

MATH and SCIENCE – RELATED BOOKS YOU CAN READ

Recommended by Mr. Brandenburg

You are lucky to be alive during a real boom in good, popular math and science writing. Some of these books are very recent, which means that they may not yet have reached the shelves of public libraries. If you want to purchase really low-cost versions of some of these books, look up Daedalus Books (<http://www.daedalus-books.com/>) or Dover Books (Store.Doverpublications.Com) or Hamilton Books (<http://www.hamiltonbook.com>). Of course, the major book-selling chains will have most of these titles.

For each book, I have listed the title, author, publisher, the number of pages, and a copyright date, reading level, and a short review. If I personally read the book, you will see the code GFBR and some asterisks, indicating my personal opinion of the book. Five asterisks (*****) is my highest rating, and one asterisk (*) is the lowest. Approximate reading levels are indicated – teen, adult, middle school, ages, adult, and so on.

Some books, especially popular ones, change publishers and go through several different editions over the years, so the publisher and date of publication of a copy that you find may not be same as the ones given here.

You will be given guidelines and a rubric for your report later. For now, concentrate on finding a book that suits your interests, informing your teacher of your choice, and starting to read it. No more than four students may read the same title.

ASTRONOMY

1. **365 Starry Nights: An Introduction to Astronomy for Every Night of the Year.** By Chet Raymo. (Prentice-Hall, 225 pp, several editions) GFBR***** Teen-Adult. “*365 Starry Nights* is a unique and fascinating introduction to astronomy designed to give you a complete, clear picture of the sky every night of the year. Divided into 365 concise, illustrated essays, it focuses on the aesthetic as well as the scientific aspects of stargazing. It offers the most up-to-date information available, with hundreds of charts, drawings, and maps-that take you beyond the visible canopy of stars and constellations into the unseen realm of nebulae and galaxies. This simple yet substantial text is full of critical information and helpful hints on how to observe the stars; describe their position; calculate their age, brightness, and distance; and much more. Whether you observe the sky with a telescope or the naked eye, *365 Starry Nights* makes the infinite intimate and brings the heavens within your grasp. Keep this invaluable, informative guide close at hand, and you'll find that the sky is the limit 365 nights a year.”
2. **The Book of Nothing : Vacuums, Voids, and the Latest Ideas About the Origins of the Universe.** By John D. Barrow (Pantheon, 361 pp, 2001) HS-adult. “From our modern perspective, it is easy to deride the wranglings of medieval scholars over the number of angels that could dance of the head of a pin and whether Nature abhors a vacuum. But as John Barrow reveals in this timely and important book, new discoveries in science have shown that these scholars were right to suspect that Nothing has hidden depths.It is a concept shot through with paradoxes: even innocent-looking phrases like "Nothing is real" flip their meanings as we ponder them, like those illusions that look like a vase one moment, and opposing faces the next. Nothing is fertile, too, as Barrow shows via a stunning trick that allows every number one can think of to be built out of nothing at all. But his book is about far more than mind games.

Arguably, the most important discovery of 20th-century physics is that there is no such thing as nothing: even the tightest vacuum is teeming with subatomic particles popping in and out of existence, according to the dictates of quantum theory. Now, many astronomers suspect that such "vacuum effects" may have triggered the Big Bang itself, filling our universe with matter. Indeed, the very latest observations suggest that vacuum effects will dictate the ultimate fate of the universe. As an internationally respected cosmologist, Barrow does a fine job of explaining these new discoveries. The result is a book that is required reading for anyone who wants to understand why there will be much ado about Nothing among scientists in the years ahead."

3. **Celestial Treasury : From the Music of the Spheres to the Conquest of Space.** By Marc Lachize-Rey, et al. (Cambridge, 210 pp, 2001) General audiences. This book "is an impressive coffee-table book surveying the history of man's exploration of the stars. The informative and engaging text is wonderfully enhanced with 380 full-color illustrations as the reader is treated to a full spectrum history of astronomy from antiquity down to the present day. Along the way such questions are addressed as how philosophers and scientists approach explaining the order that governs celestial motions; how geometers and artists measure and map the skies; when and how the Earth came into being; who inhabits the heavens; and more. Celestial Treasury is especially recommended as a 'Memorial Gift' acquisition for both academic and community library astronomy and history of science collections."
4. **First Light; The Search for the Edge of the Universe.** By Richard Preston (Random House, 275 pp,1987) GFB ****. General audiences. "First Light is first of all a love letter to the Palomar Observatory and to the astronomers and civilians who are using it to plumb a few of the details of our situation here in the universe. It is one of the finest accounts of scientists at work that I have read. Most writers say they want their books to read like a novel, but Preston actually delivers."
1. **A Guide to the End of the World: Everything You Never Wanted to Know.** By Bill McGuire. (Oxford, 224 pp, 2002) General audiences. Describes the terrible catastrophes that could put an end to the world as we know it – a volcanic blast, global warming, or an asteroid impact.
2. **Newton's Clock; Chaos in the Solar System.** By Ivars Peterson. (W.H. Freeman, 317 pp, 1993) GFBR***. Advanced HS-Adult. The author examines a mystery that has fascinated and tormented astronomers and mathematicians for centuries: are the orbits of planets and other bodies stable and predictable, or are there elements affecting the dynamics of the solar system that defy calculation? It is "an uncommonly readable new history... readers will find no more inviting introduction to a subject that asks some of the biggest questions of all."
3. **Rogue Asteroids and Doomsday Comets; The Search for the Million Megaton Menace That Threatens Life on Earth.** By Duncan Steel. (Wiley, 308 pp, 1995) General audience. "Could a giant asteroid or comet crash into Earth and destroy life as we know it? Many astronomers who once discredited the risks are now convinced. A chilling and utterly convincing account of a cosmic menace that must not be ignored any longer."
4. **Secrets of the Night Sky. The most amazing things in the universe you can see with the naked eye.** By Bob Berman. (Morrow, 320 pp, 1996) GFBR *****. General audiences. "You don't need expensive instruments to appreciate the beauty of the night sky, as Bob Berman exuberantly demonstrates in *Secrets of the Night Sky*. Berman takes you on a tour of the night sky, pointing out its highlights and its history, along with a wealth of practical tips and tricks, such as how to categorize satellites that appear overhead. *Secrets of the Night Sky* is not only a how-to manual for enjoying the celestial sphere but is also a painless introduction to the science of cosmology. With a flair for analogies, Berman imparts a visceral understanding of the scale

of stellar objects. And in case your explorations do lead you to buy a telescope, the book's appendices contain a variety of no-nonsense advice that may save you from getting fleeced.”

5. **Seeing and Believing; How the Telescope Opened Our Eyes and Minds to the Heavens.** By Richard Panek. (Viking, 198 pp, 1998) GFBR**** HS-Adult. “Journalist Richard Panek begins his historical essay on the telescope with the Hubble Deep Field. This extended exposure by space telescope is a picture that looks out of our galaxy--farther, immeasurably farther, than the human eye has seen before. It exemplifies the purpose of all telescopes: ‘To address our place in the universe, literally. To size up all of space and figure out where we are in it.’ How and why did this particular technology have such profound effects? Panek first considers Galileo, who ‘raised his new instrument toward the night sky and understood at once that there was more to see--and more to seeing--than meets the eye.... Unlike spectacles or magnifying lenses, the optic tube offered not just a distortion of what was already there, but *more*. It revealed evidence that was different from what the naked eye could see, evidence that *wasn't otherwise there*.’ Panek goes on to look at the, ahem, luminaries of observational astronomy--William Herschel, George Ellery Hale, Edwin Hubble--showing how faith in the telescope grew and our mental image of the universe expanded until ‘all the assumptions safely based on observation are gone.’ Panek's prose is vivid and beautiful, sustaining this (curiously) unillustrated book as it traces the astronomer's quest for light and dark, sight and belief. “
6. **Seeing in the Dark: How Backyard Stargazers Are Probing Deep Space and Guarding Earth from Interplanetary Peril.** By Ferris, Timothy (Simon & Schuster, 379 pp, 2002) General audiences. “Amateur astronomers are the heroes of this latest opus from one of the country's best-known and most prolific science writers. Ferris (Coming of Age in the Milky Way) has a special place in his heart for these nonprofessionals who gaze into space out of wonderment and end up making discoveries about comets, the moon and the planets that change our understanding of the galaxy. Ferris recounts how he, as a boy growing up in working-class Florida, was first captivated by the spectacle of the night sky. He then looks at the growing field of amateur astronomy, where new technologies have allowed neophytes to see as much of the cosmos as professionals. The book introduces readers to memorable characters like Barbara Wilson, a one-time Texas housewife who turned to astronomy after her children were grown and has since helped found the George Observatory in Houston (where a number of new asteroids have been discovered) and developed a reputation as one of the most skilled amateur observers. Ferris also takes stock of what we know today about the cosmos and writes excitedly about the discoveries yet to come. With a glossary of terms and a guide for examining the sky, this book should turn many novices on to astronomy and captivate those already fascinated by the heavens.”
7. **Sky Phenomena; A guide to Naked-eye Observation of the Stars.** By Norman Davidson. (Lindisfarne, 206 pp, 1993) General Audiences. “This book shows how the sky works – the daily trail of the sun and nightly travels of stars, the phases and placement of the moon, the mechanisms of eclipses, the vagrancies of the planets, and more. It’s an owner’s manual for the sky.”

BAD SCIENCE

1. **At the Fringes of Science.** By Michael W. Friedlander. (Westview, 216 pp, 1999) General audiences. “Where does science end and fruitcakery begin? How can you tell the difference between the cutting edge, the speculative, and the wacky? Physicist Michael Friedlander looks all around the fringes of science and gives a helpful guide to drawing the lines. He is

particularly good at showing science as a communal endeavor, with the strengths and weaknesses that implies, and he gives a more truthful account than is usual of how scientific journals and conferences actually work. Friedlander frankly admits that scientists have sometimes manufactured their own social problems, usually through arrogance. He is a "modified realist"; he provides checklists so you can tell the difference between a Galileo and a Velikovsky, but he also shows how scientists like Alfred Wegner (who thought up continental drift) can be essentially correct and yet not be believed. He even reveals one of the open secrets of science: that a theory can be incorrect or widely doubted, like the idea of a "fifth force" in physics, and still be a fruitful source of new research."

2. **Mathematical Cranks.** By Underwood Dudley (MAA, 384 pp, 1992.) GFBR****. General audiences. About the strange people who become convinced that they have proved mathematical results that just aren't so. "On the one hand, mathematics is the great leveler of the sciences. Anyone can do mathematical research, with no equipment but pencil and paper. On the other hand, mathematics is the only science where something can be proven, irrefutably and for all time, to be impossible. These two ingredients make mathematics one of the most fertile grounds for inspiring crankery. This book is not only entertaining, the broadness of its examples provides a fascinating insight into the mind of cranks. I couldn't put it down."
3. **Voodoo Science: The Road from Foolishness to Fraud.** By Robert Park. (Oxford U Press, 230 pp, 1999) GFBR****. Teen-Adult. "Scientific error, says Robert Park, 'has a way of evolving ... from self-delusion to fraud. I use the term voodoo science to cover them all: pathological science, junk science, pseudoscience, and fraudulent science.' In pathological science, scientists fool themselves. Junk science refers to scientists who use their expertise to befuddle and mislead others (usually juries or lawmakers). Pseudoscience has the trappings of science without any evidence. Fraudulent science is, well, fraud--old-fashioned lying. Park is well-acquainted with voodoo science in all its forms. Since 1982, he has headed the Washington, D.C., office of the American Physical Society, and he has carried the flag for scientific rationality through cold fusion, homeopathy, 'Star Wars,' quantum healing, and sundry attempts to repeal the laws of thermodynamics. Park shows why a 'disproportionate share of the science seen by the public is flawed' (because shaky science is more likely to skip past peer review and head straight for the media), and he gives a good tour of recent highlights in *Voodoo*. He has a rare ability to poke holes compassionately, without excoriating those taken in by their fondest wishes. Park is less forgiving of scientists (especially Edward Teller) when he thinks they've fallen down on the job, a job that should include helping the public separate the scientific wheat from the voodoo chaff."
4. **Why Things Bite Back; Technology and the Revenge of Unintended Consequences.** By Edward Tenner. (Vintage Books, 431 pp, 1996) GFBR***. General Audiences. If computers really eliminate paperwork, why is the office recycling bin always overflowing? From football padding that makes football more dangerous than rugby, to "low tar" cigarettes that compel smokers to smoke more, from antibiotics that breed new, resistant strains of bacteria to computer software that requires faster processors and more support staff, Edward Tenner offers a virtual encyclopedia of innovation's unintended consequences. And he shows us what we have to do to survive in a world where "reality is always gaining on us."
5. **Yes, We Have No Neutrons; An Eye-Opening Tour through the Twists and Turns of Bad Science.** By A. K. Dewdney (Wiley, 180 pp, 1997) GFBR****. Teen-adult. "In this lively excursion, the author takes a fun-filled, in-depth look at eight infamous cases of bad science: highly touted discoveries or projects that are astonishing examples of serious scientific slipups."

