



The Humanity of Science and Technology



Why Am I Reading This?

These books explore the *what ifs*, the *whys* and *why nots* of science and technology from a humanities perspective. The authors, many of whom are renowned scientists, consider the personal, social, environmental, and ethical implications of their laboratory or field work. Spanning topics from proto-human remains to time machines to iPads, the readings are sure to spark interesting discussions of how science and technology affect our quality of life and our understanding of what it means to be human. (Chuck Guilford, Author, Ret. Lit. Prof., BSU)

Book List:

1. [A Briefer History of Time](#), by Stephen Hawking with Leonard Mlodinow
2. [Alone Together: Why We Expect More from Technology and Less from Each Other](#), by Sherry Turkle
3. [Animals in Translation: Using the Mysteries of Autism to Decode Animal Behavior](#), by Temple Grandin
4. [Born in Africa: The Quest for the Origins of Human Life](#), by Martin Meredith
5. [My Year of Meats](#), by Ruth Ozeki
6. [Physics of the Impossible](#), by Michio Kaku
7. [The Botany of Desire](#), by Michael Pollan
8. [The Control of Nature](#), by John McPhee
9. [The Immortal Life of Henrietta Lacks](#), by Rebecca Skloot
10. [The Lives of a Cell: Notes of a Biology Watcher](#), by Lewis Thomas
11. [The Shallows: What the Internet is Doing to Our Brains](#), by Nicholas G. Carr
12. [The Unexpected Universe](#), by Loren Eiseley

Book Summaries

A Briefer History of Time

Stephen Hawking's worldwide bestseller *A Brief History of Time* remains a landmark volume in scientific writing. But for readers who have asked for a more accessible formulation of its key concepts—the nature of space and time, the role of God in creation, and the history and future of the universe—*A Briefer History of Time* is Professor Hawking's response. Although "briefer," this book is much more than a mere explanation of Hawking's earlier work. *A Briefer History of Time* both clarifies and expands on the great subjects of the original and records the latest developments in the field—from string theory to the search for a unified theory of all the forces of physics. Thirty-seven full-color illustrations enhance the text and make *A Briefer History of Time* an exhilarating and must-have addition in its own right to the great literature of science and ideas.

Author Information

Stephen Hawking is the former Lucasian Professor of Mathematics at the University of Cambridge and author of *A Brief History of Time*, which was an international bestseller. Now Director of Research at the Institute for Theoretical Cosmology at Cambridge, his other books for the general reader include *A Briefer History of Time*, the essay collection *Black Holes and Baby Universe* and *The Universe in a Nutshell*. In 1963, Hawking contracted motor neurone disease and was given two years to live. Yet he went on to Cambridge to become a brilliant researcher and Professorial Fellow at Gonville and Caius College. Since 1979 he has held the post of Lucasian Professor at Cambridge, the chair held by Isaac Newton in 1663. Professor Hawking has over a dozen honorary degrees and was awarded the CBE in 1982. He is a fellow of the Royal Society and a Member of the US National Academy of Science. Stephen Hawking is regarded as one of the most brilliant theoretical physicists since Einstein.

Leonard Mlodinow was born in Chicago, Illinois, to immigrant Jewish parents who were holocaust survivors. He received his PhD in theoretical physics from the University of California at Berkeley and is now at Caltech. His book *The Drunkard's Walk: How Randomness Rules our Lives* was a New York Times Bestseller, Editor's Choice, and Notable Book of the Year, and was short-listed for the Royal Society book award. His other books include two co-authored with physicist Stephen Hawking -- *A Briefer History of Time* and *The Grand Design*. In addition to his books and research articles, he has written for the Wall Street Journal, the New York Times, and Forbes magazine, among other publications, and for television series such as *McGyver* and *Star Trek: The Next Generation*.

Discussion Questions for A Briefer History of Time

1. Chapter 3 describes the quest for a comprehensive and unified theory of everything. What are some existing contradictions that such a theory would need to resolve? Do you see major benefits to such a theory? Do you think it will ever be attained?
2. "Imagine you are playing Ping Pong on a train . . ." What might you learn from doing that? How can shifting perspectives alter your understanding of rest and motion? Of absolute and relative speed? Of absolute and relative time? (see p. 33) As the author says, "These are not easy ideas to grasp," but if you feel up to it, try explaining "the local flow of time."
3. This book describes a view of the universe that has changed radically from ancient times to the present, from a time when Earth was thought to be the center of the solar system to today when Earth is believed to be a small planet orbiting a rather ordinary star on the edge of one of many galaxies in a vast and ever-expanding universe. Is such knowledge important? Does it have any impact on how you live your life?
4. Despite its brevity, the book includes some technical scientific discussions that are hard for a general reader to follow. Fortunately, precise understanding of many concepts is not essential to grasping the broad relevance of the big picture. Take, for instance, Werner Heisenberg's famous *uncertainty principle*, discussed in Chapter 9. What, in your own words, does this principle tell us, and why is it important in quantum mechanics? Why did this principle bother Einstein? Does it bother you?
5. Chapter 10 explains how particles may be seen to move backward and forward in time and then goes on to consider whether it will ever be possible to create time machines in which people can visit the past and the future. What are the main arguments for and against such a possibility? How might this affect the concept of history? Or is it just too "far out" to imagine?
6. Chapter 11's discussion of the quest for a unified theory of the forces of nature tells how the effort appeared stalled due to the absence of a quantum theory of gravity. Currently the most promising way forward is *string theory*, which requires that the universe have either 10 or 26 dimensions, which we can't see, perhaps due to the *anthropic principle* (p. 180). What is this anthropic principle, and how does it relate to the *uncertainty principle* and to the three possibilities listed on p. 134?
7. The Conclusion is in some ways a reflection on both the potential and limitations of scientific discovery. And the book ends with a call for discussion of this topic by "philosophers, scientists, and just ordinary people." Why are such discussions important?

http://www.nytimes.com/2014/02/02/opinion/sunday/scientific-pride-and-prejudice.html?ref=opinion&_r=0

