The Enlightenment

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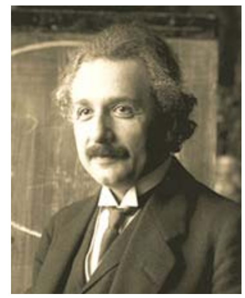
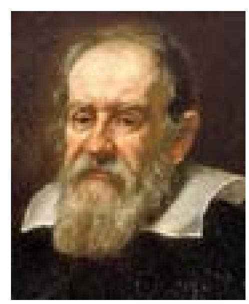
The Wonders of Science

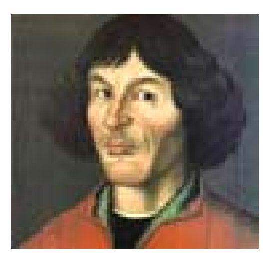

Einstein 1879-1955

Humanist principle No. 3 states: Humanists advocate the use of the scientific method, both as a guide to distinguish fact from fiction and to help develop beneficial and creative uses of science and technology. Centering on this principle, science is the theme of this special edition of *The Enlightenment*. The contents of this issue will not only point out some of the historical achievements of scientists, but will also suggest ways that science might aid in promoting humanistic values. As well, some of the amazing phenomena of the scientific world that inspire awe and wonder will be highlighted.


Newton 1643-1727

Up until about the 15th century, God was often cited as the originator and cause of natural phenomena. For instance, only an omniscient God knew how to make a tree, or knew how conception came about. But as time went by, the need for the divine became less and less as scientists unraveled more and more of the mysteries of the cosmos. Also there developed a very distinct difference between science and religion. Whereas religious beliefs tended to be cast in stone forever and ever, science is self-correcting. As new discoveries are made, old assumptions or beliefs are emended or discarded. For example, it took centuries for the Catholic Church hierarchy to pronounce that Galileo was right when he claimed that the planets revolve around the sun, but when Einstein proved that Newton's laws of motion do not apply at high velocities in outer space, the scientific community was reasonably quick to accept Einstein's findings.


Galileo 1564-1642


Copernicus 1473-1542

Einstein is often described as a "giant" among scientists, but in his typical modest way, he shunned this moniker. Instead, he said that he stood on the shoulders of giants. This has been a historic fact of science. Galileo furthered the work of Copernicus who affirmed the heliocentricity of the solar system. Newton built on Galileo's telescope experiments, and Einstein augmented the laws of Newton. And so it goes. Faraday used the discoveries of Volta, Ampere and Ohm, to discern electromagnetic induction. This led to the prediction of electromagnetic waves by Maxwell that led to the proof of their existence by Hertz. This in turn led to the invention of radio by Marconi and then television by Farnsworth, all monumental scientific achievements. The ensuing pages document these and many more fascinating aspects of science.

Learning About Science

From time to time there are comments in the media lamenting the fact that on a proportionate basis, certain of the Asian countries are training far more scientists and engineers than western countries. The concern is, of course, that western standards of living will not keep pace with other developed countries if we lack the people trained with the skills necessary to be competitive in the fast moving global economy.

For many students the sciences may not be their first love when it comes to selecting courses of study. This could be because some of the sciences require proficiency in mathematics or because the fascination of science itself was not ingrained into their young formative minds. It is the aim of this special edition of *The Enlightenment* to point out a few of the amazing realities of nature and the scientific world in the fields of chemistry, physics, biology, geology, astronomy and microbiology that should pique the interest of everyone, and in particular, young people.

In an effort to stimulate increased interest in science, it is submitted that scientific education must begin with the very young. Instead of teaching young children that God created the universe in six days, they should be made aware of the true age of the cosmos and the processes of biological evolution and geology. While it requires a brilliant mind to fully understand the intricacies of advanced science, the basics as described herein are easily comprehended by everyone. Let's use science as a tool in imparting humanist thinking into the minds of the youth of today and of the future.

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The Humanist Association of London and Area meets at the Cross Cultural Learner Centre, 505 Dundas Street in London, on the second Thursday of the months of September to July inclusive at 7:30 PM. Please use the rear door off the parking lot. *The Enlightenment* is published quarterly in January, April, July and October. Please note: We reserve the right to edit and publish articles at our discretion.

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The Wonders of Chemistry - What Are We Made Of?

According to a nursery rhyme written in the early 1800s, little boys are made of “Snaps and snails and puppy-dogs’ tails,” and little girls are made of “Sugar and spice, and everything nice.” Today we know a lot more about the composition of matter, both living and inert, than was known two hundred years ago. During this two-century period chemists have laid bare the composition of just about everything -- from the basic elements to the most complicated organic compounds.