BIOGRAPHY: MATHEMATICIANS + SCIENTISTS

1. **A Beautiful Mind: A Biography of John Forbes Nash, Jr.** By Silvia Nasar.(Simon & Schuster, 459 pp, 1998) General audience. This is the book on which the movie was based. John Nash was one of the most brilliant mathematicians of the 1940s and 1950s, but he suffered from schizophrenia, which devastated not only him, but his work, and his family (or families). Eventually he got well enough to earn a Nobel Prize for game theory. "...a story about the mystery of the human mind, in three acts: genius, madness, reawakening." .
2. **Benjamin Banneker: Surveyor, Astronomer, Publisher, Patriot.** By Charles A. Cerami, Robert M. Silverstein (Wiley, 288 pp, 2002) Teen-Adult. "Herein breathes the universal genius Benjamin Banneker — mathematician, astronomer, diarist, and sage.... Captured completely is the flowering genius of a largely home-schooled boy wonder, exhibiting mathematical wizardry while devouring the Bible, Plato, Epictetus, and virtually every other extant tome. ... We understand how the pragmatic farmer who was imbued with Quaker ideology endured decades of ignominious racism with overt equanimity while haunted by incessant night terrors. We comprehend the heroism of the man whose very existence refuted Thomas Jefferson's notorious public denial of black intellect in Notes on Virginia when, speaking truth to power, Banneker launched an anti-slavery epistle at the ambivalent and duplicitous Jefferson. We are enraged at the account of arsonists setting fire on the day of Banneker's funeral to the small, rustic log cabin where the genius had labored in solitude among his instruments, papers, and books...." I don't know whether this volume repeats the many [untrue] myths that have grown up around its subject.
1. **Ex-Prodigy: My Childhood and Youth.** By Norbert Wiener (or other similar titles by him—not easy to find!) General audiences. Norbert Wiener was one of the greatest applied mathematicians of this century, and had a great impact on the invention and uses of robots and computers. His writing is clear and elegant. The last book mentioned does not have a single equation. Anything by him that you can find in a library would be good, if you can understand it. I read **Cybernetics** when I was in high school and thought it was great.
2. **Galileo's Daughter; A Historical Memoir of Science, Faith, and Love** by Dava Sobel. . (Walker, 420 pp, 1999) GFBR ****. HS-Adult. Details the life of Galileo Galilei, the inventor of the astronomical telescope, and his daughter, a nun, and how he was condemned and sentenced by the Catholic Inquisition for his views on whether the earth revolved around the sun, or vice versa, even though Galileo always considered himself to be a good Catholic. By the way, you also find out that Galileo wasn't always right about everything.
3. **The Life of Benjamin Banneker: The First African-American Man of Science.** By Silvio A. Bedini. (Md. Historical Society, 448 pp, 1999) GFBR ****. HS-Adult. "Bedini's authoritative biography of Banneker will be welcomed by those interested in the history of American science as well as students of black history. Well written and exhaustively researched, it is more than simply a recounting of the life and deeds of the black astronomer and almanac maker. Bedini's work deals with the economy of 18th-century Maryland, the important contributions of the Ellicott family to the area and the new nation, the surveying of the District of Columbia, and the methods used by early almanac makers in their computations." This well-researched accurate book lays to rest several popular myths about Banneker and shows what he really accomplished.
4. **The Man Who Loved Only Numbers: The Story of Paul Erdős and the Search for Mathematical Truth.** By Paul Hoffman. (Little, Brown, 317 pp, 1999) GFBR ****. Teen-adult. "Paul Erdős was an amazing and prolific mathematician whose life as a world-wandering

numerical nomad was legendary. He published almost 1500 scholarly papers before his death in 1996, and he probably thought more about math problems than anyone in history. Like a traveling salesman offering his thoughts as wares, Erdős would show up on the doorstep of one mathematician or another and announce, ‘My brain is open.’ After working through a problem, he’d move on to the next place, the next solution.” He never learned to drive, cook, or tie his shoes, and never had a home or an apartment, but he gave away priceless mathematical knowledge and all the money he earned from his published articles.

5. **A Mathematician's Apology.** By G. H. Hardy. (Cambridge, 142 pp, reprinted from 1940 edition) HS – Adult. “This is a profoundly sad book, the memoir of a man who has reached the end of his ambition, who can no longer effectively practice the art that has consumed him since he was a boy. But at the same time, it is a joyful celebration of the subject--and a stern lecture to those who would sully it by dilettantism or attempts to make it merely useful. "The mathematician's patterns," G.H. Hardy declares, "like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics." ’
6. **The Meaning of it all: Thoughts of a Citizen-Scientist.** By Richard P. Feynman. (Helix Books, 1998) Teen-adult. “In this series of lectures originally given in 1963, which remained unpublished during Richard Feynman's lifetime, the Nobel-winning physicist thinks aloud on several ‘meta’--questions of science. What is the nature of the tension between science and religious faith? Why does uncertainty play such a crucial role in the scientific imagination? Is this *really* a scientific age? Marked by Feynman's characteristic combination of rationality and humor, these lectures provide an intimate glimpse at the man behind the legend. ‘In case you are beginning to believe,’ he says at the start of his final lecture, ‘that some of the things I said before are true because I am a scientist and according to the brochure that you get I won some awards and so forth, instead of your looking at the ideas themselves and judging them directly...I will get rid of that tonight. I dedicate this lecture to showing what ridiculous conclusions and rare statements such a man as myself can make.’ Rare, perhaps. Irreverent, sure. But ridiculous? Not even close.”
7. **Men of Mathematics.** By Eric Temple Bell. (Touchstone, 590 pp, many editions) GFBR **. HS-Adult. “Here is the classic, much-read introduction to the craft and history of mathematics by E.T. Bell, a leading figure in mathematics in America for half a century. *Men of Mathematics* accessibly explains the major mathematics, from the geometry of the Greeks through Newton's calculus and on to the laws of probability, symbolic logic, and the fourth dimension. In addition, the book goes beyond pure mathematics to present a series of engrossing biographies of the great mathematicians -- an extraordinary number of whom lived bizarre or unusual lives. Finally, *Men of Mathematics* is also a history of ideas, tracing the majestic development of mathematical thought from ancient times to the twentieth century. This enduring work's clear, often humorous way of dealing with complex ideas makes it an ideal book for the non-mathematician.” On the other hand, he totally omits the women of mathematics, and his stories are not always 100% accurate.
8. **Microbe Hunters.** By Paul de Kruif. (many editions, 357 pp) GFBR****. General audience. The book “charts the amazing shift in medical knowledge from both the historical and philosophical viewpoints. Dr. de Kruif's genius lies in the fact that he can transform the highly technical jargon of medicine into a compelling story of men versus nature. It is very readable! He maps the course that men such as [van Leeuwenhook,] Pasteur and Koch blazed into the realm of scientific methodology that is still revered today. You will feel the heat of the battle as the individuals depicted herein challenged the conventional wisdom of their day and transformed medicine from superstition to a healing art. I was first introduced to the book in a class on microbiology, but obtained a true education in how curiosity, dedication and

perseverance on the part of a few pioneers changed our view of nature forever. This book is a must read for anyone wanting to understand human nature or the strange and wonderful world of pathogens. As a college professor I recommend this book to anyone who wants to find the inspiration for education in one book.” This was first published in 1926, and, hence, some of the sentiments are quite dated.

9. **The Monk In the Garden: The Lost and Found Genius of Gregor Mendel, the Father of Genetics.** By Robin Marantz Henig. (Houghton Mifflin, 292 pp, 2000) GFBR **. General audiences. Gregor Mendel, a monk in what is now the Czech Republic, is the person who, by conducting various experiments on cross-breeding different strains of peas, discovered the basic principles of modern genetic transmission. “This breezily written biography portrays not only Mendel but also his ‘rediscoverers’ (Hugo de Vries, Karl Correns) and the scientists (Raphael Weldon, T. H. Morgan, and especially William Bateson) who, two decades after his death, quarreled over the applicability of his now-famous findings. Readers looking for an introduction to the science itself will be disappointed, however, since the book offers only a cursory introduction. The biography is lean, because very little is known about Mendel himself. The author resorts to imagining probable scenes from his life: ‘In a corner of the monastery garden, Mendel huddled myopically over rows of greening plants.’ ‘His curly brown hair thinning around his widening face, Mendel sat at the oak writing table in the orangery, where the air was warm and lushly fragrant.’ You either enjoy this sort of thing, or you don't--but I can report that at least Henig does not invent dialogue. By far the more interesting part of the book is the second half, which conveys the quarrels and intrigues by which Mendel and his publications were rediscovered and illuminated by a gaggle of ego-driven scientists bent on proving each other wrong. It's fun reading, if a little disheartening, but it's nice to know that the dead man wins. Overall, *The Monk in the Garden* is a decent historical introduction to the founding of genetics, but not much more.”
10. **My Brain is Open: The Mathematical Journeys of Paul Erdős.** By Bruce Schechter (Touchstone, 224 pages, 2000) GFBR ****. Teen-Adult. “Physicist and science writer Bruce Schechter's biography of legendary Hungarian mathematician Paul Erdős is an engaging portrait, warm and intimate, bringing this strange, happy man to life. Schechter's focus is quite a bit tighter, and more traditionally biographical, than in Paul Hoffman's The Man Who Loved Only Numbers. Here, we get to see Erdős's brief childhood transform quickly into a carefree adolescence of solving difficult math problems with his circle of brilliant friends-uniquely encouraged by a country that valued the contributions of mathematics in a way that has never been equaled.”
11. **Rosalind Franklin: The Dark Lady of DNA.** By Brenda Maddox. (HarperCollins, 2002) Teen-Adult. Rosalind Franklin made one of the most important discoveries in 20th – century science, but has received almost no recognition at all. It was her X-ray crystallography studies that revealed that DNA, the genetic messenger in all cells, had the form of a helix. James Watson, Francis Crick, and Maurice Wilkins, who worked close by Franklin in Cambridge, England, and who used her work without her authorization, later won the Nobel Prize for their work in discovering the double-helix structure of DNA, based in a very important way on Ms. Franklin’s extremely careful work. She, however, died of cancer a few years later, and it was those three men who were awarded the Nobel Prize in 1962. Watson later wrote a book called *The Double Helix* and dismissed Franklin as a dowdy and bad-tempered person. This book attempts to set the record straight.
12. **The Search for E. T. Bell.** By Constance Reid (MAA, 384pp, 1993) HS-Adult. “An account of one of the century's most colorful mathematicians. Bell's *Men of Mathematics* (1937) presented mathematics and mathematicians in a way that had never been done before, fascinating many of his colleagues, irritating others, and inspiring young people to become mathematicians. Bell

was also widely known as the science fiction writer John Taine. As a result of biographer Reid's discoveries about his early life, almost every statement now in print about Bell's family background and early life will have to be revised, and a new look taken at his extensive mathematical work and his science fiction.”

