

Seven Wonders

By Lewis Thomas

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A while ago I received a letter from a magazine editor inviting me to join six other people at dinner to make a list of the Seven Wonders of the Modern World, to replace the seven old, out-of-date Wonders. I replied that I couldn't manage it, not on short order anyway, but still the question keeps hanging around in the lobby of my mind. I had to look up the old biodegradable Wonders, the Hanging Gardens of Babylon and all the rest, and then I had to look up that word wonder to make sure I understood what it meant. It occurred to me that if the magazine could get any seven people to agree on a list of any such seven things you'd have the modern Seven Wonders right there at the dinner table.

Wonder is a word to wonder about. It contains a mixture of messages: something marvelous and miraculous, surprising, raising unanswerable questions about itself, making the observer wonder, even raising skeptical questions like, "I *wonder* about that." Miraculous and marvelous are clues; both words come from an ancient Indo-European root meaning simply to smile or to laugh. Anything wonderful is something to smile in the presence of, in admiration (which, by the way, comes from the same root, along with, of all telling words, 'mirror').

I decided to try making a list, not for the magazine's dinner party but for this occasion: seven things I wonder about the most.

I shall hold the first for the last, and move along.

My Number Two Wonder is a bacterial species never seen on the face of the earth until 1982, creatures never dreamed of before, living violation of what we used to regard as the laws of nature, things literally straight out of Hell. Or anyway what we used to think of as Hell, the hot unlivable interior of the earth. Such regions have recently come into scientific view from the research submarines designed to descend twenty-five hundred meters or more to the edge of deep holes in the sea bottom, where open vents spew superheated seawater in plumes from chimneys in the earth's crust, known to oceanographic scientists as 'black smokers.' This is not just hot water, or steam, or even steam under pressure as exists in a laboratory autoclave (which we have relied upon for decades as the surest way to destroy all microbial life). This is extremely hot water under extremely high pressure, with temperatures in excess of 300 degrees centigrade. At such heat, the existence of life as we know it would be simply inconceivable. Proteins and DNA would fall apart, enzymes would melt away, anything alive would die instantaneously. We have long since ruled out the possibility of life on Venus because of that planet's comparable temperature; we have ruled out the possibility of life in the earliest years of this planet, four billion or so years ago, on the same ground.

B. J. A. Baross and J. W. Deming have recently discovered the presence of thriving colonies of bacteria in water fished directly from these deep-sea vents. Moreover, when brought to the surface, encased in titanium syringes and sealed in pressurized chambers heated to 250 degrees centigrade, the bacteria not only survive but reproduce themselves enthusiastically. They can be killed only by chilling them down in boiling water.

And yet they look just like ordinary bacteria. Under the electron microscope they have the same essential structure—cell walls, ribosomes, and all. If they were, as is now

being suggested, the original archbacteria, ancestors of us all, how did they or their progeny ever learn to cool down? I cannot think of a more wonderful trick.

My Number Three Wonder is *oncideres*, a species of beetle encountered by a pathologist friend of mine who lives in Houston and has a lot of mimosa trees in his backyard. This beetle is not new, but it qualifies as a Modern Wonder because of the exceedingly modern questions raised for evolutionary biologists about the three consecutive things on the mind of the female of the species. Her first thought is for a mimosa tree, which she finds and climbs, ignoring all other kinds of trees in the vicinity. Her second thought is for the laying of eggs, which she does by crawling out on a limb, cutting a longitudinal slit with her mandible and depositing her eggs beneath the slit. Her third and last thought concerns the welfare of her offspring; beetle larvae cannot survive in live wood, so she backs up a foot or so and cuts a neat circular girdle all around the limb, through the bark and down into the cambium. It takes her eight hours to finish this cabinetwork. Then she leaves and where she goes I do not know. The limb dies from the girdling, falls to the ground in the next breeze, the larvae feed and grow into the next generation, and the questions lie there unanswered. How on earth did these three linked thoughts in her mind evolve together in evolution? How could any one of the three become fixed as beetle behavior by itself, without the other two? What are the odds favoring three totally separate bits of behavior—liking a particular tree, cutting a slit for eggs, and then girdling the limb—happening together by random chance among a beetle's genes? Does this smart beetle know what she is doing? And how did the mimosa tree enter the picture in its evolution? Left to themselves, unpruned, mimosa trees have a life expectancy of twenty-five to thirty years. Pruned each year, which is what the beetle's girdling labor accomplishes, the tree can flourish for a century. The mimosa-beetle relationship is an elegant example of symbiotic partnership, a phenomenon now recognized as pervasive in nature. It is good for us to have around on our intellectual mantelpiece such creatures as this insect and its friend the tree, for they keep reminding us how little we know about nature.

The Fourth Wonder on my list is an infectious agent known as the scrapie virus, which causes a fatal disease of the brain in sheep, goats, and several laboratory animals. A close cousin of scrapie is the C-J virus, the cause of some cases of senile dementia in human beings. These are called 'slow viruses,' for the excellent reason that an animal exposed to infection today will not become ill until a year and a half or two years from today. The agent, whatever it is, can propagate itself in abundance from a few infectious units today to more than a billion next year. I use the phrase 'whatever it is' advisedly. Nobody has yet been able to find any DNA or RNA in the scrapie or C-J viruses. It may be there, but if so it exists in amounts too small to detect. Meanwhile, there is plenty of protein, leading to a serious proposal that the virus may indeed be *all* protein. But protein, so far as we know, does not replicate itself all by itself, not on this planet anyway. Looked at this way, the scrapie agent seems the strangest thing in all biology and, until someone in some laboratory figures out what it is, a candidate for Modern Wonder.

