

LEONARDO DIGITAL REVIEWS

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BOOKS

OBSERVING THE MOON: THE MODERN ASTRONOMER'S GUIDE

by Gerald North. Cambridge Univ. Press, Cambridge, U.K., 2000. 356 pp., illus. \$39.95. ISBN: 0-521-62274-3.

Reviewed by David Topper, Univ. of Winnipeg, Winnipeg, MB R3B 2E9, Canada. E-mail: <Topper@Uwinnipeg.ca>.

Gerald North's book is a comprehensive primer for the serious astronomer. Partially a personal account of three decades of observing the moon, this practical guide begins with naked eye observations of phases, eclipses and libations of the moon, plus some elementary physics about oceanic tides. It then moves into telescopic observations, becoming a manual about choosing telescopes (with information on eyepieces and magnification), followed by sections on photography (tripods, lenses, films and exposures) and use of video cameras and computers. The book includes a brief history of the manned and unmanned missions to the moon, from 1959 to the Clementine probe of 1994 and the Lunar Prospector of 1998. The major section of the book, a chapter of almost 200 pages titled "A to Z of Selected Lunar Landscapes," details 48 specific areas (such as craters) of the moon. Pointing to some famous sites (and sights!) and several "off the beaten track" things to see, it is a sort of visual guide for the telescopic traveler. The final chapter, "Transient Lunar Phenomena," discusses phenomena such as mysterious changes in brightness or color, blurring or even flashes

of light that are observed occasionally (or, at least, are reported as seen) from small areas of the moon's surface.

For readers of *Leonardo*, there is little in this book relevant to the art/science theme. However, I did find the black-and-white drawings of some features of the moon executed by several artist/illustrator/observers to be lovely; these drawings, which often accompany corresponding photographs of specific lunar features, brought to mind the delicate watercolor sketches of the moon by Galileo.

AMERICAN MONSTER

by Paul Semonin. New York Univ. Press, New York, NY, U.S.A., 2000. \$28.95, trade. ISBN: 0-8147-8120-9.

Reviewed by George Gessert, 1230 West Broadway, Eugene, OR 97402, U.S.A. E-mail: <ggessert@igc.org>.

Our current picture of the deep past is radically different from the one that prevailed at the beginning of the industrial revolution. In 1750, most Westerners believed that human beings came into existence 6 days after the beginning of time. The first humans were immortal and lived in Eden, a place without death or misery. Suffering commenced with the fall, and toil, childbirth and mortality have been with us ever since. Today, we believe almost the exact opposite: that human beings are evolutionary newcomers to a world previously ruled by brutal beasts, such as Tyrannosaurus Rex. Over the last 10,000 years, we have gradually replaced the old nature, red in tooth and claw, with a humanized second nature that, for all of its violence and uncertainty, delivers at least a few people from toil and promises widespread relief from many kinds of suffering, including childbirth and someday, perhaps, death itself. Both constructs are myths. It is easy to recognize the mythological elements of the Eden story, but not so easy to pinpoint them in contemporary beliefs. The problem is that contemporary beliefs about the deep past have received very little attention from

historians. Paul Semonin's *American Monster* fills this void.

American Monster tells the story of how mastodons were discovered and assimilated into European and Anglo-American culture. It is a story involving science, religion, politics and the birth of museum culture. Most of us know about mastodons from natural history dioramas, where bedraggled stuffed toys, grazing on dusty grass, are about to be speared by men in loincloths, or sink into tar-pits. An air of pathos seems to hover about these bulky creatures—they do not even have the luck to be destroyed by an asteroid. The founding fathers of our nation, however, envisioned mastodons quite differently, as ferocious carnivores capable of devouring deer, elk and human beings in single chomps. Furthermore, these terrifying monsters either still roamed unexplored regions of the West or, if they did not, their very absence threatened deeply held beliefs. Mastodons quickly became symbols of the new nation's spirit.