Alone Together: Why We Expect More from Technology and Less from Each Other

Facebook. Twitter. SecondLife. “Smart” phones. Robotic pets. Robotic lovers. Thirty years ago we asked what we would use computers for. Now the question is what *don’t* we use them for. Now, through technology, we create, navigate, and perform our emotional lives. We shape our buildings, Winston Churchill argued, then they shape us. The same is true of our digital technologies. Technology has become the architect of our intimacies. Online, we face a moment of temptation. Drawn by the illusion of companionship without the demands of intimacy, we conduct “risk free” affairs on Second Life and confuse the scattershot postings on a Facebook wall with authentic communication. And now, we are promised “sociable robots” that will marry companionship with convenience. Technology promises to let us do anything from anywhere with anyone. But it also drains us as we try to do everything everywhere. We begin to feel overwhelmed and depleted by the lives technology makes possible. We may be free to work from anywhere, but we are also prone to being lonely everywhere. In a surprising twist, relentless connection leads to a new solitude. We turn to new technology to fill the void, but as technology ramps up, our emotional lives ramp down. *Alone Together* is the result of MIT technology and society specialist Sherry Turkle’s nearly fifteen-year exploration of our lives on the digital terrain. Based on interviews with hundreds of children and adults, it describes new, unsettling relationships between friends, lovers, parents, and children, and new instabilities in how we understand privacy and community, intimacy and solitude. It is a story of emotional dislocation, of risks taken unknowingly. But it is also a story of hope, for even in the places where digital saturation is greatest, there are people—especially the young—who are asking the hard questions about costs, about checks and balances, about returning to what is most sustaining about direct human connection.

Author Information

A professor, author, consultant and researcher, Sherry Turkle has spent the last 30 years researching the psychology of people’s relationships with technology. She is the Abby Rockefeller Mauzé Professor of the Social Studies of Science and Technology in the Program in Science, Technology, and Society at MIT, as well as the founder and current director of the MIT Initiative on Technology and Self, a center of research and reflection on the evolving connections between people and artifacts. Referred to by many as the “Margaret Mead of digital culture,” Sherry has investigated the intersection of digital technology and human relationships from the early days of personal computers to our current world of robotics, artificial intelligence, social networking and mobile connectivity.

Discussion Questions for Alone Together

1. The Introduction speaks of our time as a "robotic moment." What is meant by this? Can you imagine having a relationship with a "companionate" robot? Could you imagine a robot as a pet? As a friend? As a romantic partner? What are the advantages and disadvantages of companionate robots?
2. The book makes much of childhood experiences as shapers of adult attitudes and beliefs regarding technology. Do you believe this applies to you and to members of your generation? How do the games and toys of your childhood differ from those of today? Have you ever experienced a Furby, a Tamagotchi, or an Aibo? Are the boundaries between machines and living creatures becoming blurred?
3. It is sometimes said that because there are not enough human caregivers to serve our growing population of seniors, sociable robots should be used, as in Japan, to help close this gap. Do you agree? In what circumstances? Would you want one? What would it do? Can robots care? What about Paro the harp seal? What arguments does Turkle give for and against their use?
4. One more question on robots: "When the brain in your phone marries the body of your robot, document preparation meets therapeutic massage. Here is a happy fantasy of security, intellectual companionship, and nurturing connection. How can we not be tempted?" (p.142)
5. In discussing Pete and Jade's online relationship in Second Life (p.160), Pete speaks of his "life mix." What is this "life mix"? Is it a new idea? How does his marriage fit in? How common is such complex intermingling of online and offline identities? How does this blending affect traditional bonds with friends and family? Are online relationships and traditional ones more likely to conflict or to complement each other?
6. Many online communities, like Facebook, encourage the creation of a virtual identity, projected through avatars, profiles, photo albums, favorites lists, and so forth. Is this a healthy way of developing a sense of identity and sharing one's life experience? Or do such activities encourage relatively superficial relationships and stunted growth?
7. This book returns often to the paradox that the new social technologies offer increased opportunities for contact, but decreased opportunities for meaningful, satisfying communication: a text is less than a phone call; an email less than a handwritten letter; a chat room less than a face to face meeting. But is it really so clear? If we truly find the new connectivity choices less satisfying than more traditional ones, why do we continue to choose them?

Animals in Translation: Using the Mysteries of Autism to Decode Animal Behavior

Temple Grandin's *Animals in Translation* speaks in the clear voice of a woman who emerged from the other side of autism, bringing with her an extraordinary message about how animals think and feel. Temple's professional training as an animal scientist and her history as a person with autism have given her a perspective like that of no other expert in the field. Standing at the intersection of autism and animals, she offers unparalleled observations and groundbreaking ideas about both. Autistic people can often think the way animals think -- in fact, Grandin and co-author Catherine Johnson see autism as a kind of waystation on the road from animals to humans -- putting autistic people in the perfect position to translate "animal talk." Temple is a faithful guide into their world, exploring animal pain, fear, aggression, love, friendship, communication, learning, and, yes, even animal genius. Not only are animals much smarter than anyone ever imagined, in some cases animals are out-and-out brilliant. The sweep of *Animals in Translation* is immense, merging an animal scientist's thirty years of study with her keen perceptions as a person with autism -- Temple sees what others cannot.

Author Information

Grandin was born in Boston, Massachusetts, to Richard Grandin and Eustacia Cutler. She was diagnosed with autism in 1950. Having been labeled and diagnosed with brain damage at age two, she was placed in a structured nursery school with what she considers to have been good teachers. Grandin's mother spoke to a doctor who suggested speech therapy, and she hired a nanny who spent hours playing turn-based games with Grandin and her sister. At age four, Grandin began talking, and making progress. She considers herself lucky to have had supportive mentors from primary school onwards. However, Grandin has said that middle and high school were the worst parts of her life. She was the "nerdy kid" whom everyone teased. At times, while she walked down the street, people would taunt her by saying "tape recorder," because she would repeat things over and over again. Grandin states that, "I could laugh about it now, but back then it really hurt." After graduating from Hampshire Country School, a boarding school for gifted children in Rindge, New Hampshire, in 1966, Grandin went on to earn her bachelor's degree in psychology from Franklin Pierce College in 1970, her master's degree in animal science from Arizona State University in 1975, and her doctoral degree in animal science from the University of Illinois at Urbana-Champaign in 1989. Received an Honorary doctorate degree from the Ontario Veterinary College, University of Guelph in Guelph, Ontario, Canada at the 2012 Winter Convocation where she was the keynote speaker.

