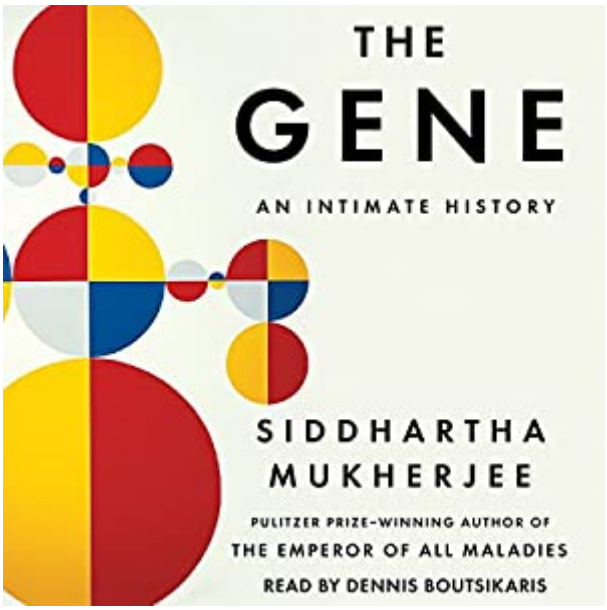
The Gene: An Intimate History



Synopsis

From the Pulitzer Prize-winning, best-selling author of The Emperor of All Maladies, a magnificent history of the gene and a response to the defining question of the future: What becomes of being human when we learn to "read" and "write" our own genetic information? The extraordinary Siddhartha Mukherjee has written a biography of the gene as deft, brilliant, and illuminating as his extraordinarily successful biography of cancer. Weaving science, social history, and personal narrative to tell us the story of one of the most important conceptual breakthroughs of modern times, Mukherjee animates the quest to understand human heredity and its surprising influence on our lives, personalities, identities, fates, and choices. Throughout the narrative, the story of Mukherjee's own family - with its tragic and bewildering history of mental illness - cuts like a bright red line, reminding us of the many questions that hang over our ability to translate the science of genetics from the laboratory to the real world. In superb prose and with an instinct for the dramatic scene, he describes the centuries of research and experimentation - from Aristotle and Pythagoras to Mendel and Darwin, from Boveri and Thomas Morgan to Crick, Watson, and Rosa Franklin, all the way through the revolutionary 21st-century innovators who mapped the human genome. As The New Yorker said of The Emperor of All Maladies, "It's hard to think of many books for a general audience that have rendered any area of modern science and technology with such intelligence, accessibility, and compassion.... An extraordinary achievement." A riveting, revelatory, and magisterial history of a scientific idea coming to life and an essential preparation for the moral complexity introduced by our ability to create or "write" the human genome, The Gene is a must-listen for everyone concerned about the definition and future of humanity. This is the most crucial science of our time, intimately explained by a master.

Book Information

Audible Audio Edition
Listening Length: 19 hoursÂ andÂ 23 minutes
Program Type: Audiobook
Version: Unabridged
Publisher: Simon & Schuster Audio
Audible.com Release Date: May 17, 2016
Whispersync for Voice: Ready
Language: English
ASIN: B01D3BXLP8

Best Sellers Rank: #8 inÂ Books > Medical Books > Basic Sciences > Genetics #9 inÂ Books > Medical Books > History #13 inÂ Books > Medical Books > Medicine > Internal Medicine > Pathology > Diseases