13. **Surely You're Joking, Mr. Feynman!** By Richard Feynman. (Norton, 350 pp, reprints) GFBR **** General audience. “A series of anecdotes shouldn't by rights add up to an autobiography, but that's just one of the many pieces of received wisdom that Nobel Prize-winning physicist Richard Feynman (1918-88) cheerfully ignores in his engagingly eccentric book, a bestseller ever since its initial publication in 1985. Fiercely independent (read the chapter entitled ‘Judging Books by Their Covers’), intolerant of stupidity even when it comes packaged as high intellectualism (check out ‘Is Electricity Fire?’), unafraid to offend (see ‘You Just Ask Them?’), Feynman informs by entertaining. It's possible to enjoy *Surely You're Joking, Mr. Feynman* simply as a bunch of hilarious yarns with the smart-alecky author as know-it-all hero. At some point, however, attentive readers realize that underneath all the merriment simmers a running commentary on what constitutes authentic knowledge: learning by understanding, not by rote; refusal to give up on seemingly insoluble problems; and total disrespect for fancy ideas that have no grounding in the real world. Feynman himself had all these qualities in spades, and they come through with vigor and verve in his no-bull prose. No wonder his students--and readers around the world--adored him.”
14. **What Do You Care What Other People Think? Further Adventures of a Curious Character.** By Richard Feynman (Norton, 256 pp, 2001) GFBR **** General audience. A Nobel-Prize Winning physicist tells stories about his own life and experiences. Both books are permeated by his inquisitive nature, and describe ways of applying math and science to everyday life situations in a common-sense manner. This second book details his involvement in the Space Shuttle Challenger disaster; Feynman is the one who figured out that it was an O-ring failure.

BIOLOGY/LIFE SCIENCE/EVOLUTION

1. **Beautiful Swimmers.** By William W. Warner.(Little Brown, 304 pp, many editions) GFBR*****. General Audiences. An amazing natural history of the blue crab in general and of the Chesapeake Bay in particular. ‘Beautiful Swimmers’ is a translation into English of the Greek/Latin name of the blue crab: Callinectes Sapidus.
2. **The Beauty of the Beastly; New Views of the Nature of Life.** By Natalie Angier. (Houghton Mifflin, 278 pp, 1995) GFBR***. HS-Adult. “The beauty of the natural world lies in the details, and most of those details are not the stuff of calendar art. ... I have made it a kind of hobby, almost a mission, to write about organisms that many people find repugnant: spiders, scorpions, parasites, worms, rattlesnakes, dung beetles, hyenas. I have done so out of a perverse preference for subjects that other writers generally have ignored, and because I hope to inspire in readers and appreciation for diversity, for imagination, for the twisted, webbed, infinite possibility of the natural world.”
3. **The Biology of Doom: The History of America's Secret Germ Warfare Project.** By Ed Regis (Owl, 259 pp, 2000) General audiences. “Regis ... interested himself in what the U.S. and other countries did during and after World War II to develop methods of biological warfare. With the aid of the Freedom of Information Act, he obtained more than 2,000 pages of formerly secret U.S. government documents on the subject. They form the foundation of this account, which traces the U.S. biological weapons program from its inception in 1942 to its termination by President Richard Nixon in 1969 ... By then, according to Regis, ‘the U.S. Army

had officially standardized and weaponized two lethal biological agents, *Bacillus anthracis* and *Francisella tularensis*, and three incapacitating biological agents, *Brucella suis*, *Coxiella burnetii*, and Venezuelan equine encephalitis virus. The Army had also weaponized one lethal toxin, botulinum, and one incapacitating toxin, staphylococcal enterotoxin B.’ Notwithstanding all this activity ... nations have so far avoided serious biological warfare. Regis thinks the reason is that biological weapons lack ‘the single most important ingredient of any effective weapon, an immediate visual display of overwhelming power and brute strength.’

4. **The Blind Watchmaker: Why the evidence of evolution reveals a universe without design.** By Richard Dawkins. (Norton, 331 pp, 1986) GFBR ***** Teen-Adult. This book “is an astonishingly lucid exposition of Darwinism. The obvious design of organisms and other apparent objections to Darwin’s theory are met head on, but with such clarity of thought and lucid prose that no reader will be thwarted. Dawkins is a born writer with an unmatched gift for the brilliant metaphor, the inspired syntactic switch, and the relevant zoological detail. {it} is entertaining as well as engrossing: Dawkins’ most wonderful book!”
5. **The Botany of Desire: A Plants’-Eye View of the World.** By Michael Pollan. (Random House, 271 pp, 2001) GFBR *****. Teen-adult. “Working in his garden one day, Michael Pollan hit pay dirt in the form of an idea: do plants, he wondered, use humans as much as we use them? While the question is not entirely original, the way Pollan examines this complex coevolution by looking at the natural world from the perspective of plants is unique. The result is a fascinating and engaging look at the true nature of domestication. In making his point, Pollan focuses on the relationship between humans and four specific plants: apples, tulips, marijuana, and potatoes. ... he explains how a global desire for consistently perfect French fries contributes to both damaging monoculture and the genetic engineering necessary to support it. Pollan has read widely on the subject and elegantly combines literary, historical, philosophical, and scientific references with engaging anecdotes, giving readers much to ponder while weeding their gardens.”
6. **Climbing Mount Improbable.** By Richard Dawkins. (Norton, 340 pp, 1996) GFBR **** HS-Adult. Dawkins, an untiring popularizer of Darwinian evolution, shows how creatures that seem miraculously designed for the lives they lead, actually evolved gradually, almost infinitely slowly, up the gentle paths of Mount Improbable, rather than adapting in sudden leaps or by design from an intelligent creator
7. **Darwin's Dangerous Idea: Evolution and the Meanings of Life** By Daniel Clement Dennett (Touchstone, 672 pp, 1996) General Audiences. “One of the best descriptions of the nature and implications of Darwinian evolution ever written, it is firmly based in biological information and appropriately extrapolated to possible applications to engineering and cultural evolution. Dennett's analyses of the objections to evolutionary theory are unsurpassed. Extremely lucid, wonderfully written, and scientifically and philosophically impeccable. Highest Recommendation!”
8. **Deadly Feasts: Tracking the Secrets of a Terrifying New Plague.** By Richard Rhodes. (Simon & Schuster, 259 pp, 1997) GFBR ***** General Audiences. “The British epidemic of bovine spongiform encephalopathy, or "mad cow" disease, is only one in a series of mysterious and often fatal afflictions that have baffled scientists for more than 40 years. *Deadly Feasts* is a compelling account of decades of research into a family of diseases ranging from kuru in primitive human tribes to scrapie in sheep. Richard Rhodes traces the attempts of scientists to understand these strange diseases, which are now known to be transmitted by ingesting the brain or nervous tissue of infected creatures, even though the pathogen itself is an enigma that

- seems to be neither bacterial nor viral. *Deadly Feasts* is packed with historical, anthropological, and epidemiological detail, and is graphic and occasionally even alarming in its speculations.”
9. **Evolutionary Wars: A Three-Billion-Year Arms Race—the Battle of Species on Land, at Sea, and in the Air.** By Charles Kingsley Levy. (Freeman, 300 pp, 1999) General audience. “Describes how various species of bacteria, fungi, insects, worms, reptiles, birds and mammals have fought each other over hundreds of millions of years to survive. We can see the results of this arms race all around us every day.”
 10. **Flu: The Story of the Great Influenza Pandemic of 1918 and the Search for the Virus that Caused It.** By Gina Kolata. (Farrar, Strauss & Giroux, 330 pp, 1999) GFBR****. Teen-Adult. . The 1918 flu epidemic killed tens of millions of people all around the world, (including 2 aunts and an uncle that I never met) -- more than were killed in World War I, but almost nobody who lived through it ever mentioned it again. What happened, and why, and can it happen again?
 11. **Life On Earth.** By David Attenborough. (Little Brown, 319 pp, 1980) GFBR****. Teen-adult. “In this unique book, David Attenborough has undertaken nothing less than a history of nature, from the emergence of tiny one-celled organisms in the primeval slime more than 3,000 million years ago to apelike but upright man, equally well adapted to life in the rain forest of New Guinea and the glass canyons of a modern metropolis.” Has wonderful pictures, great descriptions, very original.
 12. **River out of Eden: A Darwinian View of Life.** By Richard Dawkins. (Basic Books, 172 pp, 1995) GFBR **** Teen-Adult. “Nearly a century and a half after Charles Darwin formulated it, the theory of evolution is still the subject of considerable debate. Oxford scientist Richard Dawkins is among Darwin's chief defenders, and an able one indeed-- witty, literate, capable of turning a beautiful phrase. In *River Out of Eden* he introduces general readers to some fairly abstract problems in evolutionary biology, gently guiding us through the tangles of mitochondrial DNA and the survival-of-the- fittest ethos. (Superheroes need not apply: Dawkins writes, ‘The genes that survive . . . will be the ones that are good at surviving in the average environment of the species.’) Dawkins argues for the essential unity of humanity, noting that ‘we are much closer cousins of one another than we normally realize, and we have many fewer ancestors than simple calculations suggest.’”
 13. **The Secret Life of Dust: From the Cosmost to the Kitchen Counter, the Big Consequences of Little Things.** By Hannah Holmes. (Wiley & Sons, 240 pp, 2001) GFBR **** General audiences. “Despite its ubiquity, dust is not a popular subject among scientists, and lay people tend to brush it off. But Holmes, a science and natural history writer for the Discovery Channel Online, teases many tantalizing facts from this particulate microscopic substance. ‘[P]olar researchers are drinking water that fell as snow during the crusades,’ for instance. ‘Hundreds of years’ worth of dust has piled up on the well floor,’ most of it ‘space dust,’ as ‘only a small amount of windblown Earth dusts’ reach Antarctica. Some readers may be turned off or sent on a wild cleaning frenzy by much of the information: ‘you breathe about 700,000 of your own skin flakes each day,’ for instance, or ‘a cup of flour... isn't legally filthy until it contains about 150 insect fragments and a couple of rodent hairs.’ And some of her more harrowing facts might inspire minor lifestyle changes: household dust is comprised of all manner of toxic materials, like ‘widely produced’ chromium and mercury metals, pesticides, and herbicides, and ‘the average child eats 15 or 20 milligrams of dust a day, and superslurpers eat 30 to 50 milligrams.’ While factoid set-pieces run the show here, Holmes's tours through the science behind them are lucid. Allergy sufferers and other interested parties will relish this book; others may prefer to remain blissfully ignorant of their particulate surroundings. “
 14. **The Secret Life of Germs: Observations and Lessons from a Microbe Hunter.** By Philip M. Tierno Jr. (Pocket Books, 290 pp, 2001) GFBR****. General Audiences. “Germs are the seeds of life as well as disease, explains Tierno, the New York University Medical Center

doctor who helped solve the mystery of toxic shock syndrome. A germ hunter in the truest sense, Tierno spells out how to survive a world so rife with germs that ‘alien observers might conclude that they are the dominant life form on our planet.’ His field samplings from high-trafficked New York City locations such as pay phones, taxicabs, public restrooms and even the engagement ring counter at Tiffany's will startle readers, but the author is not an alarmist: his aim is disease prevention, and his method is education. The book opens with a quick history of germ evolution and of human understanding of germs, from biblical injunctions on cleanliness to the modern science of microbiology. It outlines the various ways illness-causing bacteria are transmitted and gives precise instructions for minimizing infection with a bulleted list of ‘protective response strategies’ at the end of each chapter. On subjects of controversy, Tierno tends to fall on the conservative side. He rejects the recent notion that overcleaning is responsible for deficient immune systems and increased childhood asthma (arguing that even the most vigilant housekeeping wouldn't protect kids from all germs), and his warnings against unpasteurized products will be questioned by some. The last third of the book touches on the unexpected role of germs in illnesses such as ulcers and heart disease; antibiotic-resistant bacteria strains; germ warfare; and bacteria-fighting methods of the future. This germ primer brings the bug into focus while setting even the most jittery hypochondriac's mind at ease.”

15. **Unweaving the Rainbow: Science, Delusion and the Appetite for Wonder.** By Richard Dawkins. (Houghton Mifflin, 1998) GFBR **** General audiences. “Dawkins takes to heart his title of Charles Simonyi Professor of Public Understanding of Science at Oxford in this thoughtful exegesis on the nature of science and why its detractors are all wrong. More with pity than anger, he takes Keats to task for faulting “cold philosophy” for unweaving the rainbow in the long poem Lamia. On the contrary, Dawkins observes, Newton's use of a prism to split white light into the spectrum not only led to our understanding of how rainbows form in raindrops, but enabled astronomers to read the make-up of stars. Dawkins devotes a few chapters to debunking astrology, magic, and clairvoyance, arguing that, as rational adults, we need to be critical about ideas. This notion serves him handily in chapters on coincidence: He explains the exacting calculations of probabilities to show that coincidences aren't so unusual. Yet people have a penchant for finding patterns where there are none, which leads Dawkins also to address superstitions, the class of errors known as false positives and false negatives, and a wealth of cultural practices from rain dances to human sacrifice. He takes to task what he calls bad poetic science, in which he includes the theories of his rival Stephen Jay Gould in relation to what Gould sees as the three perennial questions in paleontology: Does time have a directional arrow? Do internal or external forces drive evolution? And does evolution occur gradually or in jumps? The spleens so heavy here that one can anticipate a debate, if not a duel. Final chapters provide him with a platform for reweaving the rainbow, enlarging on his earlier themes and metaphors in relation to memes, genes, and evolution. The speculative writing here is less rooted in complex gene analysis than in philosophy of the Dennett school. A sharp mind is much in evidence, delighting in exposing fraud, providing instruction, baiting a colleague, and indulging in his own high-wire acts of evolutionary dreaming.”

