

Excerpt from the Appendix: 100 Wonders of the World



The Top 10 Wonders of the World

THE WONDER OF THE WORLD: **A Journey from Modern Science to the Mind of God** by Roy Abraham Varghese is an inquiry into those everyday experiences and “facts of life” that are as mystifying as they are obvious and ordinary. From commonplace phenomena like language and reproduction to such enigmas as energy, life, consciousness, mind and the laws of nature, science brings us face to face with magic and mystery. The world is nothing less than a wonderland. Paradoxically, we search anxiously for signals from across the Universe that show the presence out there of (“extra-terrestrial”) intelligent agents: but the Universe itself with its laws and fields and forces is the ultimate Signal of Intelligence. While offering a framework within which these mysteries may be resolved, Varghese lays out a hundred or so wonders of the world that evoke awe and admiration. Here are the Top Ten.

1. Electrons and Protons

Every electron in the universe has the same charge, follows the same laws (orbiting the nucleus, shooting out a photon when it collides with another electron, for instance) and has a natural “life-span” of ten billion trillion years. A proton is 1,836 times bigger than an electron but the two have equal yet opposite charges (proton=positive, electron=negative); the electron to proton mass ratio is the exact proportion required for molecules to form. Stephen Hawking notes that any difference in the charge of the electron would have meant that stars either could not (a) burn hydrogen and helium or (b) explode—both of which were required for life.

2. Energy

Energy is everywhere around us and yet we’re barely aware of its presence. The energy in a single gram of any kind of matter, reports Gerald Schroeder, can boil 34 billion grams of water into steam. We know that different forms of energy are converted into each other given a conversion mechanism. But where did energy, take, for instance, the energy fields in vacuums, come from? Martin Rees acknowledges that it is basically mysterious how empty space could have energy associated with it. And we know nothing about the origin of energy or the primal field.

3. Protein Folding

All proteins in living beings are made from different sequences of just twenty organic molecules called amino acids. Proteins have the extraordinary ability to assemble themselves without external intervention. This self-assembly is a process called protein-folding whereby a given sequence of amino acids forms a specific three-dimensional structure: it becomes a particular protein with a precise structural or functional role. Gerald Schroeder points out that every cell in the body (other than sex and blood cells) makes two thousand proteins every second from hundreds of amino acids. This process is so complex, says *Scientific American*, that a supercomputer, programmed with the rules for protein folding, would take 10^{127} years to generate the final folded form of a protein with just 100 amino acids. *But what takes a supercomputer trillions of years, takes seconds for real proteins.*

4. The Five Senses

Perhaps our senses can bring us to our senses! In seeing, hearing, smelling, tasting and touching, a mechanical stimulus is transformed into a nerve signal that is sent to the brain and then converted into a conscious state. Despite decades of scientific study spent in understanding

the network of proteins, ions, signals and cellular structures involved, the bridge between these two worlds, the external stimulus and the corresponding sense-perception, remains as much a mystery today as ever. On the one hand, we have an efficient chain of precise physical processes that monitor, transmit and respond to an immense variety of sensory inputs. On the other, we have a mysterious and radical conversion: the merely physical becomes something of which we are conscious, something in which we “participate.”

5. Insect Flight

How do insects fly and hover? Initially it might seem that the aerodynamics involved would work against flight. For instance, how is it possible for a bumblebee to fly given that its wings are too small to support the lift required by its weight? Moreover, insects, unlike airplanes, continually flap their wings—and this is hard to square with theoretical calculations. Michael Dickinson points out that fruit flies, which know nothing of aerodynamics, nevertheless utilize

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vortex production, delayed stall, rotational circulation and wake capture as they effortlessly stay aloft while flapping their wings about 200 times a second.

6. Seeing

A chain of chemical reactions is triggered off when a retinal cell absorbs light—a single photon acting on the rhodopsin protein in a rod cell sets off cascades of enzymatic activities that translate this information into a signal that can be processed by the nervous system. The retina processes ten one-million-point images every second. Through chemical amplifiers it produces up to 100,000 messenger molecules from a single photon. To match the retina's processing power, a robot vision program would have to perform a 1,000 million computer instructions per second.

It has also been estimated that computer simulation of the processing performed by just one retinal nerve cell in one hundredth of a second would call for the solution of 500 simultaneous non-linear differential equations 100 times.

7. Reproduction

Neo-Darwinists like to say that there is no purpose in nature. But neo-Darwinists themselves have to assume capabilities of self-reproduction at the earliest stages of life. Yet reproduction is an irreducibly purpose-driven act, one which can't simply spring from matter. How is it that the first living beings had the powers of replication? How is it that life came with this fundamentally purposive capability pre-installed? John Maddox, the former editor of *Nature*, admits that we don't know how sexual reproduction itself evolved despite decades of speculation. Replication is the engine that runs evolutionary theory. *It's the horse of reproduction that draws the cart of natural selection.* If you put the cart before the horse, you won't get started. But who came up with the idea of replication—and who then imprinted material structures with a vast variety of replicational capabilities?

8. Consciousness

We are conscious and aware that we are conscious; we perceive, conceive, remember, imagine, sense, feel, plan, intend, choose. Not only are we conscious of being conscious but we are just as clearly conscious that our consciousness is dramatically different from anything material or physical—it has no size or shape, color or smell. We have pinpointed the kinds of information processing carried out by the nervous system and we have hypotheses about what brain mechanisms enable consciousness to access such information. But, says Steven Pinker, we have no idea where sentience, i.e., *what consciousness feels like on the inside*, came from. How can a purely physical universe give rise at random to something that we experience intentionally as qualitatively non-physical?

9. Language

The most obvious everyday instance of conceptual thought is language. Syntactical language is unique to human beings—found even in ancient civilizations and instinctively mastered by children at a very young age. Language is built around the ability to understand. There is no organ, no part of the brain that performs “understanding.” Words are symbols or codes signifying something—and the coding and decoding activities required for using language presuppose an entity that can endow and perceive meaning in symbols. Can a material object perceive meaning? By its very nature, the act of comprehending the meaning of something is non-physical. And it's something we do all the time. Richard Dawkins points out that (a) nobody knows how language began since there's no syntax in non-human animals and it's hard to

imagine evolutionary forerunners of it and (b) the origin of semantics, of words and their meanings, is equally obscure.

10. The laws of nature

From atoms and cells to galaxies and ecosystems, we see intricately ordered activities and operations manifesting carefully defined laws; the laws that affect a quark affect a galaxy. How utterly extraordinary it is that the physical constituents of this world obey any laws at all. Why on earth should stones and feathers and stars follow uniform laws of motion? How can mass-energy be made to conform to the law of its conservation? What tells the molecules of a gas that the product of their volume and pressure should be proportional to their absolute temperature? How do nucleic acids like DNA and proteins know that they can and *should* communicate and construct, repair and replicate? How do genes know when to switch on and why do they continue to do so at just the right time? What compels organisms to adapt to environment? Why should these and all the other particles and forces, galaxies and gas clouds, cells and chemicals that make up our world follow “instructions?” Do they know they're supposed to act in that way? Were they programmed to obey orders, march in step? Trillions of quarks and cells, billions of galaxies—all of them doing what they're told to. But by whom and how?

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