Customer Reviews

Genetics is humanity and life writ large, and this book on the gene by physician and writer Siddhartha Mukherjee paints on a canvas as large as life itself. It deals with both the history of genetics and its applications in health and disease. It shows us that studying the gene not only holds the potential to transform the treatment of human disease and to feed the worldÃ¢Â Â™s burgeoning population, but promises to provide a window into lifeÃ¢Â Â™s deepest secrets and into our very identity as human beings.The volume benefits from MukherjeeÃ¢Â Â™s elegant literary style, novelistÃ¢Â Â™s eye for character sketches and expansive feel for human history. While there is ample explanation of the science, the focus is really on the brilliant human beings who made it all possible. The authorÃ¢Â Â™s own troubling family history of mental illness serves as a backdrop and keeps on rearing its head like a looming, unresolved question. The story begins with a trip to an asylum to see his troubled cousin; two of his uncles have also suffered from various "unravelings of the mind". This burden of personal inheritance sets the stage for many of the questions about nature, nurture and destiny asked in the pages that follow.The book can roughly be divided into two parts. The first part is a sweeping and vivid history of genetics. The second half is a meditation on what studying the gene means for human biology and medicine.The account is more or less chronological and this approach naturally serves the historical portion well. Mukherjee does a commendable job shedding light on the signal historical achievements of the men and women who deciphered the secret of life. Kicking off from the GreeksÃ¢Â Â™ nebulous but intriguing ideas on heredity, the book settles on the genetics pioneer Gregor Mendel. Mendel was an abbot in a little known town in Central Europe whose pioneering experiments on pea plants provided the first window into the gene and evolution. He discovered that discrete traits could be transmitted in statistically predictable ways from one generation to next. Darwin came tantalizingly close to discovering MendelÃ¢Â Â™s ideas (the two were contemporaries), but inheritance was one of the few things he got wrong. Instead, a triumvirate of scientists rediscovered MendelÃ¢Â Â™s work almost thirty years after his death and spread the word far and wide. MendelÃ¢Â Â™s work shows us that genius can emerge from the most unlikely quarters; one wonders how rapidly his work might have been disseminated had the Internet been around.The baton of the gene was next picked up by Francis Galton, DarwinÃ¢Â Â™s cousin. Galton was the father of eugenics. Eugenics has now

acquired a bad reputation, but Galton was a polymath who made important contributions to science by introducing statistics and measurements in the study of genetic differences. Many of the early eugenicists subscribed to the racial theories that were common in those days; many of them were well intended if patronizing, seeking to Ã¢Â Âˆimprove the weakÃ¢Â Â™, but they did not see the ominous slippery slope which they were on. Sadly their ideas fed into the unfortunate history of eugenics in America and Europe. Eugenics was enthusiastically supported in the United States; Mukherjee discusses the infamous Supreme Court case in which Oliver Wendell Holmes sanctioned the forced sterilization of an unfortunate woman named Carrie Buck by proclaiming, Ã¢Â ÂœThree generations of imbeciles are enoughÃ¢Â Â•. Another misuse of genetics was by Trofim Lysenko who tried to use LamarckÃ¢Â Â™s theories of acquired characteristics in doomed agricultural campaigns in Stalinist Russia; as an absurd example, he tried to Ã¢Â Âœre educateÃ¢Â Â• wheat using Ã¢Â Âœshock therapyÃ¢Â Â•. The horrific racial depredations of the Nazis which the narrative documents in some detail of course Ã¢Â Âœput the ultimate mark of shameÃ¢Â Â• on eugenics.The book then moves on to Thomas Hunt MorganÃ¢Â Â™s very important experiments on fruit flies. Morgan and his colleagues found a potent tool to study gene propagation in naturally occurring mutations. Mutations in specific genes (for instance ones causing changes in eye color) allowed them to track the flow of genetic material through several generations. Not only did they make the crucial discovery that genes lie on chromosomes, but they also discovered that genes could be inherited (and also segregated) in groups rather than by themselves. Mukherjee also has an eye for historical detail; for example, right at the time that Morgan was experimenting on flies, Russia was experimenting with a bloody revolution. This coincidence gives Mukherjee an opening to discuss hemophilia in the Russian royal family Ã¢Â Â“ a genetically inherited disease. A parallel discussion talks about the fusion of Darwin's and MendelÃ¢Â Â™s ideas by Ronald Fisher, Theodosius Dobzhansky and others into a modern theory of genetics supported by statistical reasoning in the 40s Ã¢Â Â“ whatÃ¢Â Â™s called the Modern Synthesis.Morgan and othersÃ¢Â Â™ work paved the way to recognizing that the gene is not just some abstract, ether-like ghost which transmits itself into the next generation but a material entity. That material entity was called DNA. The scientists most important for recognizing this fact were Frederick Griffiths and Oswald Avery and Mukherjee tells their story well; however I would have appreciated a fuller account of Friedrich Miescher who discovered DNA in pus bandages from soldiers. Griffiths showed that DNA can be responsible for converting non-virulent bacteria to virulent ones; Avery showed that it is a distinct molecule separate from protein (a lot of people believed that proteins with their functional significance were the hereditary material).All these events set the stage for the golden age of molecular biology, the