CHAOS THEORY

1. **Chaos: Making a New Science.** by James Gleick. (Viking Penguin, 317pp., 1988). HS-Adult. “*Chaos* records the birth of a new science. This new science offers a way of seeing order and pattern where formerly only the random, the erratic, the unpredictable--in short, the chaotic--had been observed. Chaos is a history of discovery. It chronicles, in the words of the scientists

themselves, their conflicts and frustrations, their emotions and moments of revelation. After reading *Chaos*, you will never look at the world in quite the same way again.”

2. **Exploring Chaos: A guide to the New Science of Disorder**, edited by Nina Hall. (W.W. Norton, 223 pp, 1991) GFBR ***. HS – Adult. “In the past few years, a new line of scientific inquiry called ‘chaos theory’ has caught the popular imagination. ... Chaos theory, it turns out, has a deeper meaning for our understanding of nature. All sorts of phenomena - from dripping faucets to swinging pendulums, from the unpredictability of the weather to the majestic parade of the planets, from heart rhythms to gold futures - are best perceived through the mathematical prism of chaos theory. In this collection of incisive, front-line reports, ably edited by Nina Hall for New Scientist magazine, internationally recognized experts such as Ian Stewart, Robert May, and Benoit Mandelbrot draw on the latest research to explain the roots of chaos in modern science and mathematics.”
3. **Does God Play Dice? The New Mathematics of Chaos**. By Ian Stewart. (Blackwell, 416 pp, 2002) Teen-Adult. "The science of chaos is forcing scientists to rethink Einstein's fundamental assumptions regarding the way the universe behaves. Chaos theory has already shown that simple systems, obeying precise laws, can nevertheless act in a random manner. ... [This book] reveals a strange universe in which nothing may be as it seems. Familiar geometrical shapes such as circles and ellipses give way to infinitely complex structures known as fractals, the fluttering of a butterfly's wings can change the weather, and the gravitational attraction of a creature in a distant galaxy can change the fate of the solar system."

CODES AND CODE-BREAKING

1. **The Code Book: The evolution of secrecy from Mary, Queen of Scots to Quantum Cryptography**. By Simon Singh. (Doubleday, 402 pp, 1999) GFBR ****. Teen – Adult. “Codes have decided the fates of empires, countries, and monarchies throughout recorded history. Combining a superb storyteller's sense of drama and a scientist's appreciation for technical perfection, Singh traces the evolution of secret writing from ancient Greek military espionage to the frontiers of computer science.” Good treatment.
2. **Cracking Codes: The Rosetta Stone and Decipherment**. By Richard Parkinson. (U. of California Press, 208 pp, 1999) HS-Adult. “In 1799, while Napoleon's troops battled the fierce Mamelukes in Egypt's Western Delta, a French engineer discovered a giant granite slab that contained strange symbols and Greek letters. Two Egyptologists, the British-born Thomas Young and the astounding young French linguistic polymath Jean-François Champollion, fought to decipher the confounding script in an epic scientific battle. In 1822 Champollion finally broke through 3,000 years of mystery and revealed the Egyptian demotic and hieroglyphic system of writing--forever changing our view of history in the process. *Cracking Codes*, by Richard Parkinson, the British Museum's assistant keeper of Egyptian antiquities, is a companion volume for the museum's bicentennial exhibition of what has come to be known as the Rosetta stone. With 32 color and 200 black-and-white illustrations ranging from limestone fragments to whole statues, illustrated papyrus, and evocative wall paintings, Parkinson shows how Champollion's piercing of the mists of time has enabled the ancient Egyptians to speak to modern civilizations. Parkinson's essays on the importance of writing to human civilization and the birth of Egyptology are equally insightful. ‘The decipherment of the Egyptian scripts is not a single event that occurred in 1822,’ he writes, but ‘a continuous process that is repeated at every reading of a text or artifact. Like any process of reading, it is a dialogue.’”

3. **The Emperor's Codes: The breaking of Japan's Secret Ciphers.** By Michael Smith. (Arcade, 336 pp, 2000) GFBR **** Teen-Adult. More of a history book than a math book, it shows how important it was in World War 2 for the USA to break the Japanese codes. Gives some details on how it was done, which is good for those who want to try their hand at it!
4. **In Code: A Mathematical Journey.** By Sarah Flannery (Workman, 341 pp, 2001) Teen-adult. "British best-seller by and about the 16-year-old who stunned the world by inventing a way of making public-key encryption much more efficient; an engaging, almost playful, book in which the reader is encouraged to spend lots of time working out mathematical puzzles."

COMPUTER SCIENCE/ROBOTICS/GAME THEORY

1. **Advent of the Algorithm: The 300-Year Journey from an Idea to the Computer.** By David Berlinski. (Harcourt, 416 pp, 2000) HS- Adult. "Francis Sullivan of the Institute for Defense Analysis said 'Great algorithms are the poetry of computation'; David Berlinski calls the algorithm 'the idea that rules the world.' *The Advent of the Algorithm* is not so much a history of algorithms as a historical fantasia. Berlinski spins freely between semifictional accounts of historical figures, personal reminiscence, and mathematical proofs--without ever really defining an algorithm in so many words. This is not the book for those who were maddened by Berlinski's *A Tour of the Calculus*; his style remains quirky, digressive, self-referential, and dense: 'And then, by some inscrutable incandescent insight, Leibniz came to see that what is crucial in what he had written is the *alternation* between God and Nothingness. And for this, the numbers 0 and 1 suffice.' And: 'Twinkies and Diet Coke in hand, computer programmers can now be observed pausing thoughtfully at their consoles.' Berlinski's argument seems to be that algorithms--step-by-step procedures for getting answers--superceded logic, and will be superceded in turn by more biological, empirical, fuzzy methods. The structure of the book reflects this argument--sketches of people like Leibniz, Hilbert, Gödel, and Turing are interwoven with proofs and with characters of Berlinski's own invention. Berlinski's voice, closer to Hofstadter than to Knuth, remains unique. "
2. **Godel, Escher, Bach: An Eternal Golden Braid.** By Douglas Hofstadter. (Basic, 777pp, 1979/1999) GFBR *****. Advanced HS- Adult. "Twenty years after it topped the bestseller charts, Douglas R. Hofstadter's *Gödel, Escher, Bach: An Eternal Golden Braid* is still something of a marvel. Besides being a profound and entertaining meditation on human thought and creativity, this book looks at the surprising points of contact between the music of Bach, the artwork of Escher, and the mathematics of Gödel. It also looks at the prospects for computers and artificial intelligence (AI) for mimicking human thought. For the general reader and the computer techie alike, this book still sets a standard for thinking about the future of computers and their relation to the way we think." One of the most brilliant books I have ever read!
3. **The Magic Machine: A Handbook of Computer Sorcery; More Programming Recreations from Scientific American Magazine.** By A.K.Dewdney. (W.H. Freeman, 357 pp, 1990) GFBR ****. HS-Adult. If you want to learn how to write amazing programs on a computer or graphing calculator, this is an excellent place to start to find ideas.
4. **The Pattern on the Stone—The Simple Ideas that Make Computers Work.** By W. Daniel Hillis. (Basic Books, 164 pp, 1998) HS-Adult. "Daniel Hillis has made a career of puzzling over the nature of information and the mechanisms that put information to use. Now, he's distilled his accumulated knowledge of computer science into *The Pattern on the Stone*, a glorious book that reveals the nature of logical machines simply and elegantly. Millions of times each second, to the drumbeat of a clock signal, electronic computers compare digital values. These

comparisons, and the actions taken in response to them, are what computers are all about at their lowest levels, and, with the help of this book, they're not hard to comprehend. Moving on from the nature of logical circuits, the author deconstructs software and the mechanisms it employs to solve problems. Hillis then stands atop the building blocks he's arranged into a sturdy foundation and discusses the future of computing. Parallel processors already are in use, and neural networks with limited abilities to learn and adapt have proved quite good at certain jobs. Hillis explores the potential of both these technologies. Then, he throws some light on quantum computing and evolving systems--emerging ideas that promise to make computers much more powerful, and thereby change the world."

5. **Silicon Dreams.** By Robert Lucky: (St. Martin's Press, 1991) HS-Adult. "...a highly informed discussion of the new information age, ... what information is, how it is generated, captured, stored, and communicated, and goes on to explain information theory, cryptology, speech synthesis and recognition, and much more. Charts, diagrams, photographs."
6. **Why Flip a Coin? The Art and Science of God Decisions.** By H. W. Lewis (Wiley, 206 pp, 1997) GFBR ***. HS-Adult. "Drawing on a host of research findings and scores of examples – from how to win a war to how to win the office football pool – the author presents a host of brain-teasing problems and amusing scenarios that reveal the clever ways to avoid the chaos and anxiety of decision dilemmas."

EARTH SCIENCE/GEOLOGY

1. **Plate Tectonics: An Insider's History of the Modern Theory of the Earth.** By Naomi Oreskes (Editor), Homer Le Grand (Contributor). (Westview, 424 pp, 2002) General audiences. "Widely dismissed as crank science in earlier generations, the theory of plate tectonics--which explains the movement of continents in geological time, as well as the formation of the earth's major features--is now largely accepted as fact within the scientific community. Drawing on the memories of major theoreticians in the field, scientist and historian Naomi Oreskes offers a vivid history of just how that transformation occurred. She describes the early quest on the part of James Dana, Alfred Wegner, J. H. Hodgson, and other scientists to account for the mechanics of earthquakes and certain puzzling features of geomorphology, a quest widened and strengthened by the work of deep-ocean explorers who were able, beginning in the 1960s, to study tectonics at work far below the surface of the world's waters. Such advances, as pioneer Peter Molnar and others explain, did not immediately change the way geologists went about their work, but they quickly went on to revolutionize science--and then, as such things do, to become orthodox. A useful reference for students of geology and the history of science, this book is also easily accessible to nonspecialists."
2. **Storm Watchers: The Turbulent History of Weather Prediction from Franklin's Kite to El Niño.** By John D. Cox. (Wiley, 252 pp, 2002) General audiences. Through profiles of 30 pioneers in the field, Cox unravels the history of meteorology before the advent of high-tech machines that make highly accurate prediction possible. Readers learn about Benjamin Franklin's research on the Gulf Stream and the effects of volcanoes on atmospheric cooling and how expansion-minded government officials ignored John Finley's 19-th century warnings about ... the wrath of tornadoes in the U.S. frontier. In the process of telling these individual stories, Cox relates tales of some of the most devastating weather events ever."

