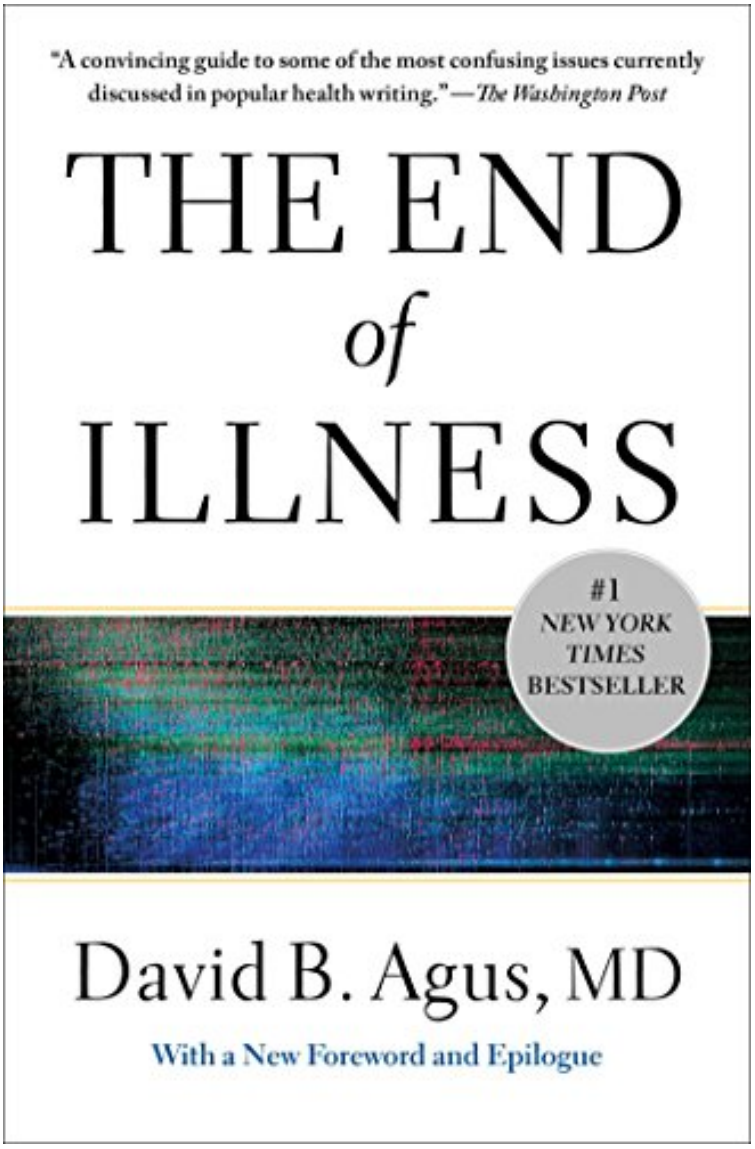
# The End of Illness (English Edition)






*Par David B. Agus*
*audiobook | *ebooks | Download PDF | ePub | DOC*

Dtails sur le produit Rang parmi les ventes : #285711 dans eBooksPubli le: 2012-01-17Sorti le: 2012-01-17Format: Ebook Kindle

[Online library] The End of Illness (English Edition)

**Par David B. Agus : The End of Illness (English Edition)** before purchasing it in order to gage whether or not it would be worth my time, and all praised The End of Illness (English Edition):

**Description :**

Prsentation de l'diteurCan we live robustly until our last breath? Do we have to suffer from debilitating conditions and sickness? Is it possible to add more vibrant years to our lives? In the #1 New York Times bestselling The End of Illness, Dr. David Agus tackles these fundamental questions and dismantles misperceptions about what health really means. Presenting an eye-opening picture of the human body and all the ways it worksand failsDr. Agus shows us how a new perspective on our individual health will allow us to achieve a long, vigorous life. Offering insights and access to powerful new technologies that promise to transform medicine, Dr. Agus emphasizes his belief that there is no right answer, no master guide that is one size fits all. Each one of us must get to know our bodies in uniquely personal ways, and he shows us exactly how to do that. A bold call for all of us to become our own personal health advocates, The End of Illness is a