Discussion Questions for *Animals in Translation*

1. In *My Story*, Temple Grandin tells about how her autism gave her a special interest in and bond with animals. What new insights did you gain into autism and animal behavior from her story?
2. In discussing animal behavior, the author focuses on the role of the cortex, claiming that the larger cortexes of humans actually limit their perceptual abilities. What is her rationale for this, and where does autism fit in? What other factors are involved in extreme animal perception? Have you ever witnessed it?
3. The book contains an extensive discussion of animals' feelings, their various types, causes, and manifestations. What information about animal emotions was new to you and what was familiar from personal experience? Does any of this contradict your personal experience? How do animal emotions resemble or differ from human emotions?
4. The chapter on animal aggression raises the issue of how much aggressive behavior is determined by genetics and how much by environment. What are some key determiners of animal aggression, and why is it important to understand them?
5. In discussing animal pain and suffering, Grandin devotes a lot of space to fear. Why? How does fear relate to animal suffering and to animal behavior in general? What can people do to prevent and counteract fear and suffering in animals? How does fear in animals compare with fear in normal and autistic humans?
6. What are the main arguments about whether animals can use language or make music? Do the examples of prairie dogs, starlings, dolphins, humpback whales, and Alex the parrot persuade you that animals can use music and language in ways that are comparable to humans?
7. Throughout the book, but especially toward the end, connections are drawn between animal thinking and autistic thinking. What are the major similarities and differences? In what ways might increased understanding of animals lead to improved lives, not only for animals, but also for autistic people, and for all humans?

Born in Africa: The Quest for the Origins of Human Life

Africa does not give up its secrets easily. Buried there lie answers about the origins of humankind. After a century of investigation, scientists have transformed our understanding about the beginnings of human life. But vital clues still remain hidden. In *Born in Africa*, Martin Meredith follows the trail of discoveries about human origins made by scientists over the last hundred years, recounting their intense rivalry, personal feuds, and fierce controversies as well as their feats of skill and endurance. The results have been momentous. Scientists have identified more than twenty species of extinct humans. They have firmly established Africa as the birthplace not only of humankind but also of modern humans. They have revealed how early technology, language ability, and artistic endeavor all originated in Africa; and they have shown how small groups of Africans spread out from Africa in an exodus sixty thousand years ago to populate the rest of the world. We have all inherited an African past.

About the Author

Martin Meredith is a historian, journalist, and biographer who has written several books on Africa and its modern history. Meredith first worked as a foreign correspondent in Africa for the Observer and Sunday Times, then as a research fellow at St Antony's College, Oxford. Living near Oxford, he is now an independent commentator and author. Meredith's writing has been described as authoritative and well-documented, despite the pessimism inherent in his subject matter.

Discussion Questions for Born in Africa

1. This book offers a scientific perspective on *Homo Sapiens*. How much of this detective story were you familiar with before starting the book? How important is an understanding of human origins to living in today's world? Does it really matter to you how humans originated? Why or why not?
2. The term "missing link" is often used to refer to an intermediate species between ape and human. Various candidates have been proposed for this role. (See especially chapters 16 & 17.) Which of those candidates, if any, do you consider the best fit for the term? Might there be more than one "missing link"? Or is the term itself outdated and misleading?
3. What traits are most important when trying to distinguish humans from pre-humans -- brain size, brain structure, upright stance, advanced tool making, articulate language, capture of fire? Or some combination of the above? Or something else entirely?
4. Besides discussing scientific theories and discoveries, the book describes several scientists and their rivalries, struggles, and triumphs. Which figures stand out for you, and what do their stories reveal about the challenges and rewards of "making" or "doing" science?
5. Disagreement, dissent, argument, debate, exaggerated claims, fraudulent schemes -- these, too, are part of the story, as the scientific community seeks to examine the evidence and separate the false from the true. How rigorous is the process by which this verification is ultimately done? Consider the case of Piltdown Man, for instance.
6. The chapter "Hadar" tells the story of Lucy's discovery by Donald Johanson. Why was this important? What do you think of her reconstructed head as pictured in the book?
7. Recently there has developed a clash between the paleoanthropologists, or bone hunters, and the biochemists and geneticists, who do their work in the laboratory analyzing DNA. Which of these paths offers the greatest promise of understanding human ancestry?
8. On p. 116 we see the statement, "There was no human consciousness inside that human body." How might one make determinations about consciousness from fossil remains? What criteria might one use to identify a human consciousness?
9. How can the intellectual/cultural climate of an era influence the acceptance of scientific ideas?
10. What social or political implications might the multiregional evolution hypothesis have had if evidence would have supported it?

The Botany of Desire

Subtitled “A Plant’s-Eye View of the World,” Michael Pollan’s bestselling book has been described by one reviewer as a “don’t-wanna-put-it-down unspooling of the socio-political, economic and historical forces that led to the cultivation of four crops.” It may surprise us to discover that any kind of discourse focusing on the subjects of apples, tulips, marijuana, and potatoes would be likely to rivet our attention (with the possible exception of pot), but that proves to be the case here because the author is part botanist, part ordinary backyard gardener, part historian, and part journalist. In his introduction, Pollan tells us he reversed the notion that we elect to plant this or that crop and posits the question, “Did I choose to plant these potatoes, or did the potato make me do it?” (xv) He decided both statements are true, and he explains that his book “is as much about the human desires that connect us to these plants as it is about the plants themselves.” (xvii) Accordingly, he constructs each of his four chapters around a specified “desire”: the apple for sweetness, the tulip for beauty, marijuana for intoxication, and the potato for control. The desires upon which Pollan bases his book are variously interpreted. For example, he observes that the introduction of the potato into Ireland from the New World at the end of the sixteenth century gave the Irish, whose land was not hospitable to grain crops, “a welcome measure of control over their lives” (200). Meanwhile, however, Pollan narrates his experiences planting a new “genetically engineered” potato from Monsanto in his own garden—a different kind of “control” altogether.