HISTORY OF MATHEMATICS

1. **e: The Story of a Number.** By Eli Maor. (Princeton, 232 pp, 1998) GFBR ****. HS-Adult. "Until about 1975, logarithms were every scientist's best friend. They were the basis of the slide rule that was the totemic wand of the trade, listed in huge books consulted in every library. Then hand-held calculators arrived, and within a few years slide rules were museum pieces. But e remains, the center of the natural logarithmic function and of calculus. Eli Maor's book is the only more or less popular account of the history of this universal constant."
2. **Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace.** By Leonard Mlodinow (Free Press, 306 pp, 2001.) GFBR ***. HS-Adult. . "Mlodinow reveals how geometry's first revolution began with a 'little' scheme hatched by Pythagoras: the invention of a system of abstract rules that could model the universe. That modest idea was the basis of scientific civilization. But further advance was halted when the Western mind nodded off into the Dark Ages. Finally in the fourteenth century an obscure bishop in France invented the graph and heralded the next revolution: the marriage of geometry and number." "The story of 5 revolutions in geometry."
3. **Fermat's Last Theorem: Unlocking the Secret of an Ancient Mathematical Problem.** By Amir D. Aczel. (Doubleday, 147 pp, 1997) Teen-Adult. "Over three hundred years ago, a French scholar scribbled a simple theorem in the margin of a book. It would become the world's most baffling mathematical mystery. Simple, elegant, and utterly impossible to prove, Fermat's Last Theorem captured the imaginations of amateur and professional mathematicians for over three centuries. For some it became a wonderful passion. For others it was an obsession that led to deceit, intrigue, or insanity. In a volume filled with the clues, red herrings, and suspense of a mystery novel, Dr. Amir Aczel reveals the previously untold story of the people, the history, and the cultures that lie behind this scientific triumph." Perhaps not as good as the next book; some reviewers said it was biased against Wiles.
4. **Fermat's Enigma: The Epic Quest to Solve the World's Greatest Mathematical Problem.** Simon Singh (Walker, 315 pp, 1997) GFBR **** Teen-Adult. This is the story of the proof of Fermat's Last Theorem by Andrew Wiles, who wrote, "Perhaps I could best describe my experience of doing mathematics in terms of entering a dark mansion. One goes into the first room and it's dark, really dark, and one stumbles around bumping into the furniture. Gradually you learn where each piece of furniture is, and finally, after six months or so, you find the light switch and suddenly it's all illuminated and you can see exactly where you are." I thought the book was very well-written and clear.
5. **Five Golden Rules: Great Theories of 20th-Century Mathematics--and Why They Matter.** By John L. Casti. (Wiley & Sons, 235 pp, 1996) HS-Adult. "Books on mathematics with such beauty, breadth, and insight are rare. Five Golden Rules is replete with intriguing information - not only for curious laypeople but also for seasoned mathematicians and scientists. Casti has produced a truly stunning survey of mathematics' manifold consequences."
6. **An Imaginary Tale; The Story of $\sqrt{-1}$.** By Paul J. Nahin. (Princeton, 258 pp, 1998) GFBR ****. HS-Adult. "...tells the 2000-year-old history of one of mathematics' most elusive numbers, the square root of minus one, also known as i, re-creating the baffling mathematical problems that conjured it up and the colorful characters who tried to solve them. Addressing readers with both a general and scholarly interest in mathematics, Nahin weaves into this narrative entertaining historical facts, mathematical discussions, and the application of complex numbers and functions to important problems."
7. **Journey Through Genius: The Great Theorems of Mathematics.** By William Dunham. (Penguin, 1990) GFBR ****. HS-Adult. "Strikes an extraordinary balance between the

historical and technical. He devotes each chapter to a principal result of mathematics, such as the solution of the cubic series and the divergence of the harmonic series. Not only does this book tell the stories of the people behind the math, but it also includes discussions and rigorous proofs of the relevant mathematical results"

8. **The Joy of Pi**. By David Blatner. (Walker, 129 pp, 1997) GFBR****. 11-adult. This is an easy book to read. It has many different parts: breezy narratives of the history of pi, and quirky stories of those obsessed with it. There are numerous cartoons, poems, limericks, and jokes as well as the first one million digits of pi.
9. **Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time**. By Dava Sobel. (Walker & Co., 184 pp, 1996) GFBR****. Teen-Adult. "Numbers, like letter forms, have a rich and complex history. Who first invented the? How old are they, and how were they developed? How did they come to represent a world of abstract ideas and universal concepts? How do they differ throughout the world today?" Sobel's writing is a little dry, but the book is definitely easy to read. There is another edition, known as **The Illustrated Longitude**, which has many more pictures of the clocks and other devices and the people involved.
10. **Mathematical Mysteries: The Beauty and Magic of Numbers**. By Calvin C. Clawson (Perseus, 313 pp, 1996) GFBR***. Advanced HS- Adult. "Many of the dazzling beauties of higher mathematics are just as accessible to an ordinary untrained spectator as are similar wonders of great literature, visual art, and music. This well-kept secret is finally blown wide open in Calvin Clawson's latest book." Has equations, but explains them well.
11. **Mathematical Sorcery: Revealing the Secrets of Numbers**.By Calvin C. Clawson. (Perseus, 234 pp, 1999) HS-Adult. "Few mathematicians today have the ability to write about math more entertainingly, with greater enthusiasm and clarity, than Calvin Clawson. A splendid introduction to the great ideas of mathematics, their powerful magic, and their intricate, mysterious beauty."
12. **The Mathematical Universe : An Alphabetical Journey Through the Great Proofs, Problems and Personalities**. By William W. Dunham (Wiley, 314 pp, 1997) GFBR****. Teen-Adult. "Contains a wealth of amusing stories and little known facts from the annals of math. All proofs and equations are introduced through easy-to-follow, step-by-step explanations. Discusses some of the most intriguing mysteries such as Russell's Paradox. Features brief biographies of many great mathematicians including Isaac Newton, Bertrand Russell and Hypatia of Alexandria."
13. **Mathematics for the Million**.By Lancelot Hogben. (numerous versions available.) GFBR****. Teens – Adults. "The best elementary math book (for algebra, geometry, trig, and spherical trig) ... it has been in continuous print since the 1930's! There is also lots of history in it. The same author has a history- of -math book, with wonderful illustrations, that I often give to children and arts friends. It really inspired me as a kid." Albert Einstein wrote: "It makes alive the contents of the elements of mathematics."
14. **The Measure of All Things: The Seven-Year Odyssey and Hidden Error That Transformed the World**. By Ken Alder (Free Press, 422 pp, 2002) GFBR****. HS-Adult. "...this [is an] elegant history of technology, acute cultural chronicle and riveting intellectual adventure built around [the] expedition of 1792-1799 to calculate the length of the meter. Disclosing for the first time details from the astronomers' personal correspondences ... [the author] reveals how [one of the astronomers] made a mistake in his calculations, which he covered up, and which tortured him until his death. ...Alder has placed Delambre and Mechain squarely in the larger context of the Enlightenment's quest for perfection in nature and its

startling discovery of a world 'too irregular to serve as its own measure.'" The meter was supposed to a universal standard, exactly _____ of the circumference of the earth, but

15. **The Mystery of the Aleph: Mathematics, the Kabbalah, and the Human Mind.** By Amir D. Aczel (4 Walls 8 Windows, 258 pp, 2000) HS – adult. "Aczel tells of mathematicians struggling with absolute infinity and some of its mind-bending ramifications. The crown jewel of this struggle was conceived more than a century ago by Georg Cantor and remains an enigma to mathematicians. Cantor spent his life going back and forth between trying to prove and disprove his continuum hypothesis. In the Kabbalah, the aleph 'represents the infinite nature, and the oneness, of God.' Cantor deliberately picked this symbol for use in his equations: to him, trying to understand the absolute infinite was like trying to touch the face of God."
16. **The Nothing That Is: A Natural History of Zero.** By Robert Kaplan. (Oxford, 225 pp, 2000) GFBR ***. HS-Adult. "It is hard to imagine that an entertaining, informative book could be written about nothing, but Robert Kaplan has done it brilliantly. Starting with the great invention of zero as a place holder, Kaplan takes you through the use of zero in algebra, and in calculus, through the importance of the null set. His book closes with that unthinkable question, 'Why is there something rather than nothing?' about which one cannot long meditate without fear of going mad."
17. **Numbers; the Universal Language.** By Denis Guedj. (Abrams, 175 pp, 1996, 1997) Middle School-Adult. "Positional notation i.e Hindu(Arabic) is beautifully explained in this book like no other! The Photographs the artwork and the layout of the book make it even more readable. For anyone like myself that couldn't understand Mathematics at High School or University - primarily because your Teacher or Lecturer didn't understand it either should buy this book! It will open your eyes!"
18. **Trigonometric Delights.** By Eli Maor. (Princeton, 248 pp, 1998) GFBR ****. Advanced HS-Adult. "Maor writes Trigonometric Delights from an historical perspective, but it is not a history book. It contains many theorems and results of trigonometry, but it is not a textbook. Rather, Maor achieves a satisfying blend of mathematics and history, creating a work that informs, teaches, and stimulates thought, while underscoring that mathematics is a human endeavor, not a stale collection of facts that exist in a vacuum. His book is the labor of a missionary whose aim is to deepen our appreciation of ideas and the people who developed them, ideas about which we have heard, but have not fully enjoyed. It is evident throughout that Maor is devoted to his subject. His love for trigonometry is contagious. He writes enthusiastically and engagingly."
19. **The Universal History of Numbers: From Prehistory to the Invention of the Computer.** By Georges Ifrah. (Wiley, 633 pp, several editions) HS-Adult. A very in-depth treatment of the subject, much more so than I have found in any other history-of-mathematics book – and that includes Florian Cajori, Otto Neugebauer, and many others.

HOW-TO: MATHEMATICS

1. **Mathemagics: How to Look like a Genius Without Really Trying.** By Arthur Benjamin and Michael Shermer (Lowell, 218 pp, 1993) GFBR *** Teen-adult. . Teaches you how to calculate in your head faster than you can with a calculator.
2. **Calculus by and for Young People (Ages 7, Yes 7 and Up).** By Donald Cohen (1989) teen-adult. "A description of how young people, Don and some mathematicians, solved problems

which involve infinite series, infinite sequences, functions, graphs, algebra, +, - important mathematical ideas. Also available, the Worksheets (some say all you need)..."

3. **How Math Works: 100 Ways Parents and Kids Can Share the Wonders of Mathematics.** By Carol Vonderman (Putnam, 192 pp, 1999) (Ages 12 +) "Fascinating explanations, activities, profiles of history's most noted mathematical thinkers, and experiments introduce young readers to the world of mathematics."

HOW-TO: SCIENCE

1. **Practical Electronics for Inventors.** By Paul Scherz. (McGraw-Hill/TAB, 604 pp, 2000) HS-Adult. "This book gives you easy-to-use, hands-on instructions on how to turn your ideas into workable electrical gadgets. Hand drawn illustrations help this crystal-clear, learn-as-you go guide show you what a particular device does, what it looks like, how it compares with similar devices, and how it is used in applications. Includes the basic passive components: resistors, capacitors, inductors, transformers, as well as discrete passive circuits such as current limiting networks, voltage dividers, filter circuits. Topics also include diodes, transistors, integrated circuits, amplifiers, and integrated circuits."
2. **Homemade Lightning.** By R.A. Ford. (McGraw-Hill/Tab, 257 pp, 2001) HS-Adult. "This book is perfect for beginning electrical experimenters or those with an interest in advanced electrostatics. You will find complete descriptions of several types of high-voltage generators, including a Van de Graaf generator, electroscopes, cold light, electric tornadoes, and much more."

MATHEMATICS – GENERAL

1. **The Enjoyment of Math.** By Hans Rademacher and Otto Toeplitz (Dover, 216 pp, 1966/1990) Teen-Adult. "What is so special about the number 30? How many colors are needed to color a map? Do the prime numbers go on forever? Are there more whole numbers than even numbers? These and other mathematical puzzles are explored in this delightful book by two eminent mathematicians. Requiring no more background than plane geometry and elementary algebra, this book leads the reader into some of the most fundamental ideas of mathematics, the ideas that make the subject exciting and interesting. Explaining clearly how each problem has arisen and, in some cases, resolved, Hans Rademacher and Otto Toeplitz's deep curiosity for the subject and their outstanding pedagogical talents shine through."
2. **The Fourth Dimension: Toward a Geometry of Higher Reality.** By Rudy Rucker (Houghton Mifflin, 228 pp, 1984) HS-Adult. "Superb! It will hurt your brain if you don't know what you're getting into. On the other hand, if you know what to expect from Science Fact based text then you should be extremely pleased. The Plato's cave story is exceptional, and the tale of Flatland and the contemplation of a 2-D creature seeing/fathoming a 3-D creature is thought provoking. MUST READ."
3. **From Zero to Infinity : What Makes Numbers Interesting.** By Constance Reid (MAA, many editions) Teen-Adult. **Interesting** "A classic of popular mathematical literature (since 1955) that combines the mathematics and the history of number theory with descriptions of the mystique that has, on occasion, surrounded the numbers even among great mathematicians."
4. **How The Other Half Thinks; Adventures in Mathematical Reasoning.** By Sherman Stein. (McGraw-Hill, 177 pp, 2001) Teen-Adult. "Occasionally, in some difficult musical compositions there are beautiful, but easy, parts - so simple a beginner could play them. So it is

with mathematics as well. There are some discoveries in advanced mathematics that do not depend on specialized knowledge, not even on algebra, geometry, or trigonometry. Instead, they may involve, at most, a little arithmetic, such as 'the sum of two odd numbers is even,' and common sense. As I wrote, I kept in mind two types of readers: those who enjoyed until they were turned off by an unpleasant episode, usually around fifth grade; and mathematics aficionados, who will find much that is new throughout the book."