moving departure from orthodox thinking.ExtraitThe End of Illness 1 What Is Health? A New Definition That Changes Everything Everyone has a vague idea of what it means to live a healthy life. Eating a balanced diet: good. Smoking: bad. Breaking a sweat regularly: good. Binge drinking: bad. Getting a restful nights sleep: bonus. Being happy: double bonus. Some of us may choose to disregard these basic tenets on occasion, but for the most part, we know the difference between the habits that help us stay youthful and strong, and those that can detract from our well-being. We try our best to stay out of harms way, but what happens when we get sick or develop a chronic medical condition or, heaven forbid, are diagnosed with a serious illness? After experiencing the frustration of Why me? many of us begin to ask ourselves other, more probing inquiries about where we might have gone wrong. Was it something in the water? A lifelong love of hamburgers and fries? An overdemanding boss and, as a result, an overwhelming stress level? Too much alcohol? Too little exercise? Secondhand smoke? Exposure to industrial chemicals? A habit of living dangerously, whatever that might mean? Bad luck? Or perhaps, some of us think, this outcome was fated because it was just in my DNA all along. If I could collect a nickel for every time someone in the world thought that genetics was wholly to blame for this illness or that defect, Id be the wealthiest man on earth. Its human nature to point fingers at someone or something else for our flaws and shortcomings, and to avoid any personal culpability. Because DNA tends to be a relatively abstract construct, much like black holes or quarks, which we cannot touch, see, or feel, it might as well be a something else to which we can assign guilt. After all, DNA is given to us by our parents and we have no choice. In this regard, DNA is practically accidental; just as accidents happen, so does DNA, without our having much say in the matter. What most people dont think about, though, is that DNA says more about our risk than our fate. It governs probabilities, not necessarily destinies. As my friend and colleague Danny Hillis (whom well meet later when I cover emerging technologies) likes to describe it, DNA is simply a list of parts or ingredients rather than a complete manual that explains how those parts work together to generate results. To hold your DNA responsible for your health is missing the forest for the trees. Its not the pice de rsistance. I say this knowing full well that DNA does hold certain keys to your health; if it didnt, then I wouldnt have cofounded a company that performs genetic testing so you can take preventive measures based on your genomic risk profile. But right from the get-go I want to entice you to start thinking from a broader perspective that goes far beyond your genes. I want you to view your bodyfrom the outer stretches of your skin to the inner sanctum of your cellular makeupas a whole system. Its a uniquely organized and highly functioning system that leaves so much to the imagination because were only just beginning to solve its riddles. So therefore, as we probe the mystery of the human body more deeply, we discover that this system, and its complex riddles, dont necessarily hinge on DNA alone. The Inescapable Statistics To understand how weve arrived at a place where we focus so much on DNA, and why its critical to respect the body as an elaborate system beyond genetics, it helps to explore the evolution of our thinking processes against the backdrop of the challenges weve facedand continue to facein our quest for health and longevity. Most of our transformative breakthroughs in medicine have occurred only recently, in the last sixty or so years. Following the discovery of penicillin in 1928, which changed the whole landscape of fighting infections based on the knowledge that they were caused by bacteria, we got good at extending our lives by several years and, in many cases, decades. This was made possible through a constellation of contributing circumstances, including a decline in cigarette smoking, changes in our diets for the better, improvements in diagnostics and medical care, and of course advancements in targeted therapies and drugs such as cholesterol-lowering statins. Heart disease has been the leading cause of death in the United States since 1921, and stroke has been the third-leading cause since 1938; together, these vascular diseases account for approximately 40 percent of all deaths. Since 1950, however, age-adjusted death rates from cardiovascular disease have declined 60 to 70 percent, representing one of the most important public health achievements of the twentieth century. Put another way: But heres the sobering truth sitting on the sidelines of these triumphs like a lumbering white elephant: the death rate from cancer from 1950 to 2007 (the most current data available from the Centers for Disease Control and Prevention) didnt change much. We are making enormous progress against other chronic diseases, but little against cancer. Indeed, there are little wins here and there with unique types of cancer. Take, for instance, chronic myelogenous leukemia, a rare type of leukemia that had previously been a death sentence except for a small number of patients who benefited from bone-marrow transplantation. With the FDA approval of Gleevec (brand name for imatinib mesylate) in May 2001the same month it made the cover of Time magazine as the magic bullet to cure cancerwe now have a way to successfully treat most patients and achieve remarkable recovery rates. The drug targets the particular chromosomal rearrangement that is