deciphering of the structure of DNA by James Watson (to whom the quote in the title is attributed), Francis Crick, Rosalind Franklin and others. Many of these pioneers were inspired by a little book by physicist Erwin Schrodinger which argued that the gene could be understood using precise principles of physics and chemistry; his arguments turned biology into a reductionist science. MukherjeeÃ¢Â Â™s account of this seminal discovery is crisp and vivid. He documents FranklinÃ¢Â Â™s struggles and unfair treatment as well as Watson and CrickÃ¢Â Â™s do-what-it-takes attitude to use all possible information to crack the DNA puzzle. As a woman in a manÃ¢Â Â™s establishment Franklin was in turn patronized and sidelined, but unlike Watson and Crick she was averse to building models and applying the principles of chemistry to the problem, two traits that were key to the duoÃ¢Â Â™s success.The structure of DNA of course inaugurated one of the most sparkling periods in the history of intellectual thought since it immediately suggested an exact mechanism for copying the hereditary material as well as a link between DNA and proteins which are the workhorses of life. The major thread following from DNA to protein was the cracking of the genetic code which specifies a correspondence between nucleotides on a gene and the amino acids of a protein: the guiding philosophers in this effort were Francis Crick and Sydney Brenner. A parallel thread follows the crucial work of the French biologists Francois Jacob and Jacques Monod - both of whom had fought in the French resistance during World War 2 - in establishing the mechanism of gene regulation. All these developments laid the foundation for our modern era of genetic engineering.The book devotes a great deal of space to this foundation and does so with verve and authority. It talks about early efforts to sequence the gene at Harvard and Cambridge and describes the founding of Genentech, the first company to exploit the new technology which pioneered many uses of genes for producing drugs and hormones: much of this important work was done with phages, viruses which infect bacteria. There is also an important foray into using genetics to understand embryology and human development, a topic with ponderous implications for our future. With the new technology also came new moral issues, as exemplified by the 1975 Asilomar conference which tried to hammer out agreements for the responsible use of genetic engineering. I am glad Mukherjee emphasizes these events, since their importance is only going to grow as genetic technology becomes more widespread and accessible.These early efforts exploded on to the stage when the Human Genome Project (HGP) was announced, and thatÃ¢Â Â™s where the first part of the book roughly ends. Beginning with the HGP, the second part mainly focuses on the medical history and implications of the gene. MukherjeeÃ¢Â Â™s discussion of the HGP focuses mainly on the rivalries between the scientists and the competing efforts led by Francis Collins of the NIH and Craig Venter, the maverick scientist who broke off and started his own company. This

