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Canon: A Whirligig Tour of the Beautiful Basics of Science (Book Review)

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spelling out how a Christian worldview can provide a salutary perspective on and direction for mathematical practice. Yet as a mathematics educator, like Bittinger, I find that certain mathematical habits of mind and ways of perceiving reality are second nature, and I invariably exercise these as I think about other things. I perceive the importance of mathematics in the world all around me, but some things lie outside its sphere of primary relevance.

Angier, Natalie. *The Canon: A Whirligig Tour of the Beautiful Basics of Science*. New York: Houghton Mifflin, 2007. 304 pp. ISBN: 978-0-618-24295-5. Reviewed by David J. Mulder, Adjunct Instructor of Education at Dordt College and teacher at Sioux Center Christian School

One of my major teaching goals is to open students' eyes to the wonders of Creation through scientific ways of thinking and point them toward the Creator. However, both my middle-school science students and elementary science-methods undergraduates often express skepticism that science has anything to do with them. Their facial expressions and body language speak volumes: "I'm just not 'into' science—I'm here because I'm required to be; you aren't actually trying to make me *learn* anything, are you?"

Thus, I both enjoyed and empathized with Natalie Angier's *The Canon: A Whirligig Tour of the Beautiful Basics of Science*. She encapsulates conventional wisdom regarding "science" as a realm inhabited by two distinct subsets of humanity: The first group, elementary schoolchildren who relish beating the tar out of hands-on exhibits at children's museums; the second, those few disciplined souls who have plumbed the arcane depths of their hyper-specialized scientific fields to become The Experts. Prevailing thinking is that everyone else who has to deal with science (such as middle-school students and non-science major undergraduates) does so grudgingly. Angier asks us to reconsider. No matter our age, station in life, vocations, or avocations, the realm of science is—and should be—home turf for us. Angier explains the conventional arguments for understanding science, such as the idea that a more scientifically literate society would be less taken by superstition and fraud (think astrology and playing the lottery) or that greater scientific awareness is necessary because "so many of the vital issues of the day have a scientific component: think global warming, alternative energy, embryonic stem cell research, missile defense, and the tragic limitations of the dry cleaning industry" (7). However, she proposes a much more fundamental reason that everyone should take an interest in science: understanding how the world works is pleasurable in and of itself. Although I am not entirely certain about this as a primary reason for understanding science, I agree with her that science *is* fun.

Angier, a Pulitzer prize-winning science writer for the *New York Times*, has a vision of creating a more scientifically

Establishing the credibility of our faith is one of them. Nevertheless, I appreciate seeing how mathematicians with a different outlook try to work out connections between mathematics and their Christian faith. Although I disagree with Bittinger's overall thrust, his second book might prompt good discussion among mathematicians or college mathematics students in a capstone course as they explore the relation between Christian faith and mathematics.

literate society. She has published a number of books and many articles in a wide variety of popular magazines, all with the general aim of popularizing science and winning people over to—if not a *love* of science—understanding the incredible prevalence and impact of scientific research on our culture. More than that, Angier's own love of science is evident, and her writing style captures even the most hardened science-phobe's imagination and sparks a desire to engage in discovery. She infuses her prose with allusions that draw from a range of literary, historical, and popular subject matter. For instance, her introductory chapter, "Sisyphus Sings with a Ying," marries imagery from classical Greek mythology with the nimble imagination of Dr. Seuss. The Herculean challenges of understanding science are also playful and fun.

Angier intends to take us on a tour of the scientific landscape, highlighting what everyone should know about all things scientific. To do so, Angier asked hundreds of scientists to name a few things they wished everyone understood about their field, to explain what it means to think scientifically and to elaborate on things in their field that still surprise them. In short, she asked them to describe what every non-specialist, non-child should know about science, and why they might actually enjoy it.