present in this disease (part of chromosome 9 is fused to part of chromosome 22). In clinical trials, the response rate to Gleevec was over 90 percent. People went from their deathbeds to functional life after taking this small molecule with few side effects. But with the more common deadly cancers, including those that ravage the lung, colon, breast, prostate, brain, and so on, weve had an embarrassingly small impact on death rates. Whenever I throw the chart on the previous page, Change in the US Death Rates by Cause, on a slide up in front of an audience, I hear a few gasps of disbelief. How can this be? What did we do wrong in our research? Is there a mistake, or perhaps a typo, in this data? I showed this graphic during my 2009 TEDMED talk as part of a larger discussion that included thirty-seven other slides and have received hundreds of e-mails since referring to just this one slide. Many of the inquiries are aggressive in toneaccusing me of being a pessimist and somehow manipulating the data. I wish I could present better news from my camp. This graph demonstrates the profound effect that therapeutics such as statins have had in heart disease and stroke. Antibiotics and antivirals, including vaccines, have put a major dent in cases of pneumonia and infections. Even when we consider cancer rates across the globe, we can find some statistics that defy all the stereotypes. In some of the sub-Saharan countries, where we tend to think about diseases such as AIDS and other infections common in underdeveloped nations, more people die of cancer than of HIV, tuberculosis, and malaria combined. In 2010, chronic disease overtook infectious disease as the leading killer worldwide. So this problem isnt just a major cause of concern in America. It affects the global community at large. The lack of change in the death rate from cancer is truly alarming. The more astonishing observation that I want you to note here, though, is that antibiotics and antivirals do not target the human beingthey target the external, invading organism. Statins, on the other hand, target the human system in ways that we are starting to learn more about. Contrary to popular belief, the statins work not just by lowering cholesterol through a single pathway or point of interaction in the body; they have a profound effect on the entire system, lowering inflammation, thereby changing the bodys entire environment. Vaccines also target the system, but do so in a clever wayactivating the immune system artificially by making it seem as though a foreign organism has invaded the body. I stated plainly in the introduction that this isnt a cancer book, but I need to draw from my experience as an oncologist to get you to understand a few core concepts. We can actually trace our relationship to health to the study of cancer. When we consider the legacy of disease in our history and how weve come to understand today a mysterious malady such as cancer, we can begin to see how and why we may have veered off track. We can identify the thinking processes and misconceptions that weve blindly embraced and that have thwarted our efforts to advance medicine and, in turn, our individual goals of optimal health. On a positive note, we can begin to see how we can shift direction and embrace a new frontier in the pursuit of health customized to each person, you and me. We can eventually reach a point where we can make meaningful advances in the war against all illnesses.What is cancer? If you have a mass or an abnormal blood test, youll likely be referred to a specialist who will stick a needle in you and extract a sample to be examined by a pathologist. Your pathologist (whom you will probably never meet) will look for a certain pattern, because diagnosis today is by pattern recognition. Does it look normal? Or does it look abnormal? To make an analogy, consider a plastic water bottle as emblematic of a cell. Its as if your pathologist is looking at a normal plastic bottle and declaring that its a normal cell. And then looking at a deformed, crushed plastic bottle and declaring that its a cancer cell. That is the state of the art today in diagnosing cancer. Theres no molecular test. Theres no sequencing of genes. There is no fancy examination of the chromosomes. This is how we do it. A Cancerous Perspective Cancer, as I explained earlier, is a great metaphor for anything related to sickness. Its every persons archenemy, the bearer of all things bad when it comes to health, happiness, and of course longevity. All of us fear learning that our body has turned against usthat cancer has struck and the future is uncertain. This uncertainty can be most unpleasant. Suddenly we cannot answer questions such as where, how, why, and whenas in when will I be cancer-free? Or, when will I die? The most insidious part of cancer is the very nature of this beast: its self-generated in the sense that its our own cells gone awry. Theres no outside invader. No foreign organism or contagion with a mind of its own and a cellular makeup unlike ours. Cancer is like a sleeping giant lying dormant in all of us. Sometimes, he briefly awakens, inciting a collection of odd cells called a tumor, but, in most cases, before long hes tamed and lulled back to sleep by the bodys arsenal of artful mechanisms. But occasionally, often when we least expect it, this giant manages to get past our trusty gatekeepers. Something in our defense mechanisms breaks down, throwing off the checks and balances that came so automatically and reliably before, and this causes cellular dysfunction that leads to the growth of cancerous tumors. Cancer presents certain challenges not present in other illnesses, especially those that can easily be blamed on outsiders. Still, the question