Author Information

Michael Pollan was born in 1955 and grew up on Long Island. He received his B.A. from Bennington College and studied at Oxford University before completing his master’s degree in English at Columbia University in 1981. His father is the well-known attorney and financial and life consultant, Stephen M. Pollan, author with Mark Levine of such books as *Fire Your Boss* and *It’s All in Your Head: Thinking Your Way to Happiness*. His sister is actress Tracy Pollan. Michael Pollan’s books include *A Place of My Own* (1997), which recounts his building of a “one-room outbuilding” to use as his study (the ten-page index makes good reading in its own right), and *The Omnivore’s Dilemma: A Natural History of Four Meals* (2006), a critique of modern agribusiness, which the New York Times names one of the five best nonfiction books of the year. A contributing writer to the New York Times Magazine since 1987, Pollan’s essays have appeared in *Best American Science Writing* (2004) and *Best American Essays* (1990, 2003). He is married to painter Judith Belzer; they have one son.

Discussion Questions for *The Botany of Desire*

1. Very likely each reader will prefer one of the four chapters of this book to all of the others. Which one do you like best, and why? Do you find yourself trusting Pollan's science throughout this book, or do you find it more credible in one chapter than in the others? From which of the chapters do you think you learned the most?
2. Is this book of much interest to the non-botanist and non-gardener? Probably a botanist or gardener will feel more comfortable with this book, just as a fly fisherman (or any angler, for that matter) would with Norman Maclean's *A River Runs Through It*. But what might you argue in "in" this book for nearly everyone?
3. Some readers will doubtless think the chapter on marijuana is Pollan's riskiest in several respects. For example, he makes political assertions that are sure to offend some readers, and he appears to approve of a controlled, and at least technically illegal, substance. In an interview, however, he shied away from expressing support for its legalization. Do you think he shows that he knows enough about this controversial subject to take a firmer stance on it? Should he have opted for some safer "desire"?
4. What do you make of Pollan's frequent return to the tension between the Apollonian and the Dionysian poles or modes of human nature or thought processes? The terms come to us from Friedrich Nietzsche's *The Birth of Tragedy From the Spirit of Music* (1872), sometimes called simply "the Birth of Tragedy." You might find it useful to investigate this subject. Do you think this dichotomy is of much relevance, or do you think it amounts to an oversimplification?
5. The fourth chapter of Pollan's book, part of which took him to huge potato farms in southern Idaho, may be the most troublesome. At one point he eats potatoes and asks himself whether the genetically engineered spuds or the ones treated with dangerous chemicals (organophosphates) would be the more hazardous to his health. Why does this perplexing question arise? What alternative does there appear to be?
6. What would you say Pollan accomplishes in his half-dozen or so pages of epilogue? Does this book strike you as "important" in some ways, or simply as "of interest"? Do you detect an ethical stance toward the environment in this book? Certain other books in this series deal with wilderness, but this one does not, or at least it does not do so directly. Does that make it less pertinent to the issues of this theme, or in some ways even more pertinent?

The Control of Nature

The Control of Nature is John McPhee's bestselling account of places where people are locked in combat with nature. Taking us deep into these contested territories, McPhee details the strategies and tactics through which people attempt to control nature. Most striking is his depiction of the main contestants: nature in complex and awesome guises, and those attempting to wrest control from her - stubborn, sometimes foolhardy, more often ingenious, and always arresting characters. For some years, he had been planning a book about places in the world where people have been engaged in all-out battles with nature, about (in the words of the book itself) "any struggle against natural forces--heroic or venal, rash or well advised--when human beings conscript themselves to fight against the earth, to take what is not given, to rout the destroying enemy, to surround the base of Mt. Olympus demanding and expecting the surrender of the gods." In the natural cycles of the Mississippi's deltaic plain, In Iceland, at some of the more expensive real estate in Los Angeles. Taking us deep into these contested territories, McPhee details the strategies and tactics through which people attempt to control nature.

About the Author

John McPhee was born in Princeton, New Jersey, and was educated at Princeton University and Cambridge University. His writing career began at Time magazine and led to his long association with The New Yorker, where he has been a staff writer since 1965. Also in 1965, he published his first book, *A Sense of Where You Are*, with Farrar, Straus and Giroux, and in the years since, he has written nearly 30 books, including *Oranges* (1967), *Coming into the Country* (1977), *The Control of Nature* (1989), *The Founding Fish* (2002), *Uncommon Carriers* (2007), and *Silk Parachute* (2011). *Encounters with the Archdruid* (1972) and *The Curve of Binding Energy* (1974) were nominated for National Book Awards in the category of science. McPhee received the Award in Literature from the Academy of Arts and Letters in 1977. In 1999, he was awarded the Pulitzer Prize for *Annals of the Former World*. He lives in Princeton, New Jersey.

Discussion Questions for The Control of Nature

1. Just considering the book's title by itself, what was your first impression upon seeing it? Did you think of controlling nature as possible? Desirable? How have personal experience or knowledge shaped your response?
2. In "Atchafalaya," McPhee says, "the Corps has been conceded the almighty role of God." What does he mean by this? What are some of the powers and capabilities that have been assigned to the Corps of Engineers? Do you believe these are Godlike? Realistic? Why, or why not? What do you make of Mark Twain's quoted comments? Does any of this have any relevance in Idaho?
3. Given all the ambitions, benefits, risks, variables, and losses, do you believe that the Old River Control Project can be considered an example of humans successfully controlling nature? Or is that something that remains to be determined by future events?
4. In "Cooling the Lava," a small group attempts to save an Icelandic settlement by pumping water onto an advancing lava wall, igniting a controversy over whether efforts were heroic, pointless, or simply wrong-headed. Given the volcanic instability there and the ever-present dangers, why did residents stay and try so hard to combat the lava? Contrast this with the approach taken in Hawaii with Mauna Loa and Kilauea.
5. Throughout the book, and especially in "Los Angeles Against the Mountains," McPhee juxtaposes stories of people like the Genofiles with technical discussions of hydrology and geology. How does this narrative strategy affect your interest and understanding as you read? How does it affect your understanding of the underlying issues?
6. As McPhee chronicles the people and events along the San Gabriel front, he also questions the decision-making process of individuals and communities that build and live there. What are the trade-offs that they consider? How well informed are they? What do you think of the resulting situation?
7. In at least one respect, the entire book, taken as a whole, might be regarded as a cautionary tale. But what is the caution? What do we need to know and do in our efforts to manage and control nature?