The book begins with a few chapters to explain the scope and limits of scientific thinking, relating the importance of developing evidence, making arguments, and building consensus in scientific enterprise. Science is, after all, primarily a way of thinking, a scheme for organizing and investigating the Creation. By way of a number of thought experiments (such as estimating the number of piano tuners in a city the size of Chicago, or the number of school buses in Montgomery County, Maryland), Angier explains the role of probabilistic thinking in scientific enterprise, the skepticism necessary in conducting scientific investigations, and the importance of accepting the resulting levels of uncertainty with the outcomes. She also outlines difficulties imposed by the scales of the subjects of science, from the impossibly infinitesimal to the overwhelmingly enormous. For instance, Angier explains the scale of the solar system this way:

See the Earth as a fine grain of sand. The sun, then, would be an orange-sized object twenty feet away, while Jupiter, the biggest planet in of the solar system, would be a pebble eighty-four feet in the other direction—almost the length of a basketball court.... Assuming our little orrery of a solar system is tucked into a quiet neighborhood in Newark, New Jersey, you won't reach the next stars...until somewhere just west of Omaha. (81)

Angier helps the non-specialist see that science is *not* primarily a catalogue of knowledge but a dynamic way of thinking and exploring Creation. Applying scientific reasoning can lead to a deeper understanding of and appreciation for the scientific nature of the world around us.

These forays into the underlying thought processes of science set the stage for the main show: a comprehensive overview of the big ideas in the “hard” sciences: physics, chemistry, biology, genetics, geology, and astronomy. Her reporting is a poetic prose that renders the details of a gamut of scientific topics not only understandable to the non-specialist but also interesting, perhaps even (surprisingly) fascinating. In this, *The Canon* delivers on its subtitled promise: the book is indeed a wide-ranging gambol through the landscape of science, in which even the most mysterious concepts look downright delightful when viewed through her lens of fun. What Angier means by “fun” is best illustrated by some examples. We can almost hear Angier's glee/horror when reporting the response a molecular biologist gave when asked what a cell would look like “if it were blown up to the dimension of a desktop accessory. Without a moment's hesitation, she replied gaily, ‘It would look like snot.’ Snot? ‘Yes, cells are very goeey and viscous,’ she said. ‘...I like to remind my students that in vivo, in the real conditions of the cell, things are much thicker and more syrupy...more like snot’” (190). Or take, for instance, how she describes the nature of atoms:

The elements are substances that refuse to be reduced to simpler substances through normal chemical or mechanical means. If you have a sample of pure lead, you can break it apart or melt it down into smaller lumps of lead, but each piece will still be composed of lead atoms, and not the gold you might covet or the strontium you probably don't, unless you're in the pyrotechnics business and appreciate its flammability. (92)

With her nimble pen in hand, Angier gives a tour of science that is both playful and educational.

I thoroughly enjoyed *The Canon*. I found myself awed again and again as I read of the marvels of this universe, and I found my thoughts drawn to the majesty of the Lord, whom I believe created it all. I wholly appreciated Angier's wit and humor and found the book an inspiring look at the endeavors of science.

But I have a word of caution before giving it my whole-hearted endorsement. Angier strikes me as a science aficionado of the secular-humanist bent. And, like most secular-humanist science fans—including the troop of science experts she consulted—Angier whole-heartedly embraces Darwinian evolution as the only explanation of the origins of life on planet Earth. In her chapter on evolutionary biology, she clearly explains the theory of evolution by natural selection, accurately painting this as the dominant explanatory theory in mainstream scientific thinking. She then unabashedly bashes biblical-literalists, Creationists, and proponents of Intelligent Design for a few pages before settling for, “We don't know how life began...[.] we certainly don't know if it was in any way spiritually inspired—an expression of divine love, or of cosmic curiosity, the universe's desire to understand itself” (181). Overall, though, I found the book to be a wonderful reminder of the privilege I have of opening students' eyes to the wonders of Creation as well as to the One who created. To write off the book for the few instances when Angier's perspective pops up means missing out on a truly enjoyable read, one that might inspire us take a closer look at the marvels of Creation. Whatever one's theological and philosophical underpinnings, *The Canon* offers a better understanding of the evolutionist's perspective. However, if you color yourself a Six-24-Hour-Day-Young-Earth Creationist or an Intelligent Design devotee, *caveat emptor*.

In summary, *The Canon* lays out an enjoyable roadmap to scientific literacy, one with side trips, a few tourist traps, and some breathtaking vistas. Given Angier's wide-ranging allusions, any educated layperson will likely appreciate and enjoy *The Canon*. I highly recommend the *The Canon* for undergraduate non-science majors in a basic science course, and—I'm not smirking here at all—their professors as well. Science buffs will certainly enjoy this book and perhaps come to a deeper understanding of subjects outside their discipline or specialty. And certainly, this is the sort of book that all non-scientists ought to read, just to better understand and appreciate the work of their more science-minded brothers and sisters. They too might find the joy, the wonder, the pleasure of the beautiful basics of science.