For centuries it was known that certain substances could be broken down to form other substances, such as occurs with the smelting of ores to produce metals. In time, experimenters became aware that some substances, particularly metals, could be broken down no further, and the distinction between elements and compounds, which are made up of two or more elements, became known. A huge breakthrough occurred in 1869 when the Russian chemist Mendeljeff noticed that a relationship existed between atomic weights and the properties of the elements. From this observation he developed the Periodic Table of the Elements in 1871. There were many gaps in Mendeljeff’s table and he predicted that eventually elements would be discovered to fill the gaps. This proved to be true, and by the early twentieth century the table contained ninety-two elements, starting with hydrogen the lightest, and ending with uranium, the heaviest. This orderly arrangement of all the elemental substances that make up our solar system, and most likely the whole universe, surely inspires awe and wonder at the simplicity of it all, and should help stimulate students to develop an interest in science.

So what are we made of? We now know that we are made up of a complicated, intricate combination of nineteen elements that originate in air, water and soil. They are:

From Air (Also From Soil)	From Water	From Soil (Via Plants) Major Elements	From Soil (Via Plants) Trace Elements
Oxygen	Hydrogen	Calcium	Zinc
Nitrogen	Oxygen	Phosphorus	Iodine
Carbon		Potassium	Copper
		Sodium	Cobalt
		Sulfur	Fluorine
		Magnesium	Manganese
		Iron	Selenium
		Chlorine	

Some of these elements exist in the body in elemental form (minerals), or as inorganic compounds, including sodium chloride, calcium phosphate and water, but except for water, bones and teeth, the body is mostly made up of organic compounds in the forms of proteins, carbohydrates, fats and vitamins. Now what could be more mind boggling that the fact that somehow, through evolution, natural phenomena, with the help of plants, have brought together the inert elements from the three sources listed above, to form the living conscious animals we call human beings? Is this not a truly remarkable happening that should greatly stimulate one’s interest in science and, in particular, the interest of curious children?

In times past, God was credited with engineering this miracle. Now we know that the process that led up to the existence of the higher animals occurred over millions of years through evolution. As knowledge of the mechanisms involved increased, the need for God to be involved decreased. There is still, however, a most important gap in this march of events. We do not know precisely how life began. How did the first one-celled organisms come about? What were the conditions? What was the catalyst that caused inert elements and/or compounds to morph into an organic living entity? Some believers will want to fill this gap with God. Many liberal Christians have accepted the reality of evolution and the time scale involved, but believe God had a hand in getting it all started. This was the belief of the Deists in the eighteenth century. On the other hand, some scientists have predicted that the processes and mechanisms involved will be known before the end of the present century, and the "God of the gaps" will no longer be necessary.

Now as astonishing as the mechanisms that spawned the evolution of humans might be, there is another natural phenomenon that is almost as amazing. It is the process known as photosynthesis, which occurs in the leaves of plants. In this process plant leaves extract carbon dioxide from the air and take up water from the soil to produce simple sugars such as glucose. The simple sugars are then converted into compound sugars, to starches, to fats, to proteins and vitamins, all in the leaves of green plants. And to boot, the leaves produce by-product oxygen, which is essential for animal life. It is imperative that this symbiotic relationship between plants and animals remain in balance in order for humans to survive. This is why there is great concern about the excessive burning of fossil fuels that increase the air's carbon dioxide content, causing global warning, and about the destruction of the rain forests, which reduces the amount of oxygen returned to the atmosphere.

The above discourse just scratches the surface of some of the secrets of nature that chemists have been able to unravel, but perhaps it is enough to illustrate that this branch of science is truly fascinating. In addition to being useful for understanding much of what goes on in the biological sciences, chemistry is a most important tool for doctors in diagnosing medical conditions and for those involved in medical research. Advanced chemistry can get complicated, but the rudiments are fairly straightforward and can be taught to children at a young age in an effort to teach them the true facts, rather than creation stories based on Biblical myths.

The Wonders of Physics

There are several branches of physics including mechanics, properties of matter, heat, electricity and magnetism, sound, and electromagnetic waves. Much has been discovered and documented in each of these areas, but I would like to touch briefly on just two to illustrate the intrigue of this subject. These are electricity and magnetism, and electromagnetic waves.