The Immortal Life of Henrietta Lacks

From a single, abbreviated life grew a seemingly immortal line of cells that made some of the most crucial innovations in modern science possible. And from that same life, and those cells, Rebecca Skloot has fashioned in *The Immortal Life of Henrietta Lacks* a fascinating and moving story of medicine and family, of how life is sustained in laboratories and in memory. Henrietta Lacks was a mother of five in Baltimore, a poor African American migrant from the tobacco farms of Virginia, who died from a cruelly aggressive cancer at the age of 30 in 1951. A sample of her cancerous tissue, taken without her knowledge or consent, as was the custom then, turned out to provide one of the holy grails of mid-century biology: human cells that could survive--even thrive--in the lab. Known as HeLa cells, their stunning potency gave scientists a building block for countless breakthroughs, beginning with the cure for polio. Meanwhile, Henrietta's family continued to live in poverty and frequently poor health, and their discovery decades later of her unknowing contribution--and her cells' strange survival--left them full of pride, anger, and suspicion. For a decade, Skloot doggedly but compassionately gathered the threads of these stories, slowly gaining the trust of the family while helping them learn the truth about Henrietta, and with their aid she tells a rich and haunting story that asks the questions, Who owns our bodies? And who carries our memories?

About the Author

Rebecca Skloot is an award-winning science writer whose work has appeared in *The New York Times Magazine*; *O, The Oprah Magazine*; *Discover*; and many other publications. She specializes in narrative science writing and has explored a wide range of topics, including goldfish surgery, tissue ownership rights, race and medicine, food politics, and packs of wild dogs in Manhattan. She has worked as a correspondent for WNYC's *Radiolab* and PBS's *Nova ScienceNOW*. She and her father, [Floyd Skloot](#), are co-editors of [The Best American Science Writing 2011](#).

Discussion Questions for The Immortal Life of Henrietta Lacks

1. This book's author places herself right in the story. No distant, objective, third-person narrator, Skloot writes in the first person, getting involved with the people and issues, sharing her feelings, even shaping events. Do you like this way of writing? Does it impact her credibility in discussing the scientific and social issues at the center of the book?
2. Why are the HeLa cells so important to science? What benefits do they have for scientists over other cells that might be used? What benefits have they yielded for society in general? Had you ever heard of them before reading this book?
3. Many chapters tell stories, and in the process introduce incidents, places, and people from Henrietta's past. How do these stories relate to the other more technical parts of the book? Do they compete for attention with the medical and scientific information? Or do they help provide a larger context for understanding the technical issues? For instance, who is Keenen Kester Cofield, and what does his story contribute to the book?
4. What major ethical concerns were raised by the manner in which Henrietta's cells were obtained and used? Do you think she was treated fairly by George Gey and Johns Hopkins? Should her family have been compensated for what happened? Does the good done by the cells outweigh the harm done to Henrietta and her family?
5. In the course of events, Skloot finally gets to know Henrietta's daughter Deborah quite well. What is the basis of the strong bond that develops between them? Do you think it compromises the author's ability to be fair and objective?
6. Should cells remain the property of patients, or should doctors be allowed to harvest cells from patients without their consent and use those cells for research to advance medical science? "When you leave tissues in a doctor's office or lab, you abandon them as waste, and anyone can take your garbage and sell it." Is this fair and reasonable?
7. What role did the fact that Henrietta and her family were poor, uneducated blacks in the 1950's play in the way they were treated? How much have standards and practices changed since then? Can you imagine similar events happening today?
7. Race and racism are woven throughout the book, both in the story presented and in the process of the research for the book. Skloot was yet another white person asking the Lacks family about Henrietta. Did race help or hinder Skloot in the writing and researching of the book? Both?
8. Was it a good thing for the members of the Lacks family that the author wrote this book? What did they gain?
9. What role did the deferential attitude toward doctors in the early 20th century play in the interaction between Henrietta and her family and Johns Hopkins? Has that attitude toward doctors changed over the decades? Do patients' socioeconomic differences affect that relationship today?

ADDITIONAL QUESTIONS:

10. What were your reactions to the book?
11. Is this book pro-science or anti-science? How did this book affect your attitude toward scientific experimentation?
12. Why start the book with Skloot's own story about the topic? What kinds of expectations does that create for you as a reader?
13. Skloot alternates back and forth between chapters on Henrietta, Scientists, Deborah, etc. Why do this instead of grouping chapters by theme or chronologically?
14. Page 31 includes the "consent" form Henrietta signed. Is this sufficient?
15. Page 197 describes the historical context of the Rolling Stone article about HeLa. How much is this a story about race? How much is it about economics and social class?
16. Page 205 shares two contrasting legal opinions about people's right to control their own body tissues. Which one is more compelling to you?
17. On Page 271, Paul Lurz is quoted as saying, "Sometimes learning can be just as painful as not knowing." Is the pain of learning worth it for the Lacks family?

Lives of a Cell: Notes of a Biology Watcher

This book contains 29 short essays by physician-scientist Lewis Thomas, originally published in the early 1970s in *The New England Journal of Medicine*. The essays center on science and range in focus from the molecular (e.g., DNA) to the subcellular to the organism to social interactions and all the way up to the search for extra-terrestrial life. Some themes reappear in several essays: science as a grand, engaging enterprise worthy of the brightest minds; communication between organisms creating the intricate dance of the social organism; the relationship of man to both nature and the grand scheme of the universe. Lewis is fascinated by communication not only at the cellular level, but also at the pheromonal and cerebral level: "Language, once it comes alive, behaves like an active, motile organism" (90). The ant and its colony, as an example of a simultaneous individual and integrated social organism, form a link for Thomas between the enclosed unit of a cell and the complex interactions of a society. Indeed, macro-micro comparisons continue throughout the essays, and even conclude the final essay, "The World's Biggest Membrane," which lauds the atmosphere as protector, filter, and provider: "Taken all in all, the sky is a miraculous achievement. It works, and for what it is designed to accomplish it is as infallible as anything in nature. . . it is far and away the grandest product of collaboration in all of nature" (48).

