

Opinions

Where human questioning led us

By **Marcia Bartusiak** July 2

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THE UPRIGHT THINKERS

The Human Journey from Living in Trees to Understanding the Cosmos

By Leonard Mlodinow

Pantheon.

340 pp. \$27.95

"The nobility of the human race lies in our drive to know," says Leonard Mlodinow. And by tracing that voracious impulse through the millennia, Mlodinow has fashioned an entrancing tale of scientific history in his book "The Upright Thinkers."

This is, of course, a familiar journey, featuring all the usual suspects: Galileo (check), Newton (check), Darwin (check). But what makes this oft-made trip worthwhile is Mlodinow's captivating voice, sly humor and intellectual vitality. If high school history were taught in this way, college history departments would be swamped with applications.

He starts not with the Greeks or the Egyptians but much further back — with *Protungulatum donnae*, a small mammal from the age of the dinosaurs whose progeny evolved over the eons into primates, including us. Once we acquired the ability to fashion tools and obtain protein-rich meat, our brain size increased, thus boosting our cerebral powers. So, upon encountering the unknown, our primitive species moved beyond mere instinct and began to ask, "Why?" "The act of questioning is so important to our species," the author writes, "that we have a universal indicator for it: all languages . . . employ a similar rising intonation for questions." We began to think.

Humanity's queries continued as we erected first villages, then cities. A division of labor freed us from farming alone, with weavers, builders and brewers serving as humanity's proto-engineers and chemists. We started to seek

rational explanations for such natural disasters as earthquakes, windstorms and floods. Before this, Mlodinow writes, “the gods were thought to be constantly causing calamities through their anger . . . as if they were bulls in a china shop and we were the china.” Now early philosophers began to view the universe as ordered, not random. Pythagoras and company uncovered mathematical laws behind this order. “It is hard to overstate what a profound shift that was, or the degree to which it has shaped human consciousness ever since,” the author notes.

But there were limits initially. Aristotle, who resided in the top tier of Greek philosophers, was not fond of quantifying his observations. “He had just a vague understanding of speed — as in ‘some things go farther than others in a similar amount of time,’” Mlodinow points out. “That sounds to us like a message we might find inside a fortune cookie.” What Aristotle sought was the purpose or intention of all natural phenomena, an emphasis that, according to the author, impeded science for some 2,000 years.

That changed as Greek knowledge, valued and extended by the Islamic world, was rediscovered by Europeans in medieval times. The rise of universities and improvements in technology — printing presses, clocks, mechanical devices — encouraged the reexamination of its tenets. No one did this better than Galileo. Rather than carry out experiments merely to illustrate various phenomena, as scholars had done for centuries, he used them to gather quantitative data that tested his hypotheses. More than that, he didn’t throw out the measurements that went against his preconceived notions. It was that turn of mind that later allowed Isaac Newton’s breakthroughs to emerge.

Here Mlodinow vividly illustrates that Newton’s momentous laws of motion and gravity did not arise from an apple-driven “epiphany” but rather from years of dogged struggle. His success was so great that his findings and chosen language are now woven into our very culture and vocabulary. “We speak of the force of a person’s character, and the acceleration of the spread of a disease,” Mlodinow writes. “We talk of physical and even mental inertia, and the momentum of a sports team. To think in such terms would have been unheard of before Newton.” Such insights are what make this book singular. Mlodinow provides many cultural touchstones and tells personal stories, both poignant and amusing, about his experiences as a theoretical physicist to draw us even closer to the history.

After Newton, the pace of discovery quickens, into chemistry and the unveiling of the ultimate nature of matter. Being rich helped, enabling people like Englishman Robert Boyle and the Frenchman Antoine Lavoisier to draw on their families’ aristocratic wealth to set up state-of-the-art laboratories for their pivotal thermodynamic and chemical explorations.

Advances in biology are limited to a single chapter introduced in the author’s poetic style: “It is a great wonder that the sum of our cells’ activities, the interaction of a galaxy of unthinking individuals, adds up to a whole that is us.” In this section we learn about the astounding work of Anton van Leeuwenhoek (the Galileo of the microscope) and, of course, Charles Darwin (whose “Origin of the Species” serves as the biological equivalent of Newton’s “Principia”).

Once Darwin introduced the concept of natural selection, biologists became comfortable with the role of chance in nature's behavior. And soon physicists had to make a similar adjustment in understanding the goings-on of the atomic world, where light and matter are ruled by probabilities rather than Newtonian cause and effect. It is a domain where particles are waves and waves are particles — all at the same time. Though still difficult for our macroscopic minds to grasp, this realization ultimately led to the wonders of our 21st-century digital technologies.

Mlodinow is selective in the moments he chooses to emphasize — we get the grand vista rather than the rugged topography — which is perfect for those who are looking for an overall arc of science's evolution. As he puts it, he focuses on the thinkers who were “capable of looking at the world just a little bit differently. Galileo imagining objects falling in a theoretical world devoid of air resistance. Dalton imagining how elements might react to form compounds if they were made of unseeable atoms. Heisenberg imagining that the realm of the atom is governed by bizarre laws that are nothing like those we experience in everyday life.”

He has whetted my appetite for the day when future explorers unravel today's deepest mysteries — such as dark matter, dark energy, quantum gravity and the origin of the mind of each upright thinker.