discussion is somewhat brief but it culminates in the announcement of the map of the human genome at the White House in 2000. It is clear now that this Ã¢Â ÂœmapÃ¢Â Â• was no more than a listing of components; we still have to understand what the components mean. Part of that lake of ignorance was revealed by the discovery of so-called Ã¢Â Âˆepigenetic Ã¢Â Â™ elements that modify not the basic sequence of DNA but the way itÃ¢Â Â™s expressed. Epigenetics is an as yet ill-understood mix of gene and environment which the book describes in some detail. ItÃ¢Â Â™s worth noting that MukherjeeÃ¢Â Â™s discussion of epigenetics has faced some criticism lately, especially based on his article on the topic in the New Yorker.The book then talks about early successes in correlating genes with illness that came with the advent of the human genome and epigenome; genetics has been very useful in finding determinants and drugs for diseases like sickle cell anemia, childhood leukemia, breast cancer and cystic fibrosis. Mukherjee especially has an excellent account of Nancy Wexler, the discoverer of the gene causing HuntingtonÃ¢Â Â™s disease, whose search for its origins led her to families stricken with the malady in remote parts of Venezuela. While such diseases have clear genetic determinants, as Mukherjee expounds upon at length, genetic causes for diseases like cancer, diabetes and especially the mental illness which plagues members of the authorÃ¢Â Â™s family are woefully ill-understood, largely because they are multifactorial and suffer from weakly correlated markers. We have a long way to go before the majority of human diseases can be treated using gene-based treatment. In its latter half the book also describes attempts to link genes to homosexuality, race, IQ, temperament and gender identity. The basic verdict is that while there is undoubtedly a genetic component to all these factors, the complex interplay between genes and environment means that itÃ¢Â Â™s very difficult currently to tease apart influences from the two. More research is clearly needed.The last part of the book focuses on some cutting edge research on genetics thatÃ¢Â Â™s uncovering both potent tools for precise gene engineering as well as deep insights into human evolution. A notable section of the book is devoted to the recent discovery that Neanderthals and humans most likely interbred. Transgenic organisms, stem cells and gene therapy also get a healthy review, and the author talks about successes and failures in these areas (an account of a gene therapy trial gone wrong is poignant and rattling) as well as ethical and political questions which they raise. Finally, a new technology called CRISPR which has taken the world of science by storm gets an honorary mention: by promising to edit and propagate genes with unprecedented precision - even in the germ line - CRISPR has resurrected all the angels and demons from the history of genetics. What we decide about technologies like CRISPR today will impact what our children do tomorrow. The clock is ticking.In a project as ambitious as this there are bound to be a few gaps. Some of the gaps left

me a bit befuddled though. There are a few minor scientific infelicities: for instance Linus PaulingÃ¢Â Â™s structure of DNA was not really flawed because of a lack of magnesium ions but mainly because it sported a form of the phosphate groups that wouldnÃ¢Â Â™t exist at the marginally alkaline pH of the human body. The bookÃ¢Â Â™s treatment of the genetic code leaves out some key exciting moments, such as when a scientific bombshell from biochemist Marshall Nirenberg disrupted a major meeting in the former Soviet Union. I also kept wondering how any discussion of DNAÃ¢Â Â™s history could omit the famous Meselson-Stahl experiment; this experiment which very elegantly illuminated the central feature of DNA replication has been called Ã¢Â Âœthe most beautiful experiment in biologyÃ¢Â Â•. Similarly I could see no mention of Barbara McClintock whose experiments on Ã¢Â Âˆjumping genesÃ¢Â Â™ were critical in understanding how genes can be turned on and off. I was also surprised to find few details on a technique called PCR without which modern genetic research would be virtually impossible: both PCR and its inventor Kary Mullis have a colorful history that would have been worth including. Similarly, details of cutting-edge sequencing techniques which have outpaced MooreÃ¢Â Â™s Law are also largely omitted. I understand that a 600 page history cannot include every single scientific detail, but some of these omissions seem to me to be too important to be left out.More broadly, there is no discussion of the pros and cons of using DNA to convict criminals: that would have made for a compelling human interest story. Nor is there much exploration of using gene sequences to illuminate the Ã¢Â Âˆtree of lifeÃ¢Â Â™ which Darwin tantalizingly pulled the veil back on: in general I would have appreciated a bigger discussion of how DNA connects us to all living creatures. There are likewise no accounts of some of the fascinating applications of DNA in archaeological investigations. Finally, and this is not his fault, the author suffers from the natural disadvantage of not being able to interview many of the pioneers of molecular biology since they arenÃ¢Â Â™t around any more (fortunately, Horace Freeland JudsonÃ¢Â Â™s superb Ã¢Â Âœ The Eighth Day of CreationÃ¢Â Â• fills this gap: Judson got to interview almost every one of them for his book). This makes his account of science sound a bit more linear than the messy, human process that it is.The volume ends by contemplating some philosophical questions: What are the moral and societal implications of being able to engineer genomes even in the fetal stage? How do we control the evils to which genetic technology can be put? What is natural and what isnÃ¢Â Â™t in the age of the artificial gene? How do we balance the relentless, almost inevitable pace of science with the human quest for responsible conduct, dignity and equality? Mukherjee leaves us with a picture of these questions as well as one of his family and their shared burden of mental illness: a mirage searching for realization, a sea of questions looking for a tiny boat filled with answers.Overall I found