About the Author

Lewis Thomas (November 25, 1913–December 3, 1993) was a physician, poet, etymologist, essayist, administrator, educator, policy advisor, and researcher. Thomas was born in Flushing, New York and attended Princeton University and Harvard Medical School. He became Dean of Yale Medical School and New York University School of Medicine, and President of Memorial Sloan-Kettering Institute. His formative years as an independent medical researcher were at Tulane University School of Medicine. He was invited to write regular essays in the *New England Journal of Medicine* and won a National Book Award for the 1974 collection of those essays, *The Lives of a Cell: Notes of a Biology Watcher*. He also won a Christopher Award for this book. Two other collections of essays (from *NEJM* and other sources) are *The Medusa and the Snail* and *Late Night Thoughts on Listening to Mahler's Ninth Symphony*.

Discussion Questions for Lives of a Cell: Notes of a Biology Watcher

1. The book's first paragraph claims, "Man is embedded in nature," a concept developed more fully in the essay "Natural Man." Is this an obvious, indisputable truth? What are the implications of seeing humans in this way?
2. How does the building of a termite's nest resemble doing science? Why is science a social activity? Is there such a thing as a "hive mind" or a "superorganism"? How might this relate to the Internet? Consider especially websites like Wikipedia, Facebook, and Twitter.
3. If we are going to send out signals to other possible life forms in remote space, Thomas recommends music, especially Bach, or possibly paintings by Cezanne. Why? What do you think of these choices? What do they tell about humans and about life on Earth? What would you choose to send?
4. In "Autonomy," Thomas says, "I have never really been satisfied with the operation of my brain, and it might be fun to try running it myself just once." What's his point? How does it relate to Zen archery?
5. What are the major suggestions for improving health care delivery in "Your Very Good Health"? How many have been implemented? Has the system changed for the better or the worse since then? What is "the great secret, known to internists and learned early in marriage by internists' wives, but still hidden from the general public"?
6. Thomas has a special interest in, and affinity for, language. He discusses it in several essays. What are his main sources of interest? How does this interest in language relate to his work as a biologist? See especially, "Living Language."
7. This book was published in 1974, ages ago in terms of scientific discovery. What notable developments have taken place in the intervening years that might undermine or confirm ideas advanced here?

My Year of Meats

My Year of Meats is a novel which blends boisterous comedy, human drama, sometimes violent action, and unflinching reportage as it reveals the unethical practices of the American meat industry. Its narrator, Jane Tagaki-Little, is a Japanese-American filmmaker hired by a Japanese concern to produce a series of television programs promoting American meat (especially beef) entitled “My American Wife.” Sponsored by a beef-importing concern, the show is designed to highlight a different wholesome American family each week, and Jane crosses the country in search of subjects. Along the way, however, she begins to learn frightening things about the use of hormones in meat, along with practices in feedlots and slaughterhouses, and she finds herself increasingly drawn to families whose lives deviate from the stereotypically “American” paradigm that her sponsors demand (a black extended family, a lesbian vegetarian couple). As Jane begins to sabotage the series (and find her own vocation as an independent filmmaker), she enters a correspondence with the abused, childless wife of her brutal Japanese sponsor, and the novel takes up issues of sexual exploitation as well as questions of food safety and ethical practice.

Author Information

Ruth Ozeki is a filmmaker and novelist who was raised in New Haven, Connecticut, daughter of a Japanese mother and American father. She studied English and Asian Studies at Smith College, then received a Japanese Ministry of Education Fellowship to do graduate work on classical Japanese literature in Japan. While in that country, she also taught English, founded a language school, worked as a bar hostess, and studied flower arranging and Noh drama. In 1985, she returned to New York and worked on low-budget horror films. She graduated to television production, where she spent several years directing documentaries for a Japanese company, and then began directing her own films. Her work has won numerous prizes and has been aired on PBS and at prestigious festivals, including the Sundance Film Festival. *My Year of Meats* was her first novel; it was translated into eleven languages and won many awards, including the American Book Award. Her second novel, *All Over Creation*, is set on a family farm in Idaho, and it also won an American Book Award. Married to an artist, Ozeki lives in New York and in British Columbia.

Discussion Questions for My Year of Meats

1. Quite a few recent books (including *The Omnivore's Dilemma*, on the list of additional readings for this series) have exposed dangerous practices in the American meat industry. Is there an advantage to informing the reading public about these concerns through a work of fiction like this, rather than simply in a nonfiction form?
2. How do you respond to the troubling facts about American meat presented in this novel? What do these practices suggest about contemporary American culture and attitudes? What might be done to change them, and what might be the consequences of such changes?
3. What picture of America do the producers of “My American Wife” want to convey to Japanese viewers through its portrayal of American eating habits? Did this picture ever correspond to real American life, or has it always been a fiction? Why might such an image appeal to an international (or specifically Japanese) audience, even if it is a fiction, in what it suggests about America?
4. Knowing that Ozeki is a filmmaker, can you see evidence of documentary filmmaking techniques in this book? Do they enhance its message?
5. One criticism that might be leveled at this book is that almost all of its women are “good” characters. If not heroic (and many are), they are victims with good intentions who eventually find their own voices. Many male characters, on the other hand, are unethical, oblivious, or even brutal. Do you think that Ozeki is stereotyping?
6. One of the assumptions of “My American Wife” is that eating solid traditional meat-based meals makes a family ideal. What do you believe about the connection between eating patterns and family life? Do families somehow mirror the way they eat in their happiness or unhappiness, stability or instability? If so, what constitutes desirable food practices, or undesirable, in your view?
7. What parallels exist between Jane and Akiko? What does Ozeki seem to be saying through these two women about women in general, and their relationship to food?