Semonin begins the story in 1705, when a tooth weighing nearly five pounds was unearthed along the Hudson River near Albany. The governor of New York Province sent the specimen, labeled the "tooth of a Giant," to the Royal Society in London, then Britain's foremost authority on sci-

Reviews Panel: Bob Adtien, Fred Allan Andersson, Wilfred Arnold, Roy Ascott, Curtis Bahn, Marc Battier, Roy R. Behrens, Andreas Broeckmann, Annick Bureaud, Mark A. Cheetham, Robert Coburn, Nicolas Collins, Donna Cox, Gary Crighton, Sean Cubitt, Shawn Decker, Sara Diamond, Victoria Duckett, Michele Emmer, Bulat M. Galejev, George Gessert, Thom Gillespie, Molly Hankwitz, István Hargittai, Dan Harries, Craig Harris, Josepha Haveman, Paul Hertz, Jack Ox, Eduardo Kac, Richard Kade, Douglas Kahn, Curtis E.A. Karnou, Nisar Keshvani, Rahma Khazam, Daniela Kutschai, Jim Laukes, Mike Legget, Carlos Lemus, Roger F. Malina, Jacques Mandelbrojt, Mike Mosher, Axel Mulder, Kevin Murray, Frieder Nake, Carlos Palombini, Christiana Paul, Robert Pepperell, Cliff Pickover, Patricia Pisters, Michael Punt, Harry Rand, Sonya Rapoport, Henry See, Edward Shanken, Rhonda Shearer, George K. Shortess, Joel Slayton, Christa Sommerer, Yvonne Spielmann, David Topper, Rene van Peer, Ron Wakkary, Barbara Lee Williams, Stephen Wilson, Arthur Woods.

entific matters. That the tooth belonged to a human giant was a perfectly reasonable assumption at the time, given that dinosaurs were unknown, and that the Bible, which was the ultimate authority on nature, mentions giants but not extinction. The very concept of an extinct species was still anathema. At about the same time, reports of enormous tusks and bones reached Western Europe from Siberia. For centuries, people there had made tools from the ivory of mysterious animals that Ostiack tribesmen called “mammutts.” These, the tribesmen believed, were gigantic subterranean rats, tunneling to escape the cold. Naturalists dismissed these stories and, replacing folklore with folklore, proposed that the tusks belonged to unicorns, or to the Biblical Behemoth.

In the next century, many more remains surfaced, both in the Old World and the New. The science of comparative anatomy was still in its infancy, but evidence quickly accumulated that Siberian mammoth bones, as well as the bones of the American creature which had come to be known as the “incognitum,” resembled those of elephants. How did the remains of elephants, which are tropical animals, reach the north? The most widespread theory was that elephants had drowned in Noah’s Flood and been swept north by the raging deluge. Careful observers, like Sir Hans Sloane, who succeeded Sir Isaac Newton as president of the Royal Society, recognized that, although the bones of mammoths and incognitums were elephant-like, they were larger and did not quite conform to those of any living pachyderm. In the 1760s, the French naturalist Buffon, after examining incognitum remains, hinted that they belonged to creatures that might be extinct. This fit his theory of American degeneracy, which postulated that the Old World had many more large animals than the New because the latter’s watery landscapes and cool climate (perhaps he had read a few too many reports from French Canada) had deleterious effects on large and noble creatures. Debilitating vapors had gradually destroyed all of the most formidable forms of life that God had originally placed in the Americas.

Buffon published his ideas in his immensely influential *Histoire Naturelle*. By cautiously legitimizing the notion of extinction, Buffon opened the door to ideas that would lead to Darwin’s theory of evolution. However, what

most concerned Buffon’s North American contemporaries were not his subversive suggestions about extinction, but the theory of American degeneracy. Buffon did not explicitly state that European settlements in the New World were doomed to decay, but he hinted as much, which was more than enough to offend Anglo-Americans.

Benjamin Franklin helped turn the incognitum to American advantage. He suggested that the monster may not have been herbivorous, like elephants, but a carnivore. As luck would have it, Dr. William Hunter, London’s foremost authority on the incognitum, came to the same conclusion. Hunter made his case in an influential paper published in 1769, which concluded “we cannot but thank Heaven that [the incognitum] is probably extinct.” By coupling the heretical idea of extinction with God on the one hand and a ferocious carnivore on the other, Hunter laid the foundation for a new myth of prehistory to replace Eden. In this new myth the past was no paradise, but a Hobbesian battleground where the less godly made way for the more godly. The idea quickly won favor, no doubt because it suggested a flattering interpretation of imperial expansion and could be used to justify exploitation and slaughter of subject peoples.

