

University of Rochester School of Medicine and Dentistry Commencement Address

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Medicine Rebooted

President Seligman, Dean Taubman, faculty, proud families, and honored graduates,

What an honor it is for me to address you today, such a memorable day of crowning achievement, of great celebration. Thirty-two years ago I was sitting where you are today. Thirty-two years ago most of you graduates had not even been born! We hadn't heard of a cell phone, a personal computer, or the internet. No things digital. When I was in medical school, the term "digital" was reserved for the rectal examination. You are the next generation of leading physicians in a *new* era of medicine—and you are all digital natives!

You prize your cell phone right up there with food and water. You sleep with it. Let me ask you—have you ever looked up a drug or some medical information on your cell phone? Yes, it is a prosthetic brain! How many of you are on Facebook? On Twitter? Oh, you will be before long. You were born and raised in a digital information era that is continuing to explode, one in which the cloud computing power, the internet, social networking are all coalesced with mobile devices—with pervasive connectivity and ever-expanding bandwidth. In recent years, smart phones and tablets have radically transformed the way we communicate, read, study, listen to music, play games, shop, take pictures or movies, and go from place to place. How we behave. How we think. Things are moving fast. So fast, you don't even have time to wait for an email response—you just text and anticipate an immediate reply. You can download any book or movie in just seconds. You are either connected virtually all the time or have separation anxiety when you're disconnected. So much stimulation. So easy to be distracted. Multiple screens and multiple tasks at once. We have evolved to a new species. We are *Homo distractus*!

Joseph Schumpeter, a noted Austrian economist of the mid 20th century, popularized the term "creative destruction" to describe transformation that accompanies radical innovation. We've already seen digital creative destruction of our lifestyle—how we live our day-to-day lives. Just think of Rochester, George Eastman, Kodak, the invention of roll film and the impact it had on photography. For my graduation from medical school 32 years ago, my wife's parents gave me an Olympus SLR film camera. Can you even remember the last time you had film developed? Likewise, the end of Blockbuster video stores, bookstore chains like Borders. The publisher of the New York Times, with its

motto “All the News That’s Fit to Print,” announced that In future years it would not print the newspaper. These are just a few examples of creative destruction that the digital world induced.

But so far the incredible innovations of the digital world have not really intersected with the medical world to any significant degree. That is about to change. You are going to be part of the biggest shake-up in the history of medicine.

When Dean Taubman asked what the title of my address would be, I originally told him it was going to be “The creative destruction of medicine.” He said, “Eric, that will scare everyone. Can you imagine the parents? We can’t use that title.” I should say my wife and daughter fully agreed with him—that’s when you know you really blew it! But now let me give you a sense of why you are *so, so* fortunate. So lucky to be starting your careers at this moment in medicine.

For the first time, we can rapidly sequence the whole genome of a human being. All six billion bases. A decade ago, this took 13 years and cost \$3 billion. Three years ago it took four years and cost \$100 million. Now it can be done in one day for \$5000. In the next few years this will be accomplished in 15 minutes and at a cost of just hundreds of dollars—the same amount that is charged for a single genotype today! In recent months sequencing saved a young boy’s life. A five-year-old in Milwaukee had more than 100 surgeries, was repeatedly septic, constantly hospitalized, in a hyperbaric chamber, and his doctors had no idea what was wrong with him. You know the fancy medical term for this “Idiopathic.” It always reminded me of the term idiot—why, we’re so mentally deficient that we can’t figure things out in medicine. But we didn’t have the tools until now. The boy, Nicholas Volker, on death’s door, was sequenced. The culprit gene mutation was found, which led to the right treatment, and today Nicholas is thriving. In a parallel way, sequencing is cracking the case for the mutations that drive cancer and leading to highly targeted and effective treatments for conditions like malignant melanoma that were previously hopeless. And we are learning about how the gene variants in us predict whether we will respond to a drug or not, the right dose of the drug, and the avoidance of serious side effects. Our DNA sequence, our genome—our biological individuality—is being defined and that is changing medicine.

But that’s just the start. Our cell phones are like pluripotent stem cells. We use them for our calculator, alarm clock, camera, video player and recorder, audio recorder, photo album, watch, flashlight . . . the list goes on and on. But now wirelessly connect the cell phone with biosensors in Band-Aids or wrist bands—we will be able to see all vital signs—continuous, real-time, remote monitoring of heart rhythm, beat-to-beat, blood pressure, oxygen concentration in the blood, respiratory rate, temperature. Add glucose, brain waves, mood, and many more metrics. Just think, at any moment that you are using your phone—checking your email, surfing the Web, and looking at the display of all your vital signs. Probably resulting in a culture of cyberchondriacs! But for the right individual, having such information could be life changing, maybe even life-saving. Today we are lucky to get a few blood-pressure readings from each patient to better manage their hypertension. Tomorrow we can get 24/7 blood pressures, while an

individual is sleeping, or at work, or experiencing emotional upset. And soon enough there will be tiny embedded nanosensors in a patient's circulation—to pick up the earliest possible molecular signature of an impending heart attack or the first cancerous cell detection in the body. A signal goes from the sensor to the individual's cell phone—like the "check engine" light in your car—even using your favorite ring tone. The imminent capacity to prevent conditions from ever occurring for the first time.

Over 250 years ago Voltaire said:

Doctors are men who prescribe medicines of which they know little, to cure diseases of which they know less, in human beings of whom they know nothing.

But finally, you're going to have an extraordinary panoramic view of each of your patients, a whole genome plus every conceivable physiologic metric to remotely monitor as needed. Yes, you'll still treat and heal. But this "Schumpetered" new medicine will empower you to prevent!