Physics of the Impossible

A fascinating exploration of the science of the impossible—from death rays and force fields to invisibility cloaks—revealing to what extent such technologies might be achievable decades or millennia into the future. One hundred years ago, scientists would have said that lasers, televisions, and the atomic bomb were beyond the realm of physical possibility. In *Physics of the Impossible*, the renowned physicist Michio Kaku explores to what extent the technologies and devices of science fiction that are deemed equally impossible today might well become commonplace in the future. From teleportation to telekinesis, Kaku uses the world of science fiction to explore the fundamentals—and the limits—of the laws of physics as we know them today. He ranks the impossible technologies by categories—Class I, II, and III, depending on when they might be achieved, within the next century, millennia, or perhaps never.

About the Author

Michio Kaku is a futurist, popularizer of science, and theoretical physicist, as well as a bestselling author and the host of two radio programs. He is the co-founder of string field theory (a branch of string theory), and continues Einstein's search to unite the four fundamental forces of nature into one unified theory. He holds the Henry Semat Chair and Professorship in theoretical physics and a joint appointment at City College of New York and the Graduate Center of C.U.N.Y. He is also a visiting professor at the Institute for Advanced Study in Princeton and is a Fellow of the American Physical Society.

Discussion Questions for Physics of the Impossible

1. Michio Kaku points out in the Preface that "many highly accomplished scientists originally became interested in science through exposure to science fiction," and throughout the book he considers ways in which ideas taken from science fiction have helped scientists frame questions and solve problems. What features of life today, which were once considered impossible, have roots in science fiction?
2. Part I of the book examines ten Class I impossibilities that are familiar components of science fiction. How many of these had you heard of? Based on your reading, which of these, if any, do you believe will become possible in the next hundred years? Are you aware of any recent research developments in these areas?
3. The question of robots and artificial intelligence is especially contentious these days, as there is a tremendous amount of work going on in this area. What is the difference between a "true robot" and a "pre-programmed robot"? How close are we to true robots? Do you see any dangers in building them? Could humans end up as their servants?
4. The book spends two chapters on the subject of interstellar travel, as done by the Starship Enterprise in *Star Trek*. Given the vast distances involved, which of the many possible solutions, from nuclear rockets to suspended animation to nano-ships to anti-matter rockets, seem the most promising? Or is there even any point in considering such interstellar travel? Do you see any benefits?
5. From Charles Dickens's *A Christmas Carol* and Mark Twain's *A Connecticut Yankee in King Arthur's Court* to Kurt Vonnegut's *Slaughterhouse Five*, writers have speculated about time travel. Do you believe it could ever happen? What are the chief obstacles? If you could visit another time, when would it be? Would you prefer to travel forward or backward in time? Or are you quite content in the here and now?
6. Does it seem counter intuitive that perpetual motion machines and precognition would be listed as Class III impossibilities, beyond even time travel and parallel universes? If both perpetual motion machines and precognition are so completely impossible, why do they always seem so nearly with reach?
7. What is the "theory of everything"? Do you believe it will ever be formulated, tested, and proven? And if so, what difference will it make? Will the ultimate meaning of the universe finally be revealed?

The Shallows: What the Internet is Doing to Our Brains

One of the major issues dividing the critics is whether Carr's claim that the Internet has shortchanged our brain power is, essentially, correct. Many bought into his argument about the neurological effects of the Internet, but the more expert among them (Jonah Lehrer, for one) cited scientific evidence that such technologies actually benefit the mind. In the end, Carr offers a thought-provoking investigation into our relationship with technology--even if he offers no easy answers. Here he looks to neurological science to gauge the organic impact of computers, citing fascinating experiments that contrast the neural pathways built by reading books versus those forged by surfing the hypnotic Internet, where portals lead us on from one text, image, or video to another while we're being bombarded by messages, alerts, and feeds. This glimmering realm of interruption and distraction impedes the sort of comprehension and retention "deep reading" engenders, Carr explains. And not only are we reconfiguring our brains, we are also forging a "new intellectual ethic," an arresting observation Carr expands on while discussing Google's gargantuan book digitization project. What are the consequences of new habits of mind that abandon sustained immersion and concentration for darting about, snagging bits of information? What is gained and what is lost? Carr's fresh, lucid, and engaging assessment of our infatuation with the Web is provocative and revelatory. --Donna Seaman

About the Author

Nicholas Carr writes about technology, culture, and economics. His most recent book, *The Shallows: What the Internet Is Doing to Our Brains*, is a 2011 Pulitzer Prize nominee and a *New York Times* bestseller. Nick is also the author of two other influential books, *The Big Switch: Rewiring the World, from Edison to Google* (2008) and *Does IT Matter?* (2004). His books have been translated into more than 20 languages. Nick has been a columnist for *The Guardian* in London and has written for *The Atlantic*, *The New York Times*, *The Wall Street Journal*, *Wired*, *The Times of London*, *The New Republic*, *The Financial Times*, *Die Zeit* and other periodicals. His essay "Is Google Making Us Stupid?" has been collected in several anthologies, including *The Best American Science and Nature Writing 2009*, *The Best Spiritual Writing 2010*, and *The Best Technology Writing 2009*. He has been a writer-in-residence at the University of California, Berkeley, and is a sought-after speaker for academic and corporate events. Earlier in his career, he was executive editor of the *Harvard Business Review*. He holds a B.A. from Dartmouth College and an M.A., in English and American Literature and Language, from Harvard University.