The electrical age really got started in 1800, when the Italian physicist Alessandro Volta (1745-1827) invented the chemical battery, the first source of continuous direct current. Another pioneer was the French physicist and mathematician André-Marie Ampere (1775-1836), who worked on electromagnetism experiments. A significant development occurred in 1827, when the German physicist Georg Ohm (1787-1854) published what became known as Ohm's Law, which defined the mathematical relationship between voltage, current and resistance. It states:

Voltage (measured in Volts) = Current (measured in Amperes) X Resistance (measured in Ohms). It is usually expressed as E=IXR, where E stands for Electromotive Force (volts), I stands for Current (amps) and R stands for Resistance (ohms).

This simple equation, E=IXR, defines the basis of every electrical circuit in the universe and is another example of the innate beauty of a law of nature. It has to be modified for alternating current if an inductor or capacitor is introduced into the circuit, but the basic concept remains.

Speaking of inductors, we must move on to the famous English chemist and physicist Michael Faraday (1791-1867) the discoverer of electromagnetic induction, which led to the development of the electric motor, the dynamo, and the transformer. This was really the start of the modern electric age. With the invention of three-phase electrical technology by the Serbian electrical engineer, Nikolai Tesla (1856-1943) and the power dynamos of the American engineer and industrialist George Westinghouse (1846-1914), the electrification of industries and homes became a reality. And of course the American inventor Thomas Alva Edison (1847-1931) was also highly involved, with the light bulb probably being the most famous of his many inventions. In time, electric power gradually phased out the steam age. The point to be made is that by unlocking some of the amazing laws and forces of nature, a few brilliant early physicists enabled the development of technology that led to all the labour-saving devices we enjoy today. Without these devices there would be much less time for leisure.

As revolutionary as the fruits of electricity, the flowing of electrons *in wires* has been, the legacy of utilizing electromagnetic waves to transmit messages and pictures *through space* is even more astonishing. The existence of electromagnetic waves was first predicted by the Scottish mathematician and theoretical physicist James Clerk Maxwell (1831-1879). He theorized that electricity, magnetism and visible light were all manifestations of the electromagnetic field. His work, which led to the discovery of the electromagnetic spectrum, has been described as the second greatest unification in physics after the first one carried out by Newton. Maxwell was one of Einstein's heroes. He kept a picture of Maxwell on his study wall along with pictures of Faraday and Newton. Maxwell's prediction that it would be possible to transmit electromagnetic waves through space was proved correct in1887 by German physicist Heinrich Hertz (1857-1894) when he transmitted and received radio waves in his laboratory.

The discovery of the electromagnetic spectrum which consists of low frequency radio waves, microwaves, infrared, visible and ultraviolet light, X rays and gamma rays, is to physics what the periodic table was to chemistry. It is truly an amazing natural phenomenon, and like Ohm's Law can be represented by a simple equation, which is the following:

The speed of light = frequency X wavelength.

Since the speed of light is a constant of 300,000 kilometers per second, the frequency of electromagnetic radiation increases as the wavelength decreases. Thus radio waves have lower frequencies and longer wavelengths than waves higher up in the spectrum.

As we now know, the ground work on the electromagnetic spectrum by the nineteenth century physicists cited above, led to a series of inventions of great commercial importance. The Italian inventor Gugliemo Marconi (1874-1937) invented continuous wave radio in the 1890s. The Canadian inventor Reginald Fessenden (1886-1932) was the first to transmit voice in 1900. American inventor Philo Farnsworth (1906-1971) invented the first practical television in the 1930s. And then an event of monumental importance occurred with the invention of the transistor at the Bell Telephone Laboratories in 1947, by John Bardeen, Walter Brattain and William Shockley. For this the three were awarded the Nobel Prize for physics in1956. We all know the rest of the story. The substitution of the bulky vacuum tube by the miniature transistor, followed by the development of chips and integrated circuits, spurred on the space program, sped up the computer revolution and resulted in the creation of numerous miraculous devices such as cell phones, iPods, Blackberries, the amazing internet and PCs in most homes.

All of the developments cited above are the result of the work of brilliant pioneering individuals who, over a period of two centuries, had an intense interest in science and technology, and brought about monumental changes in the way we live. Surely these exciting events should be enough evidence to entice more students to engage in scientific studies.

The Science of Biology

Biology encompasses the sciences of Botany, Zoology and Genetics, all extensive subjects in themselves. Because of space limitations, I want to touch on just two very important events in these disciplines. The first is the publication of Darwin's *On the Origin of Species* in 1859 and the other is the discovery of the double helix by Watson and Crick in 1953.