In America, Hunter’s carnivorous incognitum was welcomed both as proof of the need to exterminate indigenous savages and as a refutation of the theory of degeneracy. The ferocity of the incognitum, and its great size, greater than living elephants—greater, that is, than any other terrestrial animal (since dinosaurs and other extinct megafauna were still unknown)—quickly came to symbolize the new nation’s spirit. Because of this, the founding fathers took an intense interest in the incognitum. During the darkest days of the Revolutionary War, George Washington, Commander in Chief of the rebel armies, found time to view incognitum teeth unearthed near West Point. Almost simultaneously, Jefferson was writing about the fossil elephants of North America, which he believed still lived in unexplored regions of the Northwest. When Jefferson became president, he devoted an entire room of the presidential mansion to bones of the incognitum and commanded Lewis and Clark to seek mastodons in the West. None showed up, of course, but Jefferson died in 1826, still believing that they roamed somewhere beyond the frontier.

Because of the peculiarities of their experience, Anglo-Americans were profoundly uneasy about the past. Like all peoples, they needed a past, but the histories most obviously available to them, those of Europe and Native America, were unacceptable, Europe because it represented corruption and injustice, and Native America because it was non-white and pagan, and also because to recognize it would have been to grant legitimacy to Indian claims to the continent. Without a human history to embrace, citizens of the new republic made the radical leap of finding their history in the land itself. Here was everything that the Old World had and more—immense ruins and fragmentary myths in the forms of mountains, canyons, primeval forests and the fossils of monsters.

By 1800, the incognitum had become a national obsession. Incognitum bones were sought like buried treasure, sold for thousands of dollars, enormous sums in those days, and exhibited in traveling shows and museums, such as the Philadelphia Museum, which was established by the artist Charles Willson Peale and became a prototype for the new nation. The publicity surrounding these shows made mastodons ever more terrifying: trees toppled when they passed, they devoured elk in single bites, they ate humans, they wiped out entire villages. The travelling shows became increasingly Barnumesque, and, as they did, the new myth of prehistoric nature took hold in American culture. By the 1850s, when dinosaurs began to replace mastodons in popular imagination, all the elements of present-day myths of the deep past were in place: prehistoric nature was savage, and it was literally ruled by single species, or by elite assemblages of species. The raw energy of this primordial realm fuelled progress. Life and death struggles were not in vain: they produced endless improvements, culminating in nature’s replacement by human constructs.

Today, movies such as *Jurassic Park* perpetuate these myths, as do some palaeontologists. In an afterword, “The Myth of Wild Nature,” Semonin quotes paleontologist Bob Bakker, best known for his theories about warm-blooded dinosaurs, who says that “dinosaurs spread their ecological hegemony across a world-wide empire. . . . No corner of the Mesozoic world withstood colonization by the dinosaurs.” This is the language of the global corporate order, not science. No non-human animals except, arguably, ants rule other

species in anything remotely comparable to human patterns.

American Monster's 59 illustrations include scientific studies of bones, early reconstructions of the incognitum and some quite amusing and finely rendered but chilling anatomical drawings that illustrate supposedly timeless aesthetic hierarchies among the races. *American Monster* is written for general readers as well as specialists and there are more than 30 pages of footnotes, as well as a lengthy bibliography. Fluid, well-paced, rich in detail yet precise, Semonin's style would be the envy of a novelist. For anyone interested in myths of the pre-human past, in the social functions of those myths, and in the origins of contemporary consciousness about extinction, this book is essential.

WHAT IS LIFE?

by Lynn Margulis and Dorian Sagan. University of California Press, Berkeley and Los Angeles, CA, U.S.A., 2000. 320 pp., illus. \$35.00, paper. ISBN: 0-520-22021-8.

Reviewed by Wilfred Niels Arnold, Professor of Biochemistry, University of Kansas Medical Center, Kansas City, KS 66160-7421, U.S.A. E-mail: <warnold@kumc.edu>.

Dr. Lynn Margulis is well recognized among scientists for her working hypothesis on the origin of organelles within eukaryotic cells: namely, that inter-cellular entities such as chloroplasts and mitochondria began as cyanobacteria and respiring bacteria, respectively, and that symbiotic origins for new life forms were important aspects of evolution in the Darwinian tradition. Dorian Sagan has published several "science for the citizen" books with provocative titles ranging from *What Is Sex?* to *Garden of Microbial Delights*. Together, they now bring us *What Is Life?* which foreword contributor Niles Eldredge promises will equip the reader with an understanding of the living world. This paperback edition stems from a book released by Simon and Schuster 5 years ago.