remains, why cant we make headway in understanding and combatting cancer, however small and slow? In 2009, I stood before thousands of colleagues at a meeting of the American Association for Cancer Research in Denver and bluntly said, Weve made a mistake. Weve all made a mistake, myself included, by focusing down, by reducing the study of disease down to finite points. I proposed that we take a big step back, take a twenty-thousand-foot view of disease. I then made another statement that ruffled a few more feathers in the room: We dont necessarily need to understand cancer to control it. The hisses that I heard leaking from the audience were somewhat disheartening. People evidently got upset, but it was critical to call out where wed strayed as doctorsand as members of societybecause this could help get us back on track. I was as guilty as anyone else in this straying. I didnt leave this particular audience hanging, though. I knew I had to provide some explanation to justify my statements and offer at least some hope for the future. I then shared how we had grown accustomed to a certain mode of thinking in the sciences that owes its origins to discoveries made a long time ago. Weve had a hard time moving past the germ theory of disease, which dominated, and in many ways defined, medicine in the twentieth century. According to this theory, if you can figure out what species of germ you are infected with, then your problem is solved because that tells you how you should treat the disease. This became the general paradigm of medicine. Doctors would perform a laboratory test to determine what the infectious agent was, then apply a treatment that was specific for that agent or class of agents. The treatment only cared about the invading organism, such as the bacterium that causes tuberculosis or the parasite that leads to malaria; it didnt care to define or understand the host (the human being) or even where the infection was happening in the host. That is why we use the same drug in every patient with a particular infectious disease. Which is precisely what doctors try to do: identify the diseasediagnoseand treat the diagnosis according to the best-known method. This strategy also allows science to participate because it can objectively test whether a particular treatment is effective when dealing with a given diagnosis. Does quinine help the symptoms of malaria? Is penicillin the best way to treat anthrax? Once science proves whats best, thats what the doctors do. Diagnose. Treat. Diagnose. Treat. We, as patients hoping that science makes headway in improving our health, must question these methods and ask ourselves if theres another, better wayespecially for diseases of our system, such as heart disease and cancer, rather than diseases with invading organisms such as the infectious ones. This scientific approach to medicine is relatively new. Historically, doctors had theories that resembled the traditional Hindu system of ayurvedic medicine, with its emphasis on balances between various forces in the body. Or in the West, a medieval doctor might have tried to make you less choleric or more phlegmatic. Like Eastern philosophies, the idea was to try to restore the order of the various forces that were controlling the body. But this approach to medicine and honoring the body as a whole was all but abandoned in the early twentieth century, especially in the West, where we became distracted by our triumph over infectious agents. Its all the more interesting to note that, at the time that the germ theory of disease was really exploding and antibiotics were being discovered, renowned geneticist J. B. S. Haldane articulated the following at Cambridge on February 4, 1923: The recent history of medicine is as follows. Until about 1870 medicine was largely founded on physiology, or, as the Scotch called it Institutes of Medicine. Disease was looked at from the point of view of the patient, as injuries still are. Pasteurs discovery of the nature of infectious disease transformed the whole outlook, and made it possible to abolish one group of diseases. But it also diverted scientific medicine from its former path, and it is probable that, were bacteria unknown, though many more people would die of sepsis and typhoid, we should be better able to cope with kidney disease and cancer. Certain diseases such as cancer are probably not due to specific organisms, whilst others such as phthisis [a term for tuberculosis no longer used] are due to forms, which are fairly harmless to the average person, but attack others for unknown reasons. We are not likely to deal with them effectually on Pasteurs lines, we must divert our view from the micro-organism to the patient. Where the doctor cannot deal with the former, he can often keep the patient alive long enough to be able to do so himself. And here he has to rely largely on a knowledge of physiology. I do not say that a physiologist will discover how to prevent cancer. Pasteur started life as a crystallographer. But whoever does so is likely at least to make use of physiological data on a large scale. The abolition of disease will make death a physiological event like sleep. A generation that has lived together will die together. Haldane summed up his thoughts and simultaneously made an extraordinary prediction when he stated, in reference to the germ theory, This is a disaster for medicine because were going to get focused on these germs, and were going to forget about the system. He was completely right nearly ninety years ago! Indeed, as a society, and as people desperately looking for culprits to blame for our health woes, we began to make assumptions. We started to assume that our ills originated from the outside world, which was the absolute wrong

assumption to make when it came to afflictions that had nothing to do with germs and had everything to do with our inside world. The Genetics of Infectious Thinking The germ theory spelled disaster for treating illnesses such as cancer because scientists and laypeople alike started thinking of them almost as if they were infectious diseases. It became a habit of thought that then established how people were treated, and which continues to this day. So when patients visit their doctor, they are diagnosed and placed in a categorye.g., diabetes versus celiac diseaseand then they receive the treatment that is shown to work on that category of diagnosise.g., insulin control versus avoidance of gluten. In the case of cancer, doctors treat it like an invader and try to cut it out or poison it. The exact treatment protocol depends on which body part is involved, such as the breast or prostate. But cancer isnt nearly as straightforward as infectious diseases. Diagnosing, categorizing, and treating make a lot of sense for infectious diseases because infections are speciesthey speciate and divide out, and as such need to be treated like the invaders that they are. In the case of an infectious disease, be it caused by a virus or a bacterium, if we target the Achilles heel of the intruder, we win. We dont need to know anything about the host; we just need to know who the intruder is and how to kill it. The problem also becomes one of scale: with infectious disease, we only need to consider one scalethe virus or bacterium. But with other human diseases, we need to consider multiple scales, such as the diseased cell, the organ it involves, other nearby organs, the whole body, and so on. Its no longer a one-on-one battle where one side just needs the right gun. Its an inscrutable morass of battles, some of it resembling a small civil war and some of it echoing a large war crossing borders. Now, to understand the complexity with which a disease such as cancer spreads and how it bears no resemblance to infectious disease, lets look at how the National Cancer Institute describes cancer on its website*: The illustration does a decent job of conveying how cells divide and that at the heart of the matter is a cancerous cells increased cell growth rate or inability to commit suicide. But this depiction tells only part of the story, leaving out a crucial component. For much of history, we didnt know what caused cancer or why tumors developed, but we had a vague hunch that cancer was related to a systemic problema profound bodily dysfunction that could not necessarily be solved by surgery or poison. Though some people like to opine that cancer is a modern disease and that the sins of our industrial worlddirecting blame at pollution, fast and processed food, and environmental toxinsare what fuel an alleged surge in cancer rates, I dont subscribe to this line of thinking. I agree that cancer is often seen as symbolic of our modern culture of abundance, excess, and overproduction, but cancer is as old as the human race and has been documented since ancient history. Seven Egyptian papyri written between 3000 and 1500 BC describe syndromes consistent with our description of cancer. One in particular, the Edwin Smith Papyrus, named after the man who procured or pilfered this fifteen-foot-long papyrus from an antiques seller in Luxor, Egypt, in 1862, describes eight cases of tumors or ulcers of the breast. Written likely in the seventeenth century BC, the document states that no treatment is known for this condition and recommends cauterization, using a hot instrument to burn it out. Todays surgery and radiation therapy are similar to the described cauterization; all thats changed is we now have sharper knives and thankfully anesthesia. The ancient Egyptians developed different protocols for benign and malignant tumors. This included surgical removal of surface tumors. For malignant tumors, they referred to a list of compounds to treat these more problematic manifestations of the disease. Barley, castor oil, and animal parts such as the pigs ear were all suggested. The oldest physical evidence of cancer can be found in the skull of a woman from the Bronze Age, between 1900 and 1600 BC. The tumor is similar to what we would presently describe as a head-and-neck cancer. We also have the mummified remains of a Peruvian Inca thats 2,400 years old that shows the undeniable signs of melanoma. Flash forward a few thousand years, during which cancer undoubtedly continued to ravage human bodies of old and young. Among the most insightful and observant of early physicians in more recent ancient history was the Roman physiologist, surgeon, and writer Galen, who proposed theories on illness and disease at a time when numerous scientific disciplines such as anatomy, pathology, and pharmacology were still in their infancy. Practicing medicine in the second century, Galen contributed a substantial amount to the Hippocratic understanding of pathology. Hippocrates, you might recall from your high school biology days, is considered the father of medicine and established many cogent theories on health during the classical Athens period, around 400 BC. His physiological and philosophical observations became the foundation upon which modern medicine is based, for he is credited with being the first person to believe that diseases were caused naturally and not as a result of superstition and gods. Moreover, his writings first described the difference between malignant and benign tumors. Detailing cancer by body part, Hippocrates named the disease karkinos, which is Greek for crab, to describe tumors that progress to ulceration. Its hard to see how cancer can look like a crab, but the crab image was an