Prior to Darwin's ground breaking publication, most western Christians believed in the creation story in the book of Genesis. Asking people to switch from a six-day creation a few thousand years ago, to a process of evolution through natural selection stretching over millions of years, has proved to be a long drawn out process. Even today, 150 years later, as many as half the people in the United States still believe dinosaurs and people walked the earth together 6000 years ago. This is a perfect example of how the young impressionable minds of some Christian children can be indoctrinated with untruths that they will firmly believe for life.

Most scientists, however, readily accepted the theory of evolution and it has aided biologists in classifying the plant and animal kingdoms. All living things, both plants and animals, can be slotted into the pyramidal classification system of Phylum, Class, Order, Family, Genus and Species.

The year 2009 marks the 200th anniversary of Darwin's birth (Feb. 12th) and the 150th anniversary of the publication of *On the Origin of Species.* Many humanist organizations are celebrating these events in various ways. The Humanist Association of London and Area, along with the University of Western Ontario and the London Public Library, is arranging for a series of four Darwin lectures to be held at the Wolf Performance Hall. Details of these events are contained on page ten.

For many years biologists have known of the existence of chromosomes and the part they play in heredity and in the reproductive process of mitosis. They have also know of RNA and DNA, but it was not until Watson and Crick uncovered the double helix structure of chromosomes and the possible countless combinations of the four nucleotide bases linking the helixes, that reproductive processes were fully understood. The need for God's role in reproduction disappeared. Watson and Crick received the Nobel Prize for their discovery. Their work enabled the eventual completion of the mapping of human genome as well as advances in the field of gene therapy. The potential for medical breakthroughs is huge as long as ethical issues are resolved in situations such as stem cell research. Perhaps the biggest ethical issue is human cloning. It is almost certain that the techniques necessary to clone a human being now exist, and it is also possible that some wealthy person would be willing to have himself or herself cloned. I don't think, however, as intriguing as it might be, that humanity is ready for this eventuality at this time in our history.

Just as the invention of the transistor in 1947 brought about undreamed of changes in the way we now live in the 21st century, the discovery of Watson and Crick in 1953 has the same potential to bring about great breakthroughs, particularly in the fields of medicine and plant breeding. In both cases ethical and safety issues are involved. Let's hope that these issues can be resolved sensibly and unselfishly for the future benefits of humankind.

The Science of Geology

Geology is the science and study of the materials that make up the earth, or in simple terms, the study of rocks. It is a very useful and practical science because an understanding of geology is of great commercial importance in the search for minerals and oil in the mining and petroleum industries. For humanists, geology is of interest because it gives support for Darwinian evolution and challenges creationism.

Although various people have been interested in the make-up of the earth since Grecian times, geology is a relatively young science that started to come together in Great Britain when Scottish physician James Hutton (1726-1797), often viewed as the father of modern geology, published T*heory of the Earth* in 1775. He theorized that the earth had to be much older than previously supposed in order to allow enough time for mountains to be eroded and for sediments to form new rocks which in time were raised up to become dry land. A little later in England, William Smith (1769-1839) began to observe the various strata of sedimentary rocks throughout the country. From his observations and findings he created a geological map of England using colours to differentiate the various kinds of rocks. As with Hutton, It became evident to him that the earth had to be much older than previously thought, because it had to have taken millions of years for the various strata to have been laid down by natural processes one layer after another. Of particular interest to him was the observation that the fossils in the strata became more developed as they progressed from lower to higher levels. Another Scotsman, Sir James Lyell (1797-1875) trained as a lawyer, but in 1827 he abandoned law and embarked on a geological career. He published three major books on the subject. *Principles of Geology* was published in 1830. Darwin took a copy of this book with him on his voyage on the *Beagle.* The second was *Elements of Geology* published in 1838 and the third, *Geological Evidence of the Antiquity of Man,* was published in 1863. Lyell asked Darwin to take note of any "erratic boulders" while sailing on the *Beagle* and on his return in 1836, Darwin and Lyell became close friends. The findings of one supported the other. Unlike Darwin, who considered himself an agnostic, Lyell was a devout Christian and had great difficulty reconciling his beliefs with natural selection. He was of course not alone. Even today, many devout Christians cannot accept evolution despite so much biological and geological evidence to the contrary.

From its early beginnings, geology has developed into a vast subject and has even branched out to the moon and the planets. The purpose of including geology in this discourse is to briefly point out the connection with evolution and the support it gives to Darwin's theories.