Ã¢Â ÂœThe Gene: An Intimate HistoryÃ¢Â Â• to be beautifully written with a literary flair, and in spite of the omissions, the parts of genetic history and medicine which it does discuss are important and instructive. Its human stories are poignant, its lessons for the future pregnant with pitfalls and possibilities. Its sweeping profile of lifeÃ¢Â Â™s innermost secrets could not help but remind me of a Japanese proverb quoted by physicist Richard Feynman: Ã¢Â ÂœTo every man is given the key to the gates of heaven. The same key opens the gates of hell.Ã¢Â Â• The gene is the ultimate key of this kind, and MukherjeeÃ¢Â Â™s book explores its fine contours in all their glory and tragedy. We have a choice in deciding which of these contours we want to follow.

Gene is a must-read history book on genetics. Many accounts have been penned on Relativity and Quantum Mechanics, for instance, to make their importance known to the non-professionals. Gene fills the void for the equally important science of Genetics.The author's biggest success is in weaving a beautiful narrative. Starting with the emotionally-charged personal links to the field to the frequent detailing of personalities of or anecdotes involving famous scientists, the subject is kept 'human'. There are abundant scientific notions to satisfy any reader picking up the book to understand the real subject matter, but not in the general bland fashion of studies-and-conclusions that tend to lose many a lay people.The book also excels because of the simplicity with which countless exotic concepts are explained. From the notions of introns and exons to the polygenic nature of most phenotypes, the feedback from environment to gene mutation and the massive role played by non-gene factors in most our traits, the author uncovers a staggering number of interesting findings in a highly understandable manner.Amid all this, the author keeps the focus on various moral and ethical issues. The narrative is laced with historic episodes of all kinds to emphasise the criticality of the questions confronting us as we make more scientific progress. For example, the book beautifully explains the dangers of genetic modification - which tantamounts to replacing natural selection with human selection. As professionals or parents seek to weed out certain deformities, there are genuine risks of us eliminating some important evolutionary traits mainly out of ignorance of how genes really work at this stage but also out of their possible other utilities in long future.The biggest flaw of the book is insufficient focus on latest developments and near absence of what this science is capable of solving in coming decades. The optimists out there expect congenitally blind people to see and cancers all cured. Some expect us to be able to grow a third arm if we so choose or re-create a dinosaur in a century or so. Genetics is combined with nanotechnology, cryonics, robotics etc by many fantasizers to come up with even more fanciful theories. The author could have added a chapter or two to discuss gene therapy and other recent

experiments to complete the excellent work further.That said, a remarkable book in all aspects.

The Gene: An Intimate History Gene Simmons Coloring Book: Glam Rock and Kiss Guitarist Facepaint Pioneer and Pyro Showman Inspired Adult Coloring Book (Gene Simmons Books) World History, Ancient History, Asian History, United States History, European History, Russian History, Indian History, African History. (world history) The Cooking Gene: A Journey Through African American Culinary History in the Old South History: World History in 50 Events: From the Beginning of Time to the Present (World History, History Books, Earth History) (History in 50 Events Series Book 3) History: Human History in 50 Events: From Ancient Civilizations to Modern Times (World History, History Books, People History) (History in 50 Events Series Book 1) Intimate Matters: A History of Sexuality in America, Third Edition Documenting Intimate Matters: Primary Sources for a History of Sexuality in America Intimate Matters: A History of Sexuality in America Gauguin's Intimate Journals (Dover Fine Art, History of Art) Marie Antoinette: An Intimate History The Upstairs Wife: An Intimate History of Pakistan The Beauty and the Sorrow: An Intimate History of the First World War The Vietnam War: An Intimate History Intimate Indigeneities: Race, Sex, and History in the Small Spaces of Andean Life (Narrating Native Histories) An Intimate War: An Oral History of the Helmand Conflict, 1978-2012 City of Oranges: An Intimate History of Arabs and Jews in Jaffa Brown Acres: An Intimate History of the Los Angeles Sewers Earth: An Intimate History The Body Project: An Intimate History of American Girls