appropriate one for Hippocrates. The tumor that Hippocrates sought to describe had a bunch of inflamed blood vessels around it, which made him think of a crab buried in the sand with its legs splayed in a circle. That Hippocrates came to describe cancer as resembling a crab clearly indicates that he wasnt looking at the kinds of cancers that we cannot see with the visible eye. He was observing mostly large tumors close to or on the bodys surface such as those of the breast, skin, neck, and tongue. Hippocratess thoughts on health and disease allowed future protgs such as Galen to expand and experiment on his concepts, some of which perceptively hinted at the definition of cancer. Galen described cancer as being intractably and inexorably part of the whole body. According to Galen, a glut of widespread black bile rooted cancer firmly and could not be easily extracted or done away with. This black bile invaded the entire body, with tumors reflecting the extensiveness and stubbornness of this permeating malignant state. Attempts to cut out these tumors could be met with resistance, as the black bile would not only fill in that hole but also foster another tumor. Galen may have lacked the sophisticated vocabulary and instruments such as gene sequencers and microscopes that we have today, but he was spot-on in his descriptions of cancers systemic qualities and its ability to pervade, proliferate, and regenerate. Many of Galens theories endured until the Renaissance period, and medical students continued to study Galens writings until well into the nineteenth century. Then, when nineteenth-century pathologists focused their microscopes on these invasive cellular masses, they discovered the cruel joke that defines cancer: its our own cells in excess, not black bile in overabundance. But these cells might as well be black bile because they act like rebellious blobs that break boundaries and sack other tissues. What they have in common with other cancerous cells is not only an abnormal shape but also rampant cellular proliferationrunaway cell growth under no control. Siddhartha Mukherjee describes this process beautifully in his book The Emperor of All Maladies, which paints a rich historical picture of cancer in the biography of humankind. On the molecular level, cancer happens after changes to cellular genes. Normal cells are equipped with powerful genetic signals that instruct when and how cells can divide to create more cells. Some genes activate cellular propagation, acting like little accelerators of growth. Others behave like molecular brakes, halting growth. This explains why, for example, when a skin wound heals, the cells involved in the mending know when to stop producing new cells so youre not left with clumps of extra skin. But in a cancer cell, this brilliant balance between active growth and inactivity is disrupted. The green and red lights that normally control the traffic of growth are misfiring and generating too many green lights. The cell is then left without its regulator and doesnt know how to stop growing. But this molecular view of cancer isnt all that helpful in coming up with treatments because to me, cancer looks like the following: a) Human liver with cancer that originated in the colon. b) A computerized axial tomography (CAT) scan showing cancer in the liver. c) A microscopic image of cancer in the lymph node.Here we have (a) a liver with colon cancer, what Id technically call colon cancer metastatic to the liver; it has traveledmetastasizedfrom the colon to the liver, evidenced by the white masses; (b) a CAT scan of another liver with colon cancer invading it (colon cancer metastatic to the liver; note the five circular, dark masses on the left side of the image); and (c) a microscopic image of colon cancer in a lymph node (colon cancer metastatic to lymph node). To clarify, if you have colon cancer that travels to the lungs, it doesnt become lung cancer. Its still colon cancerand looks like colon cancer. Cancer is an interaction of a cell that is no longer under growth control within the environment. Whats even more important to grasp is that cancer isnt just about uncontrolled cell division and the proliferation of a cellular clan; its about another critical characteristic that embodies cancer: its ability to evolve over time. Although people like to envision cancer as a static mad cellular copying machine, its much more clever and dynamic than that. Every time a new generation of cancer cells is born, those cells harbor new mutationsmutations that go beyond those already present in the genes that are supposed to regulate growth. Making matters worse, when cancer is exposed to chemotherapy, drug-resistant mutants can escape. In other words, just as resistant strains of bacteria can result from antibiotic use, anticancer drugs can produce resistant cancer cells. But again, lets move past the molecular view of cancer for a moment. As you can see from looking at cancer, evolution selects for cancers appearance, not its genetics. Yes, cancers all have different genes, but they all look alike. There may be fifty different molecular ways to arrive at a particular body cancer, such as breast, colon, lung, brain, or prostate, but they all appear and act the same way in the end. If I showed a pathologist ten breast cancers from ten different patients, the molecular underpinnings of each would be totally different, yet they would all look like breast cancer under the microscope. By the same token, thered be a striking similarity between the look of breast cancer cells and cancerous cells from any other organ in the body because cancerous cells have a lot in common in appearance and behavior. This is a key point in comprehending cancer. Scientists have