The Science of Astronomy

Astronomy is the oldest, and one of the most fascinating of the sciences. The ancients observed the stars and in the northern hemisphere noticed that one star, Polaris, the North Star, seemed to remain stationary while the other stars revolved around it every twenty-four hours. They also noticed that most stars remained fixed in their relation to other stars, but the two brightest "stars" (which became known as Venus and Jupiter) moved over time in relation to the other stars in an arc similar to the paths of the sun and the moon. These two moving "stars," along with three others that were not so bright, were the visible planets and all eventually assumed the names of the Roman gods, Mercury, Venus, Mars, Jupiter, and Saturn. Some of the stars, grouped together, seemed to form an outline of animals or humans and became known as constellations with names like Ursa Major, Ursa Minor, Orion, Cassiopeia and many others. Those constellations on the ecliptic, the path of the sun, became the twelve signs of the astrological zodiac. Also noticed in early times was a concentration of stars in a band that became known as the Milky Way. In the 16^{th} century it was confirmed by the Magellan expedition that the earth was spherical, and postulated by Copernicus that the earth revolved around the sun.

Modern astronomy, as we know it, began with the invention of the optical telescope and Galileo's discovery of the moons of Jupiter and the rings of Saturn in the seventeenth century. By the start of the twentieth century it was known that we live in a solar system consisting of eight planets and that all the planets revolved around the sun. (Uranus was discovered in 1781 and Neptune in 1846. Pluto is no longer considered to be a planet). It was known that our sun was in fact a star, similar to the others that were far far away. During the twentieth century tremendous advances occurred. Newtonian reflecting telescopes became larger, and many galaxies, similar to our Milky Way galaxy, were discovered by astronomer Edwin Hubble, using the 100 inch telescope at the Mount Wilson observatory in California in the early 1920s. Employing a spectroscopic Doppler technique known as the red shift, he discovered that most galaxies were moving away from us at great speeds. Thus it became known that the universe was extremely vast and was expanding rapidly. Many more exciting discoveries ensued. The invention of the radio telescope, along with other newer techniques, has allowed the discovery of phenomena that optical and reflecting telescopes could not detect. New objects such as white dwarfs, quasars, supernovae and black holes, were discovered. The orbiting Hubble telescope also enabled many new discoveries. The Big Bang theory was proposed and it was determined that the universe is nearly fourteen billion years old, with our solar system being four and a half billion years old.

The forgoing brief account barely scratches the surface of this exciting branch of science, but surely astronomy is an area that should be of great interest to the young and entice a few brilliant students into a very rewarding career. It should be noted that the International Year of Astronomy is being celebrated in 2009 to commemorate the 400^{th} anniversary of the first recorded astronomical observation using a telescope by Galileo in 1609.

The Science of Microbiology

Just as astronomy deals with the very large, microbiology deals with the very small. This science has its beginning with the invention of the microscope and the discovery of bacteria by the Dutch researcher Antonie van Leeuwenhoek in 1676. He is regarded as the father of microbiology. Probably the most famous of the microbiology pioneers is the French microbiologist Louis Pasteur, who among many other things, created the first rabies vaccine and developed a process for preventing sickness from drinking raw milk, that became known as pasteurization. Prior to the discovery of bacteria, the causes of plagues and many related diseases were unknown. As a result of research in this very important science, many human lives have been saved through improved hygiene and immunization using vaccines. Devastating diseases such as small pox, diphtheria, and polio have been practically eliminated, and others such a scarlet fever mumps and measles have been greatly reduced. As is well known, the discovery of antibiotics has also enabled many lives to be saved. The greatest challenge facing microbiological science at the present time is, of course, finding a vaccine and/or a cure for AIDS. Finally it must be mentioned that not all microbes are bad. They serve useful purposes in the fermentation process in the production of alcoholic beverages and in the breakdown of organic wastes into simpler, less harmful substances.

Albert Einstein

Any review of major scientific achievements, however brief, would not be complete without special mention of Albert Einstein. It was in 1905 while employed at the Bern Switzerland Patent Office that he wrote five papers that would make him famous and change science and the world forever.

His first paper proved that light was propagated not only as a wave motion, but also as bundles or quanta, that later became known as photons. This work was based on the photoelectric effect and won him the Nobel prize in 1921. The second paper, which became his doctoral thesis, dealt with the sizes of atoms. The third provided an explanation for Brownian movement (the continuous random movement of particles in a liquid or gas medium). Then came the big ones. The fourth introduced the hard-to-grasp theory of special relativity, which includes time as the fourth dimension. As if that were not enough, he then devised the most famous equation in physics, $E = mc^2$ which eventually led to nuclear fission and the bomb that changed the world.