My Fifth Wonder is the olfactory receptor cell, located in the epithelial tissue high in the nose, sniffing the air for clues to the environment, the fragrance of friends, the smell of leaf smoke, breakfast, nighttime and bedtime, and a rose, even, it is said, the odor of sanctity. The cell that does all these things, firing off urgent messages into the deepest parts of the brain, switching on one strange unaccountable memory after another, is itself a proper brain cell, a certified neuron belonging to the brain but miles away out in the open air, nosing around the world. How it manages to make sense of what it senses, discriminating between jasmine and anything else non-jasmine with

infallibility, is one of the deep secrets of neurobiology. This would be wonder enough, but there is more. This population of brain cells, unlike any other neurons of the vertebrate central nervous system, turns itself over every few weeks; cells wear out, die, and are replaced by brand-new cells rewired to the same deep centers miles back in the brain, sensing and remembering the same wonderful smells. If and when we reach an understanding of these cells and their functions, including the moods and whims under their governance, we will know a lot more about the mind than we do now, a world away.

Sixth on my list is, I hesitate to say, another insect, the termite. This time, though, it is not the single insect that is the Wonder, it is the collectivity. There is nothing at all wonderful about a single, solitary termite, indeed there is really no such creature, functionally speaking, as a lone termite, any more than we can imagine a genuinely solitary human being; no such thing. Two or three termites gathered together on a dish are not much better; they may move about and touch each other nervously, but nothing happens. But keep adding more termites until they reach a critical mass, and then the miracle begins. As though they had suddenly received a piece of extraordinary news, they organize in platoons and begin stacking up pellets to precisely the right height, then turning the arches to connect the columns, constructing the cathedral and its chambers in which the colony will live out its life for the decades ahead, air-conditioned and humidity-controlled, following the chemical blueprint coded in their genes, flawlessly, stone-blind. They are not the dense mass of individual insects they appear to be; they are an organism, a thoughtful, meditative brain on a million legs. All we really know about this new thing is that it does its architecture and engineering by a complex system of chemical signals.

The Seventh Wonder of the modern world is a human child, any child. I used to wonder about childhood and the evolution of our species. It seemed to me unparsimonious to keep expending all that energy on such a long period of vulnerability and defenselessness, with nothing to show for it, in biological terms, beyond the feckless, irresponsible pleasure of childhood. After all, I used to think, it is one sixth of a whole human life span! Why didn't our evolution take care of that, allowing us to jump catlike from our juvenile to our adult (and, as I thought) productive stage of life? I had forgotten about language, the single human trait that marks us out as specifically human, the property that enables our survival as the most compulsively, biologically, obsessively social of all creatures on earth, more interdependent and interconnected even than the famous social insects. I had forgotten that, and forgotten that children *do* that in childhood. Language is what childhood is for.

There is another related but different creature, nothing like so wonderful as a human child, nothing like so hopeful, something to worry about all day and all night. It is *us*, aggregated together in our collective, critical masses. So far, we have learned how to be useful to each other only when we collect in small groups—families, circles of friends, once in a while (although still rarely) committees. The drive to be useful is encoded in our genes. But when we gather in very large numbers, as in the modern nation-state, we seem capable of levels of folly and self-destruction to be found nowhere else in all of Nature.

As a species, taking all in all, we are still too young, too juvenile, to be trusted. We have spread across the face of the earth in just a few thousand years, no time at all as evolution clocks time, covering all livable parts of the planet, endangering other forms of life, and now threatening ourselves. As a species, we have everything in the world to

learn about living, but we may be running out of time. Provisionally, but only provisionally, we are a Wonder.

And now the first on my list, the one I put off at the beginning of making a list, the first of all Wonders of the modern world. To name this one, you have to redefine the world as it has indeed been redefined in this most scientific of all centuries. We named the place we live in the *world* long ago, from the Indo-European root *wiros*, which meant man. We now live in the whole universe, that stupefying piece of expanding geometry. Our suburbs are the local solar system, into which, sooner or later, we will spread life, and then, likely, beyond into the galaxy. Of all celestial bodies within reach or view, as far as we can see, out to the edge, the most wonderful and marvelous and mysterious is turning out to be our own planet earth. There is nothing to match it anywhere, not yet anyway.

It is a living system, an immense organism, still developing, regulating itself, making its own oxygen, maintaining its own temperature, keeping all its infinite living parts connected and interdependent, including us. It is the strangest of all places, and there is everything in the world to learn about it. It can keep us awake and jubilant with questions for millennia ahead, if we can learn not to meddle and not to destroy. Our great hope is in being such a young species, thinking in language only a short while, still learning, still growing up.

We are not like the social insects. They have only the one way of doing things and they will do it forever, coded for that way. We are coded differently, not just for binary choices, *go* or *no-go*. We can go four ways at once, depending on how the air feels: *go*, *no-go*, but also *maybe*, plus *what the hell let's give it a try*. We are in for one surprise after another if we keep at it and keep alive. We can build structures for human society never seen before, thoughts never thought before, music never heard before.

Provided we do not kill ourselves off, and provided we can connect ourselves by the affection and respect for which I believe our genes are also coded, there is no end to what we might do on or off this planet.

At this early stage in our evolution, now through our infancy and into our childhood and then, with luck, our growing up, what our species needs most of all, right now, is simply a future.

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