Discussion Questions for The Shallows

1. Carr claims that due to the Internet we're changing the way we think and read. What are these changes, and what are the intellectual trade-offs we make when we get involved in the online world? On balance, do the gains outweigh the losses? What are the Net's "deeper cognitive consequences"?
2. What is *neuroplasticity*, and how does it relate to computers and online activity? What are the implications for individuals? For cultures? For the future? What are the positive and negative implications of neuroplasticity? Have you noticed your thought processes changing? Do you miss your old brain?
3. What is meant by "the intellectual ethic of a technology"? How is this related to mapmaking? To timekeeping? To the Internet? What have been the roles of these technologies in shaping the course of civilization? Do you consider yourself more of an instrumentalist or a determinist when it comes to technological change? Does progress have its own irresistible logic to which humans bend?
4. How does the development of writing technology compare to mapmaking and timekeeping? What is deep reading? How is it related to thinking, silent reading, research, and the development of libraries? And where do Johannes Gutenberg and Johann Faust fit in?
5. As of 2009, "most Americans, no matter what their age, spend about 8.5 hours a day looking at a television, a computer monitor, or the screen of their mobile phone. Frequently, they use two or all three of the devices simultaneously." Does this include you? Meanwhile time spent reading printed books has declined. How is reading transformed when done on a screen? Consider non-linear reading, power browsing, abstracting important data and key ideas. How are libraries being transformed by these trends?
6. Carr believes the Internet "promotes cursory reading, hurried and distracted thinking, and superficial learning." Do you agree? And he believes that because the Internet can be so addictive, it is altering our thinking in ways that we are just beginning to appreciate. What are some benefits from the kind of mental exercise that one gets by using the Internet? Are newer, more effective forms of thinking and communicating, emerging?
7. Carr concludes his Chapter on Google with a discussion of Google's attempts to create artificial intelligence. What is artificial intelligence? Why does it remain so elusive? Do you believe Google or anyone else will create it soon?
8. Does Carr offer any suggestions about how to deal with the information he presents? Is his digression (198-200) a model we should try to follow?
9. Carr makes sure to show us that he's not Luddite (11-16)—why?
10. Who is left out of this intellectual revolution, the way some were left out of Gutenberg's revolution (72)?
11. Is Carr just fighting the inevitable and holding onto a nostalgic view of the past?

The Unexpected Universe

Drawing from his long experience as a naturalist, the author responds to the unexpected and symbolic aspects of a wide spectrum of phenomena throughout the universe. Scrupulous scholarship and magical prose are brought to bear on such diverse topics as seeds, the hieroglyphs on shells, lost tombs, the goddess Circe, city dumps, and Neanderthal man. These essays deal with a naturalist's encounters with various aspects of the universe that emphasize the unifying themes of desolation and renewal in the planet's history. Two of Eiseley's most famous essays, "The Star Thrower," and "The Innocent Fox," are included here: the first essay displays Eiseley's almost supernatural intuitiveness and the second his love for animals and their guileless appeal for him.

About the Author

Loren Eiseley (September 3, 1907 – July 9, 1977) was an American anthropologist, educator, philosopher, and natural science writer, who taught and published books from the 1950s through the 1970s. During this period he received more than 36 honorary degrees and was a fellow of many distinguished professional societies. At his death, he was Benjamin Franklin Professor of Anthropology and History of Science at the University of Pennsylvania. He was noted as a "scholar and writer of imagination and grace," which gained him a reputation and record of accomplishment far beyond the campus where he taught for 30 years. *Publishers Weekly* referred to him as "the modern Thoreau." The broad scope of his many writings considered such diverse topics as the mind of Sir Francis Bacon, the prehistoric origins of man, and the contributions of Charles Darwin. Eiseley's national reputation was established mainly through his books, including *The Immense Journey* (1957), *Darwin's Century* (1958), *The Unexpected Universe* (1969), *The Night Country* (1971), and his memoir, *All the Strange Hours* (1975). Science author Orville Prescott praised him as a scientist who "can write with poetic sensibility and with a fine sense of wonder and of reverence before the mysteries of life and nature." Naturalist author Mary Ellen Pitts saw his combination of literary and nature writings as his "quest, not simply for bringing together science and literature... but a continuation of what the 18th and 19th century British naturalists and Thoreau had done." According to his obituary in the *New York Times*, the feeling and philosophical motivation of the entire body of Dr. Eiseley's work was best expressed in one of his essays, *The Enchanted Glass*: "The anthropologist wrote of the need for the contemplative naturalist, a man who, in a less frenzied era, had time to observe, to speculate, and to dream." Shortly before his death, he received an award from the Boston Museum of Science for his "outstanding contribution to the public understanding of science" and another from the U.S. Humane Society for his "significant contribution for the improvement of life and environment in this country."

Discussion Questions for The Unexpected Universe

1. Stressing that time's course is open-ended and often unpredictable, this book acknowledges the role of the irrational and fantastic in undermining scientific laws established by reason. It implies that scientific assumptions of tidiness and predictability in the universe are ultimately misleading and incomplete. Hence modern faith in science as a guide to the future is misplaced and dangerous. Do you agree?
2. "The Ghost Continent" uses the tale of Odysseus as a reference point for discussions of scientific exploration and discovery. What is Eiseley's point in doing so? In what ways are Odysseus's adventures instructive for Eiseley as a scientist?
3. What is the "spider universe" referred to in "The Hidden Teacher"? What does Eiseley mean when he says "in the world of spider I did not exist"? Could such a universe be a way of perceiving and thinking? How might this idea apply to the "human universe"? And who, or what, is "the hidden teacher"?
4. In "The Star Thrower" what is the trickster in the mind? What is this quirky, unpredictable, indeterminate element that outwits us all, and how does it relate to scientific method? Do we live in a "trickster universe"? Can myth and folklore teach us things science can't? Explain: "It was the subtle cleft in nature before which biological thinking had faltered."
5. "The Golden Alphabet" connects the life and work of Charles Darwin with Henry David Thoreau. Though the two men are very different in many ways, Eiseley sees a common thread running through their lives and writings. What is it, and how is it related to a shell found on a beach?
6. These essays often move between dream and reality, literary allusion and scientific fact. Does this make them hard to follow? Do they seem fractured and disjointed, or do the various ways of knowing, experiencing, and feeling work together as integral parts of a whole?
7. In the last essay, Eiseley refers to himself as "an observer intent upon my own solitary hieroglyphics . . . a student of desolation." How well does this describe his work as a naturalist and writer? What does he seek among the bones, shells, and books? And what does he find? What does his work offer to the living?
8. Eiseley says that 20th century knowledge has not led to happiness (5). How has our outward search for information and knowledge conflicted with our inward yearnings for self-awareness, tranquility, and happiness? What does Eiseley mean when he says "knowledge without sympathetic perception is barren"(18)?