The book has nine chapters in all, with catchy titles such as "Once upon a Planet" and "Flesh of the Earth." The essence of the senior author's major contribution to the primary literature on symbiogenesis is covered in chapter five, "Permanent Mergers." Chapter three, "Lost Souls," starts with a review of ancient concepts about the whistling of the wind, changing phases of the

moon and so on, and ends with an embrace of James Lovelock's "Gaia hypothesis." Lovelock claims that life manifests itself on a planetary scale, based on atmospheric, astronomical and oceanographic evidence. The authors relate Gaia to "over thirty million types of beings, descendants from common ancestors, and members of five kingdoms that produce and remove gases, ions and organic compounds. Their interacting activities lead to modulation of Earth's temperature, acidity and atmospheric composition." They get full marks for courage in taking on a high level of complexity and their arguments are full of fresh metaphor and analogy, but one is sometimes left wondering how much this advances the field in the absence of measurable data.

The 31 color plates in the middle of the book are all of inherent interest, well chosen and nicely reproduced on quality paper; they could function as a freely standing entity. They start and end with pictures of the Earth from outer space and encompass all sorts of living organisms. The 18 black-and-white illustrations and two tables are useful, including schematics of the natural histories of various species. The glossary is new to this edition; from its tenor, I tried to gauge the intended audience. A few extracts follow:

ATP: adenosine triphosphate, a phosphorous-, carbon-, nitrogen-, oxygen-, and hydrogen-containing ring compound that is universally used by life to store energy in its phosphate bonds.

Cellulose: a sugar-rich compound of cell walls of plants and some prototists.

Chitin: a sugar-rich, nitrogen-containing compound of cell walls of fungi and insect exoskeletons.

Cross walls: cell walls.

Cytoplasm: the fluid of cells outside their nuclei.

Readers without any science training are surely still in doubt; others will wonder why they bothered looking up a term. The authors were apparently convinced that their patrons would be incapable of contemplating chemical structures; this is not an experience I share. The average citizen has no difficulty "seeing" the differences in the chemical structures of cellulose and chitin when they are depicted as chains of different sugar residues. Why are so many publishers afraid of chemical and physical symbols?

At the end of each chapter, the authors ask, "So, what is life?", following

with a series of summary statements. They acknowledge that the revival of Schrödinger's inquiry into "What is life?" and borrowing his title were the ideas of Peter A. Nevraumont. Curiously, however, all three forgot to provide the original reference, which is: *What is Life? The Physical Aspects of the Living Cell*, by Erwin Schrödinger (Cambridge Univ. Press: Cambridge, U.K., 1944 [based on lectures, Institute of Trinity College, Dublin, February 1943]). Accordingly, the final statement, in the epilogue, is a bit anticlimactic: "We can ask with curiosity but can answer only tentatively and with humility the question of what life is, hoping, with you, that the search continues."

COLOR AND MEANING: ART, SCIENCE, AND SYMBOLISM

by John Gage. University of California Press, Berkeley and Los Angeles, CA, U.S.A., 2000. 320 pp., illus. \$35.00, paper. ISBN: 0-520-22611-9.

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Color vision is an integrated process that involves physical, chemical, physiological and psychological aspects. It starts with the generation of signals in retinal receptors, involves comparisons and evaluations of the information that is transmitted to the brain and terminates with the declaration of particular hues in order to describe a scene. (The chemistry and physics of light and vision are mammoth subjects and *Leonardo* readers may wish to refresh their working knowledge by visiting <<http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>>, an instructive Internet site by C.R. Nave.)

The question of whether practicing artists today understand anything about the physics of light is an interesting one. Are they pragmatists or do they think about wavelengths and the differential stimulation of our retinal pigments? *Color and Meaning: Art, Science, and Symbolism* is the most recent attempt to approach this set of difficult subjects. Indeed, John Gage strives to deal with all things from the ancient and modern languages of color, through a little science, to explorations of the works of selected artists. Chapters with headings such as "Color and Culture," "Color in Art and Literature"