But that's not all. That panoramic view will include new digital medical imaging. The real icon of medicine—the stethoscope—is about to be obsolete! Last year a pocket high-resolution ultrasound device called the Vscan was introduced. It is the first real stethoscope. Now that's saying a lot, since Laennec's 1816 invention of what became known as the stethoscope but was only in reality a stethophone—steth is Greek for chest, and phone to listen. With it we can only listen to heart sounds. But now, with pocket ultrasound, we can see every part of the heart, how well it is functioning, the size of each chamber, whether the valves are normal, if there is fluid in its surrounding sac. Why would we ever use a stethophone to listen to lub dub, or the split-second heart sound when we can actually see everything exquisitely in a matter of seconds?

Collectively, these remarkably innovative technologies give us something we could never do before—digitize a human being. Superimposed on the meteoric advances in the digital world, genomics, biosensors, and health information systems will provide high-definition individuality—at the biologic, physiologic, anatomic levels. How exciting!

I've been talking about things that will change in medicine. Now how to adapt and anticipate. Paradoxically, now I want to talk about the things that won't change. The constants. The things we don't want to ever change.

You are graduates of one of the finest medical schools in the United States. One that promotes **lifelong learning** as well as or better than any other school in our country. When I started a new medical school in Cleveland in 2002—the Cleveland Clinic Lerner College of Medicine—I searched for the best curriculum. I contacted the Association of Medical Colleges and was informed that this—your—medical school received a perfect score for the Double Helix Curriculum. To start the new medical school I recruited your vice dean for education! The curriculum we developed was an emulation of this amazing, this **awesome** medical school.

One of my treasured memories of my time here was my fourth-year month elective in cardiology with Dr Arthur Moss. Every morning we met at the Minor library, spent half an hour, and looked over the latest journals to see what were the important medical breakthroughs and advances. It was an exceptional way to keep up in the old days! One conversation stands out---Andreas Gruntzig had done the first balloon angioplasty of the coronary artery published in the *Lancet*. I said to Dr Moss I thought it was crazy. Even reckless. How could arteries withstand a balloon to be blown up within them; patients could die. Indeed, some did in the early days. Little did I know that five years later I would be doing these procedures and that this would be one of the most radical innovations to come in medicine. Now the same principle is being used to replace aortic valves through a catheter without any surgery. With this great inflection, innovations in medicine will happen faster than ever. Keep up. Lifelong learning is brain food and you just can't get enough of it! And your patients need you to lead the way.

During your last couple of years of medical school you all have witnessed one of the greatest portrayals of **perseverance** one could ever see—the CEO, the leader of your medical center and former dean, my fellow medical school classmate and one of the most brilliant, quintessential physician-scientists I have ever known—Brad Berk. Following his tragic bicycle accident he has fought back, worked so hard. He continues to lead—the exemplar of perseverance. So incredible, so inspirational! Please give it up for Dr Brad Berk!

Every one of us experiences setbacks in our career and in life, although few so horrifying as what Dr Berk has been through. I think back to my darkest days, which occurred several years ago, when I raised concerns about heart attacks from the widely used medicine Vioxx. I wanted **to do the right thing for patients**, but I didn't realize it would put my professional life in total disarray. But these are things that never change for us—dealing with adversity that will inevitably come and, at the same time, hopefully, always trying to do the right thing—the primacy of patients.

How can we persevere, deal with the inevitable challenges and adversity that lie before us? There's one thing far more important than your profession—**your family**. My wife, Susan, who joins me today, a native Rochesterian whom I met on my obstetrics rotation at Highland Hospital, has been such a phenomenal support. We decided to get married just two weeks after we met, and we did so a week before my graduation 32 years ago. Our children are Evan, a health lawyer, and Sarah, a research nurse at my institute. They are about the same age as you. Three decades go by in a flash, especially when the most extraordinary profession in the world—being a doctor—can consume you. Despite the demands and challenges that you will face, don't be distracted—**your family** is your highest priority in life. Before you know it, you'll be in the parent seats watching with tears of pride!

You're entering a **noble profession**. The greatest privilege that one can have is to be entrusted for preserving the health of one's fellow man. You've taken an oath; you'll be, in your practice, privy to the secrets of your patients. You will have all the tools—

powerful medicines, devices—at your disposal. No matter how much consumers are empowered through digital medicine tools—having access to their whole genome sequence or their vital signs on their cell phone—they will need and rely on you for guidance. That trust and reliance will never change—honor that.

Which brings me to my last point. I have described the great, perhaps greatest convergence in our history—the digital world and the medical cocoon that provides the power of defining each individual with unprecedented granularity in almost every dimension—the **science of individuality**. But what about the **humanistic** impact? Ironically, by defining each individual in such an exceptional way—*Homo digitus*—it will be much too tempting, much too easy, to treat the scan, the mutation, or the physiologic metric. While the information will indeed be rich, it is void of any real human element. Your relationship with and knowledge of the person, the individual, has to override his or her virtual, digital entity. From the days and teaching of George Engel here, we learned to be great listeners to our patients, having insight about the precious importance of human intimacy, the caring, the healing, and compassion for people—to be great doctors. And hopefully we have learned a lot about humility. For all the powerful information that will come forward in this new era of medicine, there will be many times we just don't know. Or we did our best, but it just wasn't enough. Or that our patients are remarkably insightful about their own condition and many times will know more than us.

So, congratulations for what you have achieved. You should feel so proud. So fortunate. What a magnificent milestone. And your timing is simply supreme! You have the ultimate capacity to fulfill my *modus operandi*—to Think Big and Act Bigger . . . and moreover the university's—to make things better. *Meliora*—at your entry to the most momentous moment in medicine!