris in 2008, when Uber co-founders, Travis Kalanick and Garrett Camp, were unable to find a taxi to reach a conference. Travelling within one of the world's busiest cities, without your own vehicle, packed with luggage under the rain with no taxis passing by is definitely a nightmare. The friends realized this was a global issue and were already thinking of ways to solve the issue of finding a car at the right place and in the right time. They came up with a brilliant, yet simple, idea: tap a button, get a ride.

Using a mobile application, customers can book a cab when their GPS is turned on. The application notifies the customer with the drivers nearby the location; once a cab is confirmed, the customer can check the progress of his/her request and receives estimates on the arrival time of the cab.

In 2009, Garrett Camp persuaded Travis Kalanick to join him on what would later be known as Uber. Unaware, they would be the head of one of the most successful startups, the duo tested the service in early 2010 in New York, using only three cars with a few people knowing about it. A few months later, Uber had proven to be a hit, and was officially launched in San Francisco in May 2010. Uber service is now available in many countries across the world, including Australia, Egypt, France, UAE, and USA.

Initially an app, Uber has changed the nature of logistics around the world applying technology to offer people what they want, whenever they want. Gearing up for a future of driverless cars, the company continues to be an outstanding example of disruptive technology.

### Do Not Go There, Live There: Airbnb



As the tale goes, Airbnb started in 2007, when Joe Gebbia and Brian Chesky were not able to pay their rent; a conference was to be held in San Francisco and the city's hotels were fully booked. In response to their need of money and the demand from conference attendees, they came up with the idea of renting out airbeds on their living-room floor and cooking their guests breakfast.

Gebbia and Chesky created the Airbedandbreakfast.com website and within a week they had four sleeping on their floor. As they were waving their guests goodbyes, they became excited about the idea. In February 2008, Nathan Blecharzyk, a brilliant programmer, joined the duo as the third co-founder, who developed their website. The official website was launched in August 2008; its name was shortened to Airbnb.com in 2009.

The website originally offered bed and breakfast spaces to short-term travelers; it later catered long-term travelers as well. In February 2010, Airbnb announced its one-millionth booking since inception. In 2011, the company went international as its first international office was opened in Hamburg. Airbnb promotes the concept of social relationships among people, not only by meeting and exchanging experiences and ideas; it also promotes sharing possessions, and this is how it creates a bonding among people.

### No One Has to Say Goodbye Too Soon: Theranos



At the age of 31, Elizabeth Holmes's uncle's death from cancer moved her to develop a way to detect diseases earlier. Holmes founded Real-Time Cures, later changing the company's name to Theranos in 2003. The biotech company has a new approach to blood testing, with a goal of making cheaper and easier clinical blood testing.

A semester later, Holmes dropped out of Stanford, working on Theranos in the basement of a college house. The company conducted blood tests detecting medical conditions, like cancer and high cholesterol using a single finger stick rather than drawing vials of blood. With a virtually painless prick of the finger, her labs made multitude of tests at a fraction of the price of commercial labs.

Theranos is now licensed to run in all the USA States; and today, Elizabeth Holmes is the world's youngest self-made female billionaire.

### The Bottom Line

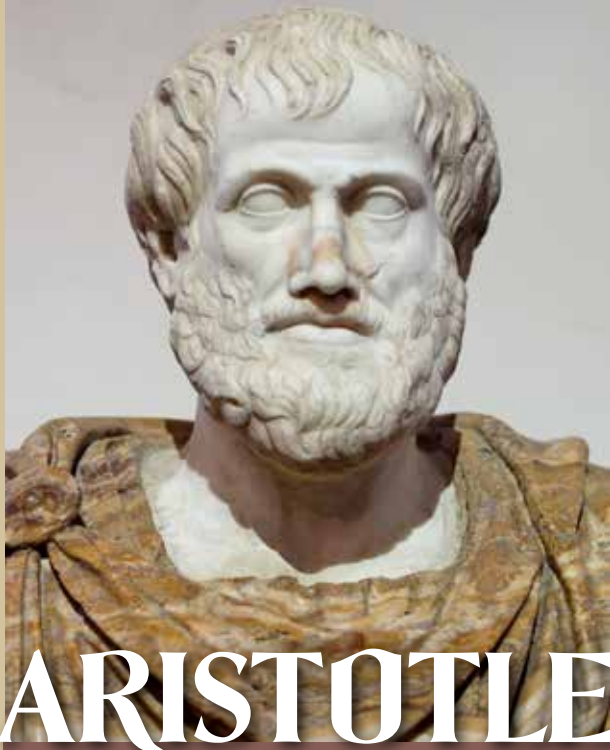
"If they can make this much before they are even forty, the mind boggles to think what they could do in their lifetime. Remember Bill Gates made his first billion by the age of 31, and has since gone on to create USD 100 billion in the next thirty years, 20% of which he has donated." Rupert Hoogewerf, Chairman and Chief Researcher of Hurun Report