long focused on the molecular defects to cancernot what it actually looks like. The National Cancer Institutes diagram of cancer gets only part of the story. Cancer isnt a disease of the genes. Rather, its a disease where cells evolve to look and behave a certain way, using gene alterations to get there. So while we may find a way to block one molecular pathway in our attempts to treat the disease, that doesnt mean cancer cant find its way down another path, which it usually does in an efficient fashion, unfortunately. Consider someone you know who has cancer. That person used to be somebody who didnt have cancer, and he or she still has the same DNA in the cells of the body. The difference between having cancer and not having cancer doesnt solely reside in the genome. Most of that persons cells are not turning into cancer. Cancer is a dynamic process thats happening, and its happening far from the confines of a static piece of DNA. Now, a specific mutation from a genome may help explain why it started. For instance, one of the exceptional genetic-test successes has been in breast cancer, which has found BRCA1 and 2, specific genes that are associated with a high risk for breast cancer. Mutations in this gene are more common in Ashkenazi Jews, but its important to understand that a mutation in BRCA1 and BRCA2 doesnt cause breast cancer. They are permissive for further mutations that cause the disease. Women with the inherited BRCA1/2 mutation are born with the mutationthey inherit it from one of their parents. But they arent born with breast cancer. In many examples like this, theres a genetic vulnerability to cancer, but the cancer itself isnt inherited. The person merely inherits a predisposition; those who have the gene are more likely to develop cancer. What the BRCA1 and 2 genes do, probably, is interrupt the conversation taking place in your body to repair broken DNA. But not everyone who has the BRCA genes gets diagnosed with breast cancer. This is because, much in the way the body has several pathways leading to cancer, it also has several pathways to repair DNA. Keep in mind, too, that the majority of women who suffer from breast cancer have completely intact BRCA genes, so clearly theres more at play here than genomics. Which brings me back to the notion of a system. How you arrive at an end point in a vast, complex system is somewhat irrelevant. Its caring for and protecting the system as a whole that can impact outcomes. More precisely, cancer is a symptom of the breaking down of the conversation thats going on within and between the cells. Somehow the cells are deciding to divide when they shouldnt, not telling each other to die, or telling each other to make blood vessels when they shouldnt, or telling each other lies. Somehow, all the regulation that is supposed to happen in this conversation is broken. When we see a whole bunch of cells starting to divide uncontrollably in an area, we call that cancer, and depending on the body part in which it happens, well call it lung cancer or brain cancer. But thats not actually whats wrong; thats a symptom of whats wrong. The habit of describing cancer by body part came about from the combination of observations made on autopsies in France in the early 1700s and microscopic techniques developed in Germany in the mid-1850s. This hasnt changed since. It is utterly archaic that we call cancer by prostate, by breast, by muscle. It makes no sense, if you think about it. There used to be dozens of kinds of cancer, and now there are hundreds of kinds of cancer. In truth, there are millions of kinds of cancer. The average cancer has more than one hundred mutations in coding genes when its first diagnosed, and I dont think theres any way to really comprehend or model that. The number of mutations shoots up exponentially as a cancer patient is treated with drugs such as chemotherapy, which inherently causes more mutations. One of the hallmarks of cancer is unstable DNA, so when chemotherapy drugs bind to DNA, they can cause cancer just as radiation can cause cancer by mutating the genome. This helps explain why survivors of breast cancer, for instance, can suffer from leukemia later in life due to the chemotherapy they received to cure their breast cancer. They made a trade of one illness for another but gained more years of quality life in the interim. Tumors themselves should be considered organs; they are as much a part of our system as our liver, heart, and lungs. Cancer is a failure of the system, simple as that. To channel Tolstoy, happy families are all alike, but unhappy families are each unhappy in their own special way; and happy bodies are kind of all alike, but when they break down, they all break down in their own special ways. We misunderstand cancer by making it a noun. I like to tell people that cancer isnt so much something that you get or have as its something that the body does. Instead of saying, You know, my house has water, we say, My plumbing is leaking. Instead of saying, Somebody has cancer, we should say, They are cancering. Were probably cancering all the time, and our body is checking this problem in various ways to make sure that were not cancering out of control. What keeps cancer under control is a conversation that is happening between your cells, and the language of that conversation is contained in your proteins. Protein Power We tend to think of proteins in terms of diet and nutrition; they are one of the three principal constituents of food (alongside fats and carbohydrates) that are known as macronutrients important to our health. But theres much more to the definition of proteins. They are essential parts of our bodies, and they