5. **Infinity and the Mind**. By Rudy Rucker (Princeton, 342 pp, 1995) HS- Adult. "...this jazzy book ... is an excellent introduction to all aspects of the infinite. Rucker does a good job balancing accessibility and sophistication - though the book covers some very sophisticated math, even a high-school student should be able to comprehend most of it. It's a good deal at roughly \$13 and, moreover, widely available - Borders, Barnes and Noble, etc usually have a copy in their math section. Run out and buy a copy - your horizons will be infinitely expanded! also contains one of the best expositions of Godel's incompleteness theorem."
6. **The Joy of Mathematics**. By Theoni Pappas. (World Wide, 237 pp, 1989) Ages 9-14. "Part of the joy of mathematics is that it is everywhere: in soap bubbles, electricity, da Vinci's masterpieces, even in an ocean wave. Written by the well-known mathematics teacher consultant, this two volume collection of over 500 clearly illustrated mathematical ideas, concepts, puzzles, and games shows where they turn up in the 'real' world. You'll find out what a googol is, visit hotel infinity, read a thorny logic problem that was stumping them back in the 8th century."
7. **Life by the Numbers**. By Keith Devlin. (Wiley, 224 pp, 1999) GFBR. *** HS-adult. "Most of us think mathematics is about numbers and counting. That's just the basics, though, and Keith Devlin's companion book to the PBS series "Life by the Numbers" gives examples of the versatility of math as a tool for understanding just about everything. Devlin loves math--he calls it 'one of the greatest creations of mankind' in a chapter entitled 'It's an M World'--and he wants everyone to love it."
8. **The Mathematical Experience**. By Philip J. Davis and Reuben Hersh. (Houghton-Mifflin, 411 pp, 1998) HS-Adult. "A brilliant and engrossing view of the development of mathematics...wonderful at communicating its beauty and excitement to the general reader." "This is the classic introduction for the educated lay reader to the richly diverse world of mathematics: its history, philosophy, principles, and personalities. Winner of an American Book Award."
9. **Mathematical Mountaintops; The Five Most Famous Problems of All Time**. By John L. Casti. (Oxford, 196 pp, 2001) HS – Adult. "The recent boom in mathematics bestsellers has contributed a great deal towards raising the public profile of the subject. But such books ignore a significant section of potential readers, namely those who have more of a mathematical background than the general reader but who are not professional mathematicians. Such mathematical enthusiasts have no doubt enjoyed some of the popular books, but would really prefer a more technical treatment. This is exactly what John Casti provides in Mathematical Mountaintops. It is neither a textbook nor a pop math book, rather it is a serious in-depth look at the great problems of mathematics."
10. **The Mathematical Tourist: Snapshots of Modern Mathematics**. By Ivars Peterson. (Freeman, 240 pp, 1988; newer versions are available.) GFBR****. HS – Adult. "The only popular book on mathematics that covers many of the really new developments in the field. Ivars is accurate yet accessible, a delicate combination in this subject, particularly."
11. **Mind Tools: The Five Levels of Mathematical Reality**. By Rudy Rucker (Mariner, 1988) HS-Adult. "This is an amazing book for teaching the concepts of mathematical logic, fractals, number theory, and information theory. I have never seen these concepts introduced in such an easy-to-understand

fashion. I recommend it highly to anyone with an interest in these concepts. Near the end of the book, it does go a little overboard with the information theory and becomes hard to follow."

12. **More Joy of Mathematics: Exploring Mathematics All Around You** .By Theoni Pappas.. (World Wide, 304 pp, 1991) Ages 9-14 "Many have sadly been led to believe that math is a cold, lifeless subject limited only to homework assignments and balancing your checkbook. Nothing could be further from the truth, and Pappas books show this. Her 'More Joy of Mathematics' shows a vast amount of instances of where math shows up, some math history, and a few visual brain teasers. How are exponents involved in the forging that creates a powerful Samuri sword? How do the properties of an elipse make your car's headlights switch to high-beam? What math can be found in an ocean wave, the strength of a honeycomb pattern, or a nautilus shell? How is math vital to the contruction of musical instruments? Is zero really a "number", and where does the concept come from? What are some currently unsolved problems in mathematics? A total layman could understand most of the book, but to understand all the mini essays you might at least want to have knowledge of math at the high school level. The book is a fast read, and fun to flip back and forth through, because each example is summarized in its own 1 or 2 page section, with illustrations. The same goes for 'Joy of Mathematics' so you don't necessarily have to read that one first; they just contain different sets of examples. And don't think that all the good ideas were already taken for the first book – 'More Joy of Mathematics' is just as exciting to read. Plus it has a single index listing the topics from both this book and the previous one, so if you buy both it's easy to find the article you want by only looking it up once. Perfect gift for a math enthusiast at any level, and it may even covert a few 'mathphobes'."
13. **Nature's Numbers: The Unreal Reality of Mathematics**. By Ian Stewart. (Basic, 176 pp, 1997) "First-rate popular mathematics writing...Stewart achieves what other popular mathematics writers merely strive for: an accurate, informative portrayal of contemporary mathematics without a single equation in sight...[If] someone you know wants to know what mathematics really is, buy them a copy of Nature's Numbers."
14. **Nonzero : The Logic of Human Destiny** By Robert Wright. (Vintage, 448 pp, 2001) (HS-Adult) "In defiance of the recent scorn heaped on speculations positing progressive or directional laws of history, Robert Wright believes that game theory offers the framework for interpreting such seemingly disparate phenomena as the invention of writing, DNA, and the World Trade Organization as parts of an overarching pattern. The "logic of human destiny" Wright refers to in his subtitle is the logic of non-zero -- that non-zero-sum games inherently provide more fitness for survival than zero-sum games in the long run, and that non-zeroness breeds more non-zeroness by opening up new and more elaborate ways to profit and thrive."

NOVELS + SHORT STORIES

1. **The Adventures of Penrose the Mathematical Cat**. By Theoni Pappas. (World Wide, 132 pp, 1997) ages 9-14. "Penrose, a cat with a knack for math, takes children on an adventurous tour of mathematical concepts from fractals to infinity. When the fractal dragon jumps off the computer screen and threatens to grow larger than the room itself, Penrose must find out if fractal patterns can work in reverse, getting smaller instead of larger."
2. **Afterwards: Folk and Fairy Tales With Mathematical Ever Afters**. by Peggy Kaye. (Cuisenaire, 128 pp, 1997) ages 9-12. "I enjoyed this book. My students enjoyed the moral lessons that it taught. The stories had a set of mathematical problems at the end for the students to work. Many of the problems could be changed to different grade levels."

3. **Algebra the Easy Way.** By Douglas Downing. (Barron's, 329 pp, 1996) Teen-Adult "An algebra text in the form of a fantasy novel, with the story's characters solving problems by using algebra." Some students who read it liked it, but others did not.
4. **Fantasia Mathematica : Being a Set of Stories, Together With a Group of Oddments and Diversions, All Drawn from the Universe of Mathematics.** Edited by Clifton Fadiman. (Copernicus, 298 pp, 1997) Teen-adult. " Some of the short stories are humorous, some are endearing, some have common characters. All deal with mathematics in one way or another.... This book closely tied math with imagination and fantasy—a connection never clearly drawn in my public education. ... It is another way to know why your baseball is going to break the window, how to build a spaceship in your back yard, and how to teleport to Argentina in 0 seconds flat. "
5. **Flatland: A Romance of Many Dimensions.** By Edwin A. Abbott. (Dover, 128 pp, reprint) GFBR**** 12 – adult. . "Flatland is one of the very few novels about math and philosophy that can appeal to almost any layperson. Published in 1880, this short fantasy takes us to a completely flat world of two physical dimensions where all the inhabitants are geometric shapes, and who think the planar world of length and width that they know is all there is. But one inhabitant discovers the existence of a third physical dimension, enabling him to finally grasp the concept of a fourth dimension.
6. **A Gebra Named Al: A Novel.** By Wendy Isdell. (Free Spirit, 128 pp, 1993) Ages 9-15 "Julie hates algebra--until she meets a gebra named Al, and the Periodic horses journey through the Land of Mathematics, where the Orders of Operations are real places and fruits that look like Bohr models grow on chemis-trees." The writer was herself a youngster taking algebra when she wrote the book!
7. **The Man Who Counted : A Collection of Mathematical Adventures.** by Malba Tahan. (Norton, 244 pp, 1993) Middle school-adult. "The Arabian adventures of a man with remarkable mathematical skills, which he uses to settle conflict and give wise advice." (Malba Tahan is a pseudonym; the author is not an Arab!)
8. **The Mathematical Magpie.** Edited by Clifton Fadiman.(Springer-Verlag, 303 pp, 1997). Teen-adult. A collection of stories, edited by Fadiman. I have never read it, and cannot advise on its quality.
9. **The Number Devil: A Mathematical Adventure.** By Hans Magnus Enzensberger (Holt, 262 pp, 2000) GFBR. **** 9-Adult. "In 12 dreams, a 12-year-old boy who hates math discovers the amazing world of numbers: infinite numbers, prime numbers, Fibonacci numbers, numbers that magically appear in triangles, and numbers that expand without end." Brilliant, in my opinion. Just don't get so hooked on his 12-year-old terminology that you think it's the real thing!
10. **The Phantom Tollbooth.** By Norton Juster. (Random House, 256 pp, many editions) Ages 9-13. . "I was ten years old when this book was first published. My father had the foresight to buy a copy of it as a Christmas gift for me. One of my most treasured childhood memories was having him read this astounding novel out loud. This is a remarkable story about an ordinary boy. He discovers the magic in the mundane world that surrounds him and he does so by getting involved with math, science, words, fractions, sound, humbugs, whiches (spelled correctly!) and some terrible demons. Now when I read the book I find the demons even more menacing because they are the demons that dwell in the world of being grownup. Juster wrote the almost impossible - a book for children that is just as good for adults. This intelligent book doesn't forego story for message, but the message is vital, a whole lot of fun and interesting from the start. After all, who wouldn't be intrigued by finding a phantom tollbooth in his bedroom?" However, I personally didn't like this book very much, and couldn't stand reading it. That's why I can't give it any stars at all – I didn't read it. Some folks really like it, though.

11. **Sphereland : A Fantasy About Curved Spaces and an Expanding Universe.** By Dionys Burger. (International, 1982) Teen-Adult. "Sphereland, the sequel to Flatland, is a great book to help one expand one's mind. This book is a satire, a geometry lesson, and a good exercise for the mind. Sphereland is also useful for helping one to think outside of the box, and the universe for that matter. This book stretches the confines of your mind and imagination."
12. **Surreal Numbers: How Two EX-Students Turned on to Pure Mathematics and Found Total Happiness: A Mathematical Novelette.** By Donald Knuth.(Addison Wesley, 128 pp, 1982, reprinted many times) Teen-adult. "An astonishing feat of legerdemain. An empty hat rests on a table made of a few axioms of standard set theory. Conway waves two simple rules in the air, then reaches into almost nothing and pulls out an infinitely rich tapestry of numbers that form a real and closed field. Every real number is surrounded by a host of new numbers that lie closer to it than any other "real" value does. The system is truly 'surreal.'"
13. **Uncle Petros and Goldbach's Conjecture.** By Apostolos Doxiadis. (Bloomsbury, 224 pp, 2001) Teen-Adult. "I'd ... recommend it to those who like literature and mathematics with some history thrown in. A mathematical conjecture unsolved for two centuries; a mathematical genius uncle driven mad trying to solve it; an ambiguous relation with a mathematically-minded nephew; and acute human observation all come together in Uncle Petros to make a very funny, tender, charming and, to my mind, irresistible novel. In the tradition of Fermat's Last Theorem and Einstein's Dreams, a novel about mathematical obsession."