Special relativity deals with the relative motion of bodies at a constant speed of motion, but not if they change velocity or direction. It took Einstein another ten years to develop the equations that would fit all conditions of movement, and this theory became known as general relativity. By this time he was thirty-six years old, and his most creative years were behind him. He spent the next forty years trying to prove that there was a mathematically explainable connection between gravity and electromagnetism. This search, for what he termed the unified field theory, never did come to fruition.

Of special interest to humanists is Einstein's slant on God and atheists. He said, "I believe in Spinoza's God who reveals himself in the beauty and harmony of all that exists, but not in a God who concerns himself with the fate and doings of mankind. Spinoza was the first philosopher to deal with the body and soul as one, and not two separate things. I do not believe in immortality. One life is enough for me." When asked if he was religious he replied, " try and penetrate with our limited means the secrets of nature and you will find that, behind all the discernable laws and connections, there remains something intangible and inexplicable. Veneration for this force beyond anything that we can comprehend is my religion. To that extent I am, in fact, religious."

Unlike Sigmund Freud, Bertrand Russell or George Bernard Shaw, Einstein never felt the need to denigrate those who believe in God; instead he tended to denigrate atheists. He said, "What separates me from most so called atheists is a feeling of the cosmos. The fanatical atheists are like slaves who are still feeling the weight of their chains, which they have thrown off after a hard struggle. They are creatures who – in their grudge against traditional religion as the 'opium of the masses' – cannot hear the music of the spheres." And he went on, "You can call me an agnostic, I do not share the crusading spirit of the professional atheist whose fervor is mostly due to a painful liberation from the fetters of religious indoctrination received in youth. I prefer the attitude of humility, corresponding to the weakness of our intellectual understanding of nature and our own being." Einstein the agnostic, had no objection to being labeled a humanist.

Special note It must be mentioned and emphasized that the most important discipline of **mathematics** has been extremely valuable in aiding in the development of many of the scientific activities and achievements outlined above.

Conclusions

Even though, in the last five hundred years, science and technology have bestowed many benefits on humankind, there have also been negative consequences; witness the fact that wars are becoming more destructive and more barbaric -- not to mention the fact that in the wrong hands, nuclear weapons could destroy civilization. While science has advanced, human nature seems to be stuck in the Stone Age. Neither religion nor philosophy has done much to discourage certain power-hungry, greedy individuals from killing other human beings. In fact religions have often been the cause and justification for much killing. It is my submission that our situation will not improve until young people the world over are no longer taught religious untruths. Perhaps, if *instead,* they are taught the rudiments of the sciences, and inspired by the awe and wonder of our natural word, they will develop a reverence for the miracle of human life and shun violence. As Carl Sagan said, “We are made of star stuff.” We are of the elements of the universe that, by some not-yet fully understood natural phenomena, came together on our planet to form conscious human beings. If everyone were made fully aware of this astonishing miracle, we might think twice about taking a human life, and in the process bring about an end to wars. This will not happen soon, but if science is used to play an active role in the early education of young people, it might help to hasten a more peaceful world for our descendents. It is recognized, of course, that in addition to science, the education of the young must include a basic grounding in the arts as well as instruction in ethical and moral values. Young children are curious, and providing them early with a well-rounded introduction to the realities of our world, in a form they can assimilate, is perhaps the only long-term hope for improving our societies.

Darwin Celebrations

In celebration of the 200th anniversary of the birth of Charles Darwin in England on February 12th 1809, and the 150th anniversary of the publication of *On the Origin of Species,* the Humanist Association of London and Area, along with the University of Western Ontario and The London Public Library, is presenting a series of four lectures which will be held in the Wolf Performance Hall at the London Library, 251 Dundas Street in London, on the following dates at 7:00 p.m.

Monday February 23rd Speaker - Dr. Andre Lachance – UWO Biology Professor.
Topic – Why Evolution?

Monday March 2nd Speaker - Donald Santor, - Retired Educator & World Religion Specialist.
Topic – Darwin & Evolution: Educational Perspectives.

Monday March 9th Speaker - Dr. Brian Alters – Professor at McGill and Harvard Universities.
Topic - Intelligent Design, Creationism and Biological Evolution.

Monday March 16th. Speaker - Dr. Jerry Lieberman – President of the Humanists of Florida.
Topic - The Future of Evolution.

Free Admission **Question & Answer Period Following the Presentations**