You would have to look really hard not to see Steve Jobs or Bill Gates in each of these young billionaires. Each had a unique success story intermingled with criticism until they became what they are. I am inspired, not by the money as none of them were planning on making fortunes, but by the ambition and the solutions they found for each need or hurdle faced. Let us turn our ambition into action and our actions into accomplishments; if they can do it, we can.

### References

[www.hurun.net](http://www.hurun.net)  
[www.facebook.com](http://www.facebook.com)  
[www.whatsapp.com](http://www.whatsapp.com)  
[www.uber.com](http://www.uber.com)  
[www.airbnb.com](http://www.airbnb.com)

[www.theranos.com](http://www.theranos.com)  
[www.theguardian.com](http://www.theguardian.com)  
[www.biography.com](http://www.biography.com)  
[http://successstory.com/](http://http://successstory.com/)  
[www.businessinsider.com](http://www.businessinsider.com)



# ARISTOTLE

## and the Legacy of Logic

By: Maissa Azab

In the 3<sup>rd</sup> century BCE, Aristotle embarked on his life-long, eternally influential career in his late teens, when he attended Plato's Academy, Greek's premier learning institution, where he studied nearly every subject offered at the time. Aristotle proved to be an exemplary scholar; he maintained a relationship with Plato, himself a student of Socrates, and his academy for two decades. However, because he had disagreed with some of Plato's philosophical treatises, when Plato passed away in 347 BCE, Aristotle did not inherit the position of director of the Academy as many imagined he would.

A prolific writer and polymath, Aristotle radically transformed most, if not all, areas of knowledge he touched. He wrote as many as 200 treatises, only 31 of which survive. Unfortunately, these works are in the form of lecture notes and draft manuscripts never intended for general readership; they do not demonstrate his reputed polished prose style, which attracted many great followers, including the Roman Cicero. Aristotle was the first to classify areas of human knowledge into distinct disciplines such as mathematics, biology, and ethics; some of these classifications are still used today.

As the "Father of Logic", Aristotle was the first to develop a formalized system for reasoning. He observed that the validity of any argument can be determined by its structure rather than its content. Aristotle's brand of logic dominated this area of thought until the rise of modern propositional logic and predicate logic 2000 years later.

Aristotle's emphasis on good reasoning, combined with his belief in the scientific method, forms the backdrop for most of his work. For example, in his work on psychology and the soul, Aristotle distinguishes sense perception from reason, which unifies and interprets the sense perceptions and is the source of all knowledge.

One of the main focuses of Aristotle's philosophy was his systematic concept of logic; his objective was to come up with a universal process of reasoning that would allow man to learn every conceivable thing about reality. The initial process involved describing objects based on their characteristics, states of being, and actions. In his philosophical treatises, he discussed how Man might next obtain information about objects through deduction and inference.

Significant scientific contribution has never been restrained to those who start their scientific endeavors as grown adults. In fact, history thrives with scientists who have shaped the world thanks to work they have conducted, or at least started, as teenagers. Had they been disregarded simply because of their age, many things we take for granted today may have not existed.