NUMBER THEORY

1. **The Book of Numbers.** By John Horton Conway and Richard K. Guy. (Copernicus/Springer-Verlag, 310 pp, 1996) GFBR ****. HS-Adult. "A fascinating review of numbers: from Egyptian fractions to surreal numbers; prime numbers, Fibonacci numbers, Catalan numbers, Fermat numbers; from numbers so large they cannot be imagined (and barely be named) to ruler-and-compass."

PHYSICAL CHEMISTRY

1. **Magick, Mayhen, and Mavericks: The Spirited History of Physical Chemistry.** By Cathy Cobb. (Prometheus, 420 pp, 2002) HS-Adult. "Cobb, a physics teacher, conveys a contagious enthusiasm for the rarely celebrated but vital science of physical chemistry, which explains and predicts molecular structure and the behavior of chemicals at the atomic scale. She traces the history of the discipline by focusing on the exceptionally gifted – and sometimes odd – characters who made key contributions to the field, including Antoine Lavoisier, Michael Faraday, and Max Planck."

PHYSICS

1. **1, 2, 3, Infinity: Facts and Speculations of Science.** George Gamow (Dover, 335 pp, reprint) GFBR ***** Teen-adult. "This book changed lives around the world. Many of us began our journey into science and mathematics with this book. The reviews at the other book site show how many of us were changed in our young lives by this book. Buy it for every child you know." This book has been in print for over 50 years, because it's really, really GOOD.
2. **Alice in Quantumland: An Allegory of Quantum Physics** By Robert Gilmore. (Copernicus, 184 pp, 1995) General audiences. Told in the same way as Alice in Wonderland and a hint of Flatland, Gilmore guides us through the principles of Quantum mechanics in a truly lively and fun way

3. **The Cartoon Guide to Physics.** By Larry Gonick. (Harper, 224 pp, reprint) GFBR ****. Teen-adult. “If you think a negative charge is something that shows up on your credit-card bill--if you imagine that Ohm's law dictates how long to meditate--if you believe that Newtonian mechanics will fix your car, here's the book for you.”
4. **The Making of the Atomic Bomb.** By Richard Rhodes. (Simon & Schuster, 889 pp, 1986) HS-Adult. “If the first 270 pages of this book had been published separately, they would have made up a lively, insightful, beautifully written history of theoretical physics and the men and women who plumbed the mysteries of the atom. Along with the following 600 pages, they become a sweeping epic, filled with terror and pity, of the ultimate scientific quest: the development of the ultimate weapon. Rhodes is a peerless explainer of difficult concepts; he is even better at chronicling the personalities who made the discoveries that led to the Bomb. Niels Bohr dominates the first half of the book as J. Robert Oppenheimer does the second; both men were gifted philosophers of science as well as brilliant physicists. The central irony of this book, which won a National Book Critics Circle Award, is that the greatest minds of the century contributed to the greatest destructive force in history.”
5. **Mr. Tompkins.** By George Gamow. (Cambridge, 186 pp, reprint) Teen-Adult. “This classic work provides a clear explanation of the central concepts in modern physics--from atomic structure to relativity and quantum theory to fusion and fission--through the fantastic adventures of its bank clerk hero First appearing over 50 years ago, George Gamow's Mr. Tompkins became known and loved by thousands of readers as the bank clerk whose fantastic adventures lead him into a world inside the atom. A new Foreword by Roger Penrose introduces Mr. Tompkins to a new generation of readers and reviews his adventures in light of current developments in physics.”
6. **Powers of Ten: About the Relative Sizes of Things in the Universe.** By Philip & Phylis Morrison. (Freeman, short, many editions) GFBR*****. Middle school-adult. Also the subject of a short movie. This shows how we humans fit into the physical structure of the universe, by burrowing deep into a person's hand and going down all the way to the sub-atomic particles that make up matter; and then backing up so that we can see the park, the city, the lake, the continent, the planet, the solar system, the local group of stars, the galaxy, and more. You have to SEE the illustrations to understand it!
7. **A Tour of The Subatomic Zoo: A Guide to Particle Physics.** By Cindy Schwarz. (Springer-Verlag, 135 pp, 1996) Teen-adult. “Insights into the structure of matter from the atom down to the quark are discussed within a historical context that makes them easily accessible to readers with no physics and little math background .”

PROBABILITY + STATISTICS

1. **Can You Win? The Real Odds for Casino Gambling, Sports Betting, and Lotteries.** By Mike Orkin. (Freeman, 181 pp, 1991) HS-Adult. If you decide to do any gambling, even a few bucks on your state lottery, consider the price of this book as your first bet. Orkin presents the real odds of most popular gambling games, at least one 'sure fire system' (yes there is such a thing, but you need deep pockets and have to be satisfied with a pretty low rate of return), and the effects of the 'house edge'in an entertaining manner and with just a minimum of math. In fact, skipping the math in the book does nothing to reduce the book's usefulness nor your reading enjoyment. Read this if you think gambling is a solution to money problems. In fact, after going through this highly readable and entertaining book you may be tempted to skip the lottery tickets and put the money in casino stock instead!

2. **The Cartoon Guide to Statistics.** By Larry Gonick. (HarperCollins, 223 pp, 1993) GFBR *** Teen-adult. "You'll find lucid explanations of probability, distributions, error functions, hypothesis testing, and other basic tools of statistics." And, best of all, it's written in the form of cartoons.
1. **Damned Lies and Statistics: Untangling Numbers from the Media, Politicians, and Activists.** By Joel Best. (U. of Calif. Press, 196 pp, 2001) HS-Adult. "In an effort to turn people into critical thinkers, Best presents three questions to ask about all statistics and the four basic sources of bad ones. He shows how good statistics go bad; why comparing statistics from different time periods, groups, etc. is akin to mixing apples and oranges; and why surveys do little to clarify people's feelings about complex social issues. Random samples, it turns out, are rarely random enough. He also explains what all the hoopla is over how the poverty line is measured and the census is counted. ... How many men were really at the Million Man March? How is it possible for the average income per person to rise at the same time the average hourly wage is falling? And how do you discern the truth behind stat wars? Learn it all here before you rush to judgment over the next little nugget of statistics-based truth you read."
2. **How to Lie With Statistics.** By Darrell Huff. (Many editions; about 140 pages) GFBR *****. Teen – adult. "There is terror in numbers,' writes Darrell Huff in *How to Lie with Statistics*. And nowhere does this terror translate to blind acceptance of authority more than in the slippery world of averages, correlations, graphs, and trends. Huff sought to break through 'the daze that follows the collision of statistics with the human mind' with this slim volume, first published in 1954. The book remains relevant as a wake-up call for people unaccustomed to examining the endless flow of numbers pouring from Wall Street, Madison Avenue, and everywhere else someone has an axe to grind, a point to prove, or a product to sell. ... Although many of the examples used in the book are charmingly dated, the cautions are timeless. Statistics are rife with opportunities for misuse, from "gee-whiz graphs" that add nonexistent drama to trends, to "results" detached from their method and meaning, to statistics' ultimate bugaboo--faulty cause-and-effect reasoning. Huff's tone is tolerant and amused, but no-nonsense. Like a lecturing father, he expects you to learn something useful from the book, and start applying it every day. Never be a sucker again, he cries!"
3. **Innumeracy.** By John Allen Paulos. (Hill & Wang, 208 pp,) GFBR ***. HS-Adult. "This is the book that made "innumeracy" a household word, at least in some households. Paulos admits that "at least part of the motivation for any book is anger, and this book is no exception. I'm distressed by a society which depends so completely on mathematics and science and yet seems to indifferent to the innumeracy and scientific illiteracy of so many of its citizens. But that is not all that drives him. The difference between our pretensions and reality is absurd and humorous, and the numerate can see this better than those who don't speak math. I think there's something of the divine in these feelings of our absurdity, and they should be cherished, not avoided. Paulos is not entirely successful at balancing anger and absurdity, but he tries. His diatribes against astrology, bad math education, Freud, and willful ignorance are leavened with jokes, mathematical or the sort (he claims) favored by the numerate. It remains to be seen if *Innumeracy* will indeed be able, as Hofstadter hoped, to 'help launch a revolution in math education that would do for innumeracy what Sabin and Salk did for polio'--but many of the improvements Paulos suggested have come to pass within 10 years. Only time will tell if the generation raised on these new principles is more resistant to innumeracy--and need only worry about being incomputable."
4. **The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century.** By David Salsburg. (Holt, 352 pp, 2002) GFBR **. Advanced HS - adult. "In *The Lady Tasting Tea*, David Salsburg tells the fascinating story of how statistics has revolutionized

science in the twentieth century. Leading the reader through a maze of randomness and probability, the author clearly explains the nature of statistical models, where they came from, how they are applied to scientific problems, and whether they are true descriptions of reality. Salsburg also discusses the flaws inherent in a statistical model and the serious problems they've created for scientists as we enter the twenty-first century." Some of his assessments of the advances and weaknesses of other statisticians are a little hard to follow, in my opinion.

5. **A Mathematician Reads the Newspaper.** By John Allen Paulos. (Basic, 212 pp, 1995) GFBR***. HS-Adult. In my opinion a bit easier to read than his "Innumeracy". Has contents of his numerous articles that are published on-line and in various periodicals, where he investigates the numbers that make the news in economics and politics, health issues, sports, spin-doctoring, recipes, celebrity features, and more.
6. **What Are the Odds? The Chances of Extraordinary Events in Everyday Life.** By Jefferson Hane Weaver. (Prometheus, 250 pp, 2001) HS-Adult. This book was "motivated by the desire to provide a lighthearted treatment of the subject matter [of statistics and probability theory] because mathematics in general and statistics in particular have very poor public images even though these fields are absolutely crucial to the continued functioning of our modern technological society." Areas explored include romance, sex, death, disaster, going to war, striking it rich, encountering danger in the workplace, employment and unemployment, becoming a doctor or lawyer, being audited, crime and punishment, medical procedures and illnesses, getting into an Ivy League school, and becoming a film star, rock star or best-selling author. This conversational style of this text makes a traditionally- academic subject accessible to the general reader. Weaver is an attorney, and the author of several popular science books

PUZZLES + PROBLEMS

1. **Conned Again, Watson! Cautionary Tales of Logic, Math, and Probability.** By Colin Bruce (Perseus, 320 pp, 2002) Teen-adult. "Some people who think they hate math are lucky to learn that they actually just can't abide its often dry, abstract presentation. Physicist Colin Bruce turns math teaching on its head by using conflict, drama, and familiar characters to bring probability and game theory to vivid life in [this book]. Using short stories crafted in the style of Sir Arthur Conan Doyle, he lets Sherlock Holmes guide Watson and his clients through elementary mathematical reasoning."
2. **Duelling Idiots and Other Probability Puzzlers.** By Paul Nahin. (Princeton, 256 pp, 2000) Advanced HS – Adult. . "What are your chances of dying on your next flight, being called for jury duty, or winning the lottery? We all encounter probability problems in our everyday lives. In this collection of twenty-one puzzles, Paul Nahin challenges us to think creatively about the laws of probability as they apply in playful, sometimes deceptive, ways to a fascinating array of speculative situations". The mathematics is NOT easy.
3. **How to Solve It.** By George Polya. (Princeton, 224 pp, 1971) Teen-Adult. "This perennial best seller was written by an eminent mathematician, but it is a book for the general reader on how to think straight in any field. In lucid and appealing prose, it shows how the mathematical method of demonstrating a proof or finding an unknown can be of help in attacking any problem that can be "reasoned" out from building a bridge to winning a game of anagrams. Generations of readers have relished G. Polya's deft--indeed, brilliant--instructions on stripping away irrelevancies and going straight to the heart of the problem."
4. **Keys to Infinity.** By Clifford A. Pickover. (Wiley, 332 pp, 1995) GFBR****. Teen-Adult. "A treasure trove of recreational problems." (Martin Gardner) "What could be more appropriate to the subject of infinity than a book like this one, so dense with wonderful puzzles, anecdotes,

images, and computer programs that you could pore over it forever?" Pickover is very, very creative and original.