participate in virtually every process within cells, including how cells talk to one another and orchestrate biological events that feed cycles of health or illness. The study of proteins is now a burgeoning new field called proteomics, and at the core of this exciting branch of research is the exploration of how proteins create the language of our bodiesand the language of health. Proteomics will allow us to listen in on that cellular conversation, which will lead to much better ways to treat cancer, as well as any other ailment or disorder. Our DNA is static, but our proteins are dynamic. They change in your body every minute, depending on whats going on internally. I cant tell from looking at your DNA if youve just had a glass of wine, how well you slept last night, when you last had a meal, or if you are under a lot of stress. But your proteins, on the other hand, will tell that story. They will reveal information about you that you cannot find elsewhere in your body. Through proteomics, I can start to look at the state of your body because Im looking at what you ate, what certain drugs you could be taking are doing to your body, how a long workout has affected you, etc. Its that twenty-thousand-foot view that allows me to look at the whole picture, at a moment in time, which DNA alone cannot provide. Galileos Genius In chapter 5, Ill be taking you on a tour of proteomics and reveal where we are in this powerful new field. I have no doubt that this will change the future of medicine, as well as the future of our health. When it comes to a breakdown in the system that results in things such as cancer, autoimmune disease such as rheumatoid arthritis and fibromyalgia, or even unexplained chronic pain and nerve disorders, having a grasp of how proteins interact and change in the system could mean the difference between an endless battle to poorly manage a chronic disease and a real treatment that can end suffering. The idea that you should be able to take a pill, and it should magically fix the manifestations of a diseasea systems disease, a failure of the systemis quite remarkable. As Ive noted, this approach is usually possible where you have an invader that doesnt belong and you take a pill that poisons that particular invader. Likewise, in a few cases where youre just missing one component to health, you can take a pill that provides the missing ingredient. Its human nature to want to find magic bullets in medicine, but they happen once in a blue moon, and we may already have had all of our blue-moon moments. We havent found many new pills lately that really cure diseases. This is why the pharmaceutical industry is somewhat broken right now; it has run out of low-hanging fruit, a magical chemical that cures a disease. I dont think were likely to find a lot of more of those; it seems like a waste of time, money, and resources to keep looking for these magic bullets. We need a different approacha new model. The good news is that if we start to model the body as a complex system, which means controlling it without necessarily understanding every fundamental component, we might be able to actually get somewhere. We may never come to understand what maladies such as cancer actually are until we begin to view the body through a lens that can honor and appreciate its intricate, interconnected nature that begs to be controlled before it can be truly appreciated. Later in the book well see how proteomics helps us create this new model and begin to explore the body in ways weve never done before. But until proteomics becomes a mature and established area of clinical medicine through which all of us can benefit, we need to change how we think about health and, at least psychologically, recognize the body from a systemic standpoint. We owe much of our understanding of the nights sky to a similar train of thought. In the early parts of the seventeenth century, Galileo would go out every night and map the stars in the sky. After a while, he had the map figured out and could peer into the sky on any given night and know what to expect; hed know where the stars would be. But did Galileo know what a star even was? Not a chance. Neither did anyone else whod been admiring these luminous patterns in the sky since ancient times. It would take science hundreds of years to figure that out. Galileos genius resided not in his ability to understand the universe, but in his capacity to surrender that need to know so he could make progress in other areas of cosmology. If I had to summarize it in a sentence, I could say that the biography of the human body is a biography of a system like no other. We may think we have a handle on certain aspects of it that deem it healthy or not, such as high or low cholesterol and ideal body weight, but these often lead to categorical and often uncompromising interpretations. Or, to put this another way, we may choose to take a B-complex vitamin to improve our energy and boost metabolism, but there could be a compromise elsewhere in the system as a result. Whats good for one thing might not be for another. And good genes, such as no history of cancer in our family, can sometimes betray us. Cancer inspires fear not only because its synonymous with a long, painful, and grievous affliction that rarely has a cure, but also because its so stealthy, artful, unfathomable, and inherently baffling. Naturally, we dont like things that we cannot comprehend well or control. Perhaps thats why it can be equally as hard to grasp that the body is a complicated, and often mysterious, being. We dont want to admit that its perplexing beyond modern comprehension, and that we may never be able to fully understand this body of ours the way we can