Although Aristotle was not technically a scientist by today's definitions, science was among the subjects that he researched at length during his time at the Lyceum—a school he founded. Aristotle believed that knowledge could be obtained through interacting with physical objects. He concluded that objects were made up of a potential that circumstances then manipulated to determine the object's outcome. He also recognized that human interpretation and personal associations played a role in our understanding of those objects.

Aristotle's research in the sciences included a study of biology. He attempted, with some error, to classify animals into genera based on their similar characteristics. He further classified animals into species based on those that had red blood and those that did not. The animals with red blood were mostly vertebrates, while the "bloodless" animals were labeled cephalopods. Despite the relative inaccuracy of his hypothesis, Aristotle's classification was regarded as the standard system for hundreds of years.

In 322 BCE, Aristotle contracted a disease of the digestive organs and passed away. In the century following his passing away, his works fell out of use, but were revived during the first century CE; over time, they came to lay the foundation of more than seven centuries of philosophy. Aristotle's influence on Western thought in the humanities and social sciences is largely considered unparalleled, with the exception of his teacher Plato's contributions, and Plato's teacher Socrates before him. The two-millennia-strong academic practice of interpreting and debating Aristotle's philosophical works continues to endure.

With his vast knowledge of subject material, Aristotle completed encyclopedias of information, covering biology, ethics, logic, metaphysics, music, physics, poetry, politics, rhetoric, theater, and zoology; paving the way for many scientists and philosophers to follow in his footsteps to this day in time.

### References

[blogs.scientificamerican.com](https://blogs.scientificamerican.com)  
[www.biography.com](https://www.biography.com)  
[www.iep.utm.edu](https://www.iep.utm.edu)  
[prezi.com](https://prezi.com)

## PROMISING INVENTIONS BY YOUNG INVENTORS OF TODAY

energy, which drives the propeller at the bottom of the probe, which in turn powers the hydroelectric generator at the top of the Probe via a pulley system inside, eventually turning ocean tides into usable power.

Her design was able to produce just enough electricity to light some LED bulbs, but Hannah aims at scaling the probe up so it could produce enough electricity to charge three car batteries in about an hour, which could be used to power desalination pumps or medical devices. Herbst won the 2015 Discovery Education 3M Young Scientist Challenge grand prize and was paired with a mentor from 3M. She is planning to keep working to improve the Ocean Energy Probe so that it can eventually be developed in developing countries.

### House of the Future



Aiming to light houses without using electricity, the eleven-year-old Nikita Rafikov from Georgia, USA, developed a way to create efficient glass and lighting through combining Green Fluorescent Protein (GFP) with magnetic gel embedded into windows. GFP is naturally present in jellyfish; it works by absorbing energy from blue light in the environment and emitting flashes of green light. Nikita presented a model of his house illuminated by GFP in the Discovery Education 3M Young Scientist Challenge.

### References

www.nbcnews.com  
www.mnn.com  
www.oddee.com  
halcyonincubator.org

## 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

#### Enlightened mind

19min. Full-dome Show

#### The Mission

24min. Full-dome Show

### Visitors INFO

- For the Planetarium daily schedule and fees, please consult the Center's official website: [www.bibalex.org/psc](http://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

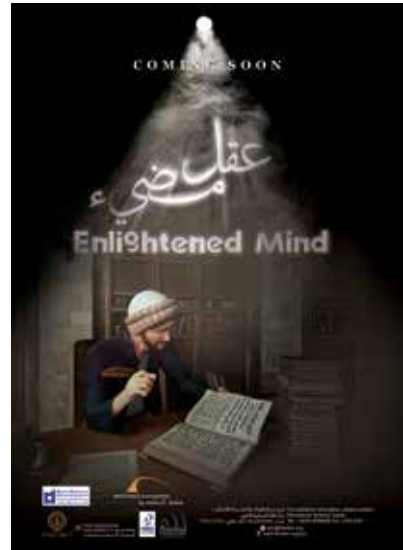
#### Opening Hours

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:  
10:00, 11:00, 12:00, 13:00, 14:00, 15:00  
Saturday: 12:00, 13:00, 14:00  
Tuesday: 10:00, 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](http://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.-

# How To Be A **Scientist** in Four Steps