5. **Knotted Doughnuts and Other Mathematical Entertainments**. By Martin Gardner. (Freeman, 278 pp, 1986) GFBR ****. HS-Adult. One of his many collections of his columns from the Scientific Americans, and contains an entirely new set of problems, paradoxes, teasers and tricks. Investigates mathematical games such as Sim, Chomp, and Race Track; also investigates coincidences that seem to violate the laws of probability. any book of his on mathematics or science would be fine. They are usually a collection of short articles on a variety of topics, and we can negotiate on how many articles you should read for your report.
6. **Math Wizardry for Kids**. By Margaret Kenda and Phyllis S. Williams. (Barron's, 336 pp, 1995) Ages 8 to 12. Over 200 math puzzles, games and designs for kids, also available as a kit with a protractor, various triangles, a ruler, compass, and other essential tools.
7. **The Mathematics of Oz: Mental Gymnastics from Beyond the Edge**. Clifford A. Pickover (Cambridge University Press, 2002) Teen-Adult. The author, "Dorothy, and Dr Oz explore some of the oddest and quirkiest highways and byways of the numerically obsessed. Prepare yourself for a shattering odyssey as The Mathematics of Oz unlocks the doors of your imagination. The thought-provoking mysteries, puzzles, and problems range from zebra numbers and circular primes to Legion's number - a number so big that it makes a trillion pale in comparison. The strange mazes, bizarre consequences, and dizzying arrays of logic problems will entertain people at all levels of mathematical sophistication. The tests devised by enigmatic Dr Oz to assess human intelligence will tease the brain of even the most avid puzzle fan."
8. **Metamagical Themas: Questing for the Essence of Mind and Pattern**. By Douglas R. Hofstadter (Basic, 880 pp, 1985) GFBR *****. Advanced HS-Adult. A compilation of mathematical columns from Scientific American by the extremely original author of Godel, Escher, Bach.
9. **The Puzzling Adventures of Dr. Ecco**. By Dennis Shasha. (Freeman, 181 pp, 1988) GFBR **. Advanced HS-Adult. "This is an extremely entertaining book written in a lively style. The problems and puzzles are unique and exciting. Dr. Ecco's Holmesian character is insightful and engaging. What is so delightful here is that the problems presented, in addition to being challenging, open up readers to significant and important areas of mathematics and their applications." Warning – these puzzles are NOT easy!
10. **Solve This**. By James Stanton. (MAA, 240 pp, 2001) 8th grade-Adult. "The book has plenty of illustrations and lots of engaging problems, some of which would be suitable for bright 8th and 9th graders. Jim has contributed articles to Math Horizons which may be accessible online. This is a wonderful book for students and teachers alike. Sophisticated mathematics is made accessible to everyone. Written with humor, thoughtfulness and a real sense of where people have difficulties and how to get around them, Tanton puts his finger on the pleasures and promises of each problem. Not to be missed, no matter how experienced or inexperienced you are."
11. **Wonders of Numbers: Adventures in Math, Mind, and Meaning** By Clifford A. Pickover (Oxford U Press, 352 pp, 2000) HS-Adult. "This book contains a delightful collection of mathematical puzzles in the tradition of Martin Gardner. There are Klingon Paths, Hexagonal Cats, Messages from the Stars, and Doughnut Loops. ... The book is not all numbers. There are historical anecdotes and stories about mathematicians told by the author's alter-ego, Dr. Googol. Are all mathematicians insane? The answer not clear. However, the author describes the five strangest. Did you know that Pythagoras believed that it was sinful to eat beans? ..."

REFERENCE – MATHEMATICS

1. **Mathematics: From the Birth of Numbers**. By Jan Gullberg. (Norton, 1120 pp, 1996) GFBR ****. HS-Adult. "If a family is to have only one mathematics book on the reference shelf, then this is the one... " Not really something you would read from cover to cover, but more like an encyclopedia. Very well written, and has some quirky little drawings.
2. **Reading the Numbers: A Survival Guide to the Measurements, Numbers, and Sizes Encountered in Everyday Life**. By Mary Blocksma. (Penguin, 224 pp, 1989) GFBR ***. Teen-Adult. This is a reference book, but it gives details on all sorts of things, like what the ISBN is, what those last 4 new digits on the Zip Code mean, what all those letters and numbers on automobile tires mean, and so on

RELIABLE, PROLIFIC AUTHORS ON SCIENCE + MATH

If you cannot find any of the other 140 + books I recommended, then try looking up these names in the “author” category. If you find a title on math or science by any one of them, but it’s not on the list, then bring it to class and see if Mr. B will approve it.

1. Isaac Asimov (**not** the science fiction!)
2. Calvin C. Clawson
3. Keith Devlin
4. George Gamow
5. Martin Gardner
6. James Gleick
7. Douglas Hofstadter
8. Lancelot Hogben
9. Eli Maor
10. Theoni Pappas
11. Ivars Peterson
12. Clifford Pickover
13. Simon Singh
14. Ian Stewart
15. Norbert Wiener

SCIENCE - GENERAL

1. **Ancient Inventions**. By Peter James and Nick Thorpe. (Ballantine, 672 pp, 1994) GFBR ****. General audiences. “From Greek steam engines to Roman fire engines, Aztec chewing gum to Etruscan false teeth, earthquake detectors in China to electric batteries in Iraq... Stone age brain surgery to Middle Age hand grenades .. the Pharaoh’s canals to the Cretans’ lavatories... here’s a lively and fascinating look at the genuine wonders of the past.”
2. **The Demon-Haunted World: Science as a Candle in the Dark**. By Carl Sagan. (Random House, 452 pp, 1999) GFBR****. General audiences.
2. **Fast Food Nation: The Dark Side of the All-American Meal**, by Eric Schlosser.(Harper-Collins, 400 pp, 2002) GFBR *****. General audiences.. “In this fascinating sociocultural report, Schlosser digs into the deeper meaning of Burger King, Auggie's, The Chicken Shack, Jack-in-the-Box, Little Caesar's and myriad other examples of fast food in America. Frequently

using McDonald's as a template, Schlosser, an Atlantic Monthly correspondent, explains how the development of fast-food restaurants has led to the standardization of American culture, widespread obesity, urban sprawl and more. In a perky, reportorial voice, Adamson tells of the history, economics, day-to-day dealings and broad and often negative cultural implications of franchised burger joints and pizza factories, delivering impressive snippets of information (e.g., two-thirds of America's fast-food restaurant employees are teenagers; Willard Scott posed as the first Ronald McDonald until higher-ups decided Scott was too round to represent a healthy restaurant like McDonald's). According to Schlosser, most visits to fast-food restaurants are the culinary equivalent of 'impulse buys,' i.e., someone is driving by and pulls over for a Big Mac. But anyone listening to this audiobook on a car trip and realizing that the Chicken McNugget turned 'a bird that once had to be carved at a table' into 'a manufactured, value-added product' will think twice about stopping for a snack at the highway rest stop."

3. **Guns, Germs and Steel: The Fates of Human Societies.** By Jared Diamond. (Norton, 480 pp, 1997) GFBR*****. HS-Adult. Ground-breaking work. Shows how local availability of plants and animals that could or could not be domesticated strongly influenced the course of human societies all over the world, and why, around 1500, it was Europeans with guns and deadly diseases who invaded and nearly wiped out the inhabitants of the Americas, rather than the other way around.
4. **The Hidden Forest: The Biography of an Ecosystem.** By Jon R. Luoma. (Holt, 288 pp, 1999) General audiences. This book is a study of a very old, untouched forest. "The forest--the H. J. Andrews Experimental Forest in Oregon--is in fact eminently visible, consisting of huge, old-growth conifers. But the researchers who have studied it closely since 1948 'have discovered a host of species previously unknown to science, and interactions in the forest ecosystem that no one previously imagined,' Luoma writes, and that is the hidden forest. The studies, here and elsewhere, have dealt with the effects of the great diversity of materials that fall to the ground from the forest canopy; of the forest's insect life; of rotting logs; of flood, fire and clear-cutting; of volcanic eruption. Luoma, a contributing editor to Audubon magazine, thinks the work may lead to 'a new sort of ecoforestry' that 'could allow a nation to protect wild forests and have some lumber too.' "
5. **The Red Queen : Sex and the Evolution of Human Nature.** By Matt Ridley. (Penguin, 1995) General audiences. "A former editor of *The Economist* asks how sexual selection has molded human nature. The title here alludes to a scene in Lewis Carroll in which Alice and the Red Queen run as fast as possible to remain in the same place. Ridley looks first at current thinking on why sexual reproduction exists at all, when many organisms manage quite well without it. The answer has to do with disease: a species must rebuild its defenses from one generation to the next merely to keep from falling behind in the race against opportunistic viruses. Sex, by allowing a new shuffle of the genetic material with each generation, improves the chance of survival. But the predators also improve with each generation, so the race (vide Lewis Carroll) is never over. Turning to animals, Ridley describes mating patterns with an eye as to whether mates are selected for health and vigor, or for esthetics. He concludes that both play a role: neither sickly fashion-plates nor healthy wallflowers will pass on their genes as often as those who combine both beauty and health. Given the contrast between a brief sexual act and long years of child-rearing, aggressive males will tend to have more children, while nurturing women will have healthier ones. Those who select mates with these qualities will transmit them to ensuing generations, along with other qualities affecting offspring survival. Ridley contends--not a popular thesis in recent decades--that such genetic programming is far more central to human nature than social conditioning. Extensively researched, clearly written: one of the best introductions to its fascinating and controversial subject."

16. **Robots: Bringing Intelligent Machines to Life?** By Ruth Aylett. “Although robots are inherently mechanical things, Aylett explains that researchers find themselves drawing on nature’s own biomechanical innovations to change the way robots move, sense their environments, think, learn, and make decisions. She explains this through illustrated two-page spreads, each devoted to a robotics topic—such as smelling the world or determining locations. She also discusses obstacles confronting the robotics community, including the need for better energy sources and the fears that robots will supercede people.” (Barron’s, 144 pp, 2002) (JHS – adult.)
6. **The Secret Garden: Dawn to Dusk in the Astonishing Hidden World of the Garden.** By David Bodanis. (Simon & Schuster, 187 pp, 1992) GFBR*****. General audiences. The author “guides us through the terrain of the familiar yet unseen world around us and brilliantly transforms it. Written with the same witty style that The Washington Post called ‘marvelously captivating’ and illustrated throughout with state-of-the-art microphotographs, The Secret Garden is an astonishing book that will fascinate and delight anyone who has ever set foot in a garden.”
7. **The Secret House: Twenty-Four Hours in the Strange and Unexpected World in Which We Spend Our Nights and Days.** By David Bodanis (Simon & Schuster, 224 pp, 1986) GFBR*****. General Audiences. A fascinating look at how a house creaks and breathes, the lives of the dust mites that eat the skin that flakes off your body, and other things you never, ever thought about, inside your house or apartment.
8. **Sensory Exotica: A World Beyond Human Experience.** By Howard C. Hughes. (MIT Press, 344 pp, 1999) General audiences. “Can a dog sense in advance that its owner is about to have an epileptic seizure? A dog described in a recent news report does that, evidently by detecting certain chemicals associated with the onset of a seizure. It is an example of a sensory capability beyond the human range. Many animals can sense things that people are unaware of or sense weakly. Such animals are the subject of the story recounted by Hughes, who is a professor of psychology at Dartmouth College. He describes sonar in bats and dolphins, biological compasses (based on the sun or stars or geomagnetism) in birds and insects, electricity sensing in fish, and pheromones (chemical signals) in insects and apparently in people. And he takes pains to pin down the mechanism of the sensory capability in each case. "We don't yet have all the answers," he says, "but at least we are learning how to ask the right questions."
9. **The Victorian Internet : The Remarkable Story of the Telegraph and the Nineteenth Century's On-Line Pioneers** By Tom Standage. (Walker, 227 pp, 1998) General audience. “Imagine an almost instantaneous communication system that would allow people and governments all over the world to send and receive messages about politics, war, illness, and family events. The government has tried and failed to control it, and its revolutionary nature is trumpeted loudly by its backers. The Internet? Nope, the humble telegraph fit this bill way back in the 1800s. The parallels between the now-ubiquitous Internet and the telegraph are amazing, offering insight into the ways new technologies can change the very fabric of society within a single generation. In *The Victorian Internet*, Tom Standage examines the history of the telegraph, beginning with a horrifically funny story of a mile-long line of monks holding a wire and getting simultaneous shocks in the interest of investigating electricity, and ending with the advent of the telephone. All the early "online" pioneers are here: Samuel Morse, Thomas Edison, and a seemingly endless parade of code-makers, entrepreneurs, and spies who helped ensure the success of this communications revolution. Fans of [Longitude](#) will enjoy another story of the human side of dramatic technological developments, complete with personal rivalry, vicious competition, and agonizing failures.”