understand English or how to ride a bicycle. Misunderstanding and ignorance beget fear. Still, the irony here is that if we have the courage to embrace ourselves as complex beings that are inexplicable in a lot of ways, and treat ourselves as such, we may move faster and closer to gaining that control we so desperately seek. We may also expel the fear that diminishes our quality of life. Health Rule We may never understand illnesses such as cancer. In fact, we may never cure cancer, which is why prevention is key. Its important to approach your health in general from a place of lack of understanding. Honor the body and its relationship to disease as a complex emergent system that you may never fully comprehend. Diseases such as cancer, heart disease, diabetes, autoimmune disorders, and neurodegenerative diseases reflect breakdowns in that system. Cancer, for instance, isnt something the body has or gets; its something that the body does.Revue de presseIn this brilliant book, David Agus introduces a whole new way of looking at illness and health. Taking a cue from physics, he views the body as a complex system and helps us see how everything from cancer to nutrition fits into one whole picture. The result is both a useful guide on how to stay healthy and a fascinating analysis of the latest in medical science. --Walter Isaacson, author of Steve JobsDr. David Agus has given us a remarkable peek into our health--and the impact will be profound. Ive made it my mission in life to live strong and help others do the same. The End of Illness is one more empowering piece to the puzzle of knowing how to do just that. This book will prevent illness, revolutionize treatments, and lengthen people's lives. A tour de force in its delivery and message. -- Lance Armstrong, 7-time Tour de France winner and Founder and Chairman, LIVESTRONGDavid Agus is one of Americas great doctors and medical researchers, a man dedicated to improving the health of as many people as he can. Written in a style and format that will truly engage readers, The End of Illness presents a dramatic, new way of thinking about our own healtha way that could lead to greatly improving the quality of life for millions, starting right now. -- Al Gore, 45th Vice President of the United States, Nobel Laureate in Peace, 2007As physician, research scientist, and friendly guide, Dr. Agus takes his readers on a fascinating tour of ideas and facts about health and illness. They will find many of those ideas to be unconventional and thought-provoking and many of the facts to be both striking and surprising. Read this book and you will very likely change at least some of your views on health and illness. -- Murray Gell-Mann, PhD, Nobel Laureate in Physics, 1969, and Distinguished Fellow and Cofounder of The Santa Fe InstituteDavid Agus's The End of Illness is a brilliant blend of enlightening manifesto and practical how-to in the realm of our most important ingredient to a long and happy life: health. Filled with unorthodox ideas backed with hard science, it simplifies for the reader the complexity of vital developments happening in medicine today and teaches us how to make the most of what's available, as well as what's soon to come. Michael Dell, Founder, Chairman, and Chief Executive Officer of Dell, Inc.Dr. David Agus is surfing the crest of two great waves of innovation -- in information technology and the life sciences. His End of Illness uses Big Data to decode the personal and molecular basis of disease. And, more important, advance a new model for health where prevention is key. -- John Doerr, partner Kleiner Perkins Caufield Byers"David Agus, one of the nation's most innovative cancer doctors, shatters the myths about health and wellness and provides us with a handbook for living a long, healthy life." -- Steve Case, Chairman of Revolution and The Case Foundation, co-founder America OnlineIn this seminal book, Dr. David Agus presents a brilliant new model of health based on the body as a complex system with an emphasis on prevention. The End of Illness may reframe everything you thought you knew about health. It is both provocative and inspiring. Highly recommended. -- Dean Ornish, MD founder and president of the Preventive Medicine Research Institute, Clinical Professor of Medicine at the University of California, San FranciscoDr. David Agus has been disrupting medicine as we know it for his entire career. Now, he brings his ideas out of the lab and exam room and into the lives of everyoneshowing us how to live long, healthy, disease-free lives. Reading this book is the best thing you can do for yourself and your loved ones. A monumental work that will change your life. -- Marc Benioff, Chairman and CEO, salesforce.comDavid Agus is one of the great medical thinkers of our age. "The End of Illness" reframes the entire discussion of sickness and health. Instead of thinking about disease Agus thinks about the system that is the human body, and what we need to do to guide it toward health. Before you take your next vitamin, read this book. Danny Hillis, PhD, Co-founder, Applied Minds and Thinking MachinesWhat you will find in this book are clear and compelling reasons to be more pro-active about your health. The sections explaining physiology and the latest medical findings are very good, and are far more persuasive than the usual lectures we are given about all our bad habits. To misquote the Hippocratic Oath, First do no harm. It will do you no harm to dream of the end of illness, but until that time, it might just do you some good to follow Aguss

eminently sensible advice. The